THE UNIVERSITY OF SYDNEY

FACULTY OF ENGINEERING AND INFORMATION TECHNOLOGIES – UNDERGRADUATE

HANDBOOK 2015

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Contents

Welcome

Welcome to the Faculty of Engineering and Information Technologies at the University of Sydney.

As one of the top 50 engineering and technology universities in the world, our graduates have the ability to lead and shape the future. Studying with us, you'll develop your skills of analysis, and invention so you can effectively design, create and build structures, systems and products that will help improve people's lives.

You'll have plenty of opportunities to take part in extracurricular activities too, like participating in team competitions, joining one of our many student societies or travelling overseas on exchange.

We also know that employers want well-rounded individuals who embrace all the opportunities and challenges that come their way. That's why we work with hundreds of organisations to support your career aspirations through scholarships, vacation work and other opportunities that will develop your real-life business skills and leadership experience. We'll also give you the chance to undertake internships, take part in industry-sponsored projects, and go on international exchange.

Whichever way you choose to get involved, you'll be doing it alongside a passionate group of students who are all interested in making a genuine difference within our own community and beyond.

I hope you enjoy your educational journey with us, a faculty that inspires, challenges and supports tomorrow's leaders.

Professor Archie Johnston
Dean, Faculty of Engineering and Information Technologies

How to use this handbook

An understanding of the information in this handbook will allow you to make more informed choices about your study at the University of Sydney. It will:

- ensure that you have the information necessary to make informed program and unit of study choices.
- ensure that you understand the rules that both govern and ensure your successful academic progress toward graduating at the end of your degree.

Most of the information presented under the tabs across the top of this web page will provide you with the information necessary to make program and unit of study choices. These choices will enable you to attain a wholistic and well-rounded understanding of your disciplinary area of interest, so that you may fulfil your academic and vocational ambitions.

- When you browse the tabs from left-to-right, you will observe a General tab and a tab for each school and two specialised study programs within the Faculty. These are:

- Aeronautical, Mechanical and Mechatronic Engineering
- Biomedical Engineering
- Chemical and Biomolecular Engineering
- Civil Engineering
- Electrical and Information Engineering
- Information Technologies and
- Project Management.

The menu sets under each of the School and Program tabs consist of general information about the courses and units of study on offer. The requirements for Flexible First-year entry are found under the General tab.

Unit of Study Tables and Descriptions

Unit of study tables and descriptions for each undergraduate degree can be found under the tab corresponding to the School or Program (Biomedical Engineering or Project Management).

In addition, elective unit of study tables and descriptions for faculty-wide electives, those on offer in the Advanced Engineering program and the Talented Information Technology program, and those related to Exchange programs, are listed under the General tab, for ease of access.

Students and professionals seeking to further develop their skills in engineering and information technology in order to meet professional requirements may apply to undertake individual units of study as non-award students. Whether you are an undergraduate degree student or a graduate seeking to enhance your learning, it is envisaged that you will find the information layout useful.

Other information under the General Tab, for instance, the course rules and course resolutions (Senate and faculty resolutions), relates to the second concern: that of ensuring that your academic progress meets the requirements necessary for you to graduate at the end of your degree.

Senate and Faculty Resolutions

The Senate Resolutions and Faculty Resolutions specify general course requirements; the Senate Resolutions for the courses offered and conferred by the University of Sydney, and the Faculty Resolutions for those courses specifically conferred by the Faculty of Engineering and Information Technologies.

Faculty Resolutions also outline the general conditions of enrolment and progression that pertain to its degrees. These conditions are outlined under five broad areas:

1. course enrolment
2. unit of study enrolment
3. studying and assessment
4. progression, results and graduation
5. transitional provisions.

Course rules

The Course Rules specify the enrolment, progression and completion requirements for each single and combined degree offered by the Faculty, and in so doing, expand upon and particularise the general course requirements contained in the Faculty Resolutions.

For instance, in order to prescribe the allowable enrolment of a student in a particular course, course rules outline the particulars of the following:

- the attendance pattern
- the streams offered within the particular degree
- admission and award requirements
- requirements for the Honours degree
- transitional provisions.

Please take the time to become familiar with the course rules and resolutions for your degree.

It is recommended that the Senate Resolutions for the Faculty of Engineering and Information Technologies be read in conjunction with both the appropriate Faculty resolutions and the individual course rules relating to your degree.

Resolutions of the Senate

The Senate Resolutions for the Faculty of Engineering and Information Technologies must be read in conjunction with the appropriate Resolutions for the Faculty of Engineering and Information Technologies the individual Course resolutions and rules.

Resolutions of the Senate

1 Degrees, diplomas and certificates of the Faculty of Engineering and Information Technologies

(1) With the exception of the Doctor of Engineering and the Doctor of Philosophy, The Senate, by authority of the University of Sydney Act 1989 (as amended), provides and confers the following degrees, diplomas and certificates, according to the rules specified by the Faculty of Engineering and Information Technologies. The Doctor of Engineering and the Doctor of Philosophy are provided and conferred according to the rules specified by the Senate and the Academic Board.

(2) This list is amended with effect from 1 January, 2015. Degrees, diplomas and certificates no longer open for admission will be conferred by the Senate according to the rules previously specified by the Faculty.

2 Degrees

Code	Course title & stream	Abbreviation	Credit points
RHENGINE	Doctor of Engineering	DEng	Published work
RPPHDENG	Doctor of Philosophy	PhD	Research
RMPHLENG	Master of Philosophy	MPhil	Research
MAENGINE	Master of Engineering	ME	72
MAINFTEC	Master of Information Technology	MIT	72
MAINFTMG	Master of Information Technology Management	MITM	72
	Master of Health Technology Innovation	MHTI	96
MAPROFEN	Master of Professional Engineering		
	Aerospace Engineering	MPE(Aerospace)	144
	Biomedical Engineering	MPE(Biomedical)	144
	Chemical and Biomolecular Engineering	MPE(Chemical & Biomolecular)	144
	Civil Engineering	MPE(Civil)	144
	Electrical Engineering	MPE(Electrical)	144
	Fluids Engineering	MPE(Fluids)	144
	Geomechanical Engineering	MPE(Geo)	144
	Mechanical Engineering	MPE(Mechanical)	144
	Power Engineering	MPE(Power)	144
	Software Engineering	MPE(Software)	144
	Structural Engineering	MPE(Structural)	144
	Telecommunications Engineering	MPE(Telecoms)	144
MAPRJMGT	Master of Project Management	MPM	72
MAPRJLEA	Master of Project Leadership	MPL	48
BPCSTECN	Bachelor of Computer Science and Technology*		
	Computer Science	BCST(ComputerScience)	144
	Information Systems	BCST(InformationSystems)	144
BPCSTECN	Bachelor of Computer Science and Technology (Advanced)*		
	Computer Science	BCST(Adv)(ComputerScience)	144
	Information Systems	BCST(Adv)(InformationSystems)	144
BUENGINE	Bachelor of Engineering^		
	Aeronautical Engineering	BE(Aeronautical)	192
	Aeronautical Engineering (Space)	BE(Aeronautical)(Space)	192
	Biomedical Engineering	BE(Biomedical)	192
	Chemical and Biomolecular Engineering	BE(Chemical & Biomolecular)	192
	Civil Engineering	BE(Civil)	192
	Civil Engineering (Construction Management)	BE(Civil)(Construction Management)	192
	Civil Engineering (Environmental)	BE(Civil)(Environmental)	192
	Civil Engineering (Geotechnical)	BE(Civil)(Geotechnical)	192
	Civil Engineering (Structures)	BE(Civil)(Structures)	192
	Electrical Engineering	BE(Electrical)	192
	Electrical Engineering (Computer)	BE(Electrical)(Computer)	192

Code	Course title & stream	Abbreviation	Credit points
	Electrical Engineering (Power Engineering)	BE(Electrical)(Power)	192
	Electrical Engineering (Telecommunications)	BE(Electrical)(Telecommunications)	192
	Mechanical Engineering	BE(Mechanical)	192
	Mechanical Engineering (Space)	BE(Mechanical)(Space)	192
	Mechatronic Engineering	BE(Mechatronic)	192
	Mechatronic Engineering (Space)	BE(Mechatronic)(Space)	192
	Project Engineering and Management (Civil)	BE(Project Eng & Mngt)(Civil)	192
	Software Engineering	BE(Software)	192
BHENGINE	Bachelor of Engineering Honours		
	Aeronautical Engineering	BEHons(Aeronautical)	192
	Aeronautical Engineering (Space)	BEHons(Aeronautical)(Space)	192
	Biomedical Engineering	BEHons(Biomedical)	192
	Chemical and Biomolecular Engineering	BEHons(Chemical and Biomolecular)	192
	Civil Engineering	BEHons(Civil)	192
	Civil Engineering (Construction Management)	BEHons(Civil)(Construction Management)	192
	Civil Engineering (Environmental)	BEHons(Civil)(Environmental)	192
	Civil Engineering (Geotechnical)	BEHons(Civil)(Geotechnical)	192
	Civil Engineering (Structures)	BEHons(Civil)(Structures)	192
	Electrical Engineering	BEHons(Electrical)	192
	Electrical Engineering (Computer)	BEHons(Electrical)(Computer)	192
	Electrical Engineering (Power Engineering)	BEHons(Electrical)(Power)	192
	Electrical Engineering (Telecommunications)	BEHons(Electrical)(Telecommunications)	192
	Mechanical Engineering	BEHons(Mechanical)	192
	Mechanical Engineering (Space)	BEHons(Mechanical)(Space)	192
	Mechatronic Engineering	BEHons(Mechatronic)	192
	Mechatronic Engineering (Space)	BEHons(Mechatronic)(Space)	192
	Project Engineering and Management (Civil)	BEHons(Project Eng & Mngt)(Civil)	192
	Software Engineering	BEHons(Software)	192
BPENCHBM	Bachelor of Project Management	BPM	144
BPPRMCES	Bachelor of Project Management (Civil Engineering Science)	BPM(Civil Engineering Science)	144
BPPRMSES	Bachelor of Project Management (Software)	BPM(Software)	144
BPPRMBEN	Bachelor of Project Management (Built Environment)	BPM(Built Environment)	144
BPINFTEC	Bachelor of Information Technology^		
	Computer Science	BIT(ComputerScience)	192
	Information Systems	BIT(InformationSystems)	192

**may be awarded with honours following a further year of study.*
^may be awarded with honours in an integrated program

3 Combined degrees

Code	Course title & stream	Abbreviation	Credit points
MAINFITM1000	Master of Information Technology/Master of Information Technology Management	MIT/MITM	96
BPENGART-01	Bachelor of Engineering^/Bachelor of Arts*	BE/BA	240
BPENGCOM-01	Bachelor of Engineering^/Bachelor of Commerce*	BE/BCom	240
BPENGDAR-01	Bachelor of Engineering^/Bachelor of Design in Architecture*	BE/BDesArch	240
BUENGLAW-01	Bachelor of Engineering^/Bachelor of Laws^	BE/LLB	288
BPENGMSC-01	Bachelor of Engineering^/Bachelor of Medical Science*	BE/BMedSci	240
BPENGSCI-01	Bachelor of Engineering^/Bachelor of Science*	BE/BSc	240
BHENGART-01	Bachelor of Engineering Honours/Bachelor of Arts	BEHons/BA	240

Code	Course title & stream	Abbreviation	Credit points
BHENGCOM-01	Bachelor of Engineering Honours/Bachelor of Commerce	BEHons/BCom	240
BHENGDAR-01	Bachelor of Engineering Honours/Bachelor of Design in Architecture	BEHons/BDesArch	240
BHENGLAW-01	Bachelor of Engineering Honours/Bachelor of Laws	BEHons/LLB	288
BHENGMSC-01	Bachelor of Engineering Honours/Bachelor of Medical Science	BEHons/BMedSci	240
BHENGSCI-01	Bachelor of Engineering Honours/Bachelor of Science	BEHons/BSc	240
BPITCART-01	Bachelor of Information Technology^/Bachelor of Arts*	BIT/BA	240
BPITCCOM-01	Bachelor of Information Technology^/Bachelor of Commerce*	BIT/BCom	240
BPITCLAW-01	Bachelor of Information Technology^/Bachelor of Laws^	BIT/LLB	288
BPITCMSC-01	Bachelor of Information Technology^/Bachelor of Medical Science*	BIT/BMedSc	240
BPITCSCI-01	Bachelor of Information Technology^/Bachelor of Science*	BIT/BSc	240
BPENGPRM-01	Bachelor of Engineering^/Bachelor of Project Management*	BE/BPM	240

**may be awarded with honours following a further year of study*
^may be awarded with honours in an integrated program

4 Graduate diplomas

Code	Course title	Abbreviation	Credit points
GNCOMPUT-02	Graduate Diploma in Computing	GradDipComp	60
GNENGINE-01	Graduate Diploma in Engineering	GradDipEng	36
GNENPROF-01	Graduate Diploma in Engineering (Professional Engineering)	GradDipEng(ProfEng)	48
GNINFTEC-02	Graduate Diploma in Information Technology	GradDipIT	48
GNINFTMG-02	Graduate Diploma in Information Technology Management	GradDipITM	48
GNPRJMGT-01	Graduate Diploma in Project Management	GradDipPM	36
GNPRJLEA-01	Graduate Diploma in Project Leadership	GradDipPL	36
	Graduate Diploma in Health Technology Innovation	GradDipHTI	~~48~~60

5 Graduate certificates

Code	Course title	Abbreviation	Credit points
GCENGINE-01	Graduate Certificate in Engineering	GradCertEng	24
GCINFTEC-02	Graduate Certificate in Information Technology	GradCertIT	24
GCINFTMG-02	Graduate Certificate in Information Technology Management	GradCertITM	24
GCPRJMGT-01	Graduate Certificate in Project Management	GradCertPM	24
GCPRJLEA-01	Graduate Certificate in Project Leadership	GradCertPL	24

Resolutions of the Faculty

Resolutions of the Faculty of Engineering and Information Technologies for coursework awards

These resolutions apply to all undergraduate and postgraduate coursework award courses in the Faculty, unless specifically indicated otherwise. Students enrolled in postgraduate research awards should consult the resolutions for their course. These resolutions must be read in conjunction with applicable University By-laws, Rules and policies including (but not limited to) the University of Sydney (Coursework) Rule 2000 (the 'Coursework Rule'), the resolutions for the course of enrolment, the University of Sydney (Student Appeals against Academic Decisions) Rule 2006 (as amended) and the Academic Board policies on Academic Dishonesty and Plagiarism.

Part 1: Course enrolment

Terminology: In the following resolutions, all reference to the Bachelor of Engineering degree applies to both the Bachelor of Engineering and Bachelor of Engineering Honours, except where otherwise indicated.

1 Enrolment restrictions

(1) Except as with the permission of the Dean an undergraduate student shall satisfy the following enrolment requirements.
(a) No more than 24 credit points in either semester one or two;
(b) No more than 12 credit points in the summer session and 6 credit points in the winter session;
(c) In first year, a student may only enrol in level 1000 units of study;
(d) In second year, a student may only enrol in level 1000 and/or level 2000 units of study;
(e) A student shall enrol in lower year level core units of study as a priority above any higher year level units of study irrespective of meeting any prerequisite requirements of the higher year units.

2 Flexible First Year

(1) Undergraduate students entering first year may choose to undertake the Flexible First Year program, instead of choosing a particular degree or stream. Two types of Flexible First Year program are available:
(a) Students planning on entering Aeronautical, Chemical and Biomolecular, Civil, Mechanical, Aeronautical (Space) or Mechanical (Space) Engineering streams can enrol in program A as set out in the Bachelor of Engineering Flexible First Year table of units of study. Students in this program undertake a common set of units in semester one. They can then transfer to a stream in semester two or at the end of the year. The semester two enrolment will consist of common units and a choice of core or elective units for the stream that students plan to pursue in later years.
(b) Students planning on entering Biomedical, Electrical, Electrical (Computer), Electrical (Power), Electrical (Telecommunications), Mechatronics, Mechatronics (Space), Software Engineering or the Bachelor of Computer Science and Technology or Bachelor of Information Technology degrees can enrol in program B as set out in the Bachelor of Engineering Flexible First Year table of units of study. Students in this program undertake a common set of units in semester one. They can then transfer to a stream or degree in semester two or at the end of the year. The semester two enrolment will consist of common units and a choice of core or elective units for the stream or degree that students plan to undertake in later years.
(c) Transfer into the Bachelor of Project Management is not part of the flexible first year program.
(2) Students gaining entry to any of the combined degree courses may also choose to undertake the Flexible First Year program.
(3) Those students who have met the requirements for first year entry (ATAR cut-off) into a particular degree and stream will be guaranteed a place in second year in that stream or degree even though they choose the Flexible First Year program. Students attaining high average marks in the Flexible First Year program will be eligible to apply for second year entry into higher ATAR cut-off degrees or streams. See transfer requirements in the table shown below. These conditions for entry into a second year specialist degree or stream will also apply for combined degree candidates.
(4) Transfer from Flexible First Year into streams or degrees will be assessed based on either of the following two conditions:
(a) Students have met the ATAR requirement for the degree or stream at the time of initial enrolment; or
(b) Students have achieved an average mark as shown in the following requirements table. For Program A the average mark is based on the performance in first year units of study. For Program B, the average mark is based on performance in first year, first semester units of study.
(5) *Degree/stream transfer table*

Degree/Stream	Flexible entry program	AAM requirement
BEHons(Aero)	A	65
BEHons(Aero)(Space)	A	75
BEHons(Biomedical)	B	70
BEHons(Chem)	A	always allowed
BEHons(Civil)	A	always allowed
BEHons(Civil)(Construction)	A	65
BEHons(Civil)(Environmental)	A	65
BEHons(Civil)(Geotechnical)	A	65
BEHons(Civil)(Structures)	A	65
BEHons(Electrical)	B	always allowed
BEHons(Electrical) (Computer)	B	65
BEHons(Electrical)(Power)	B	65
BEHons(Electrical)(Telecom)	B	65
BEHons(Mechanical)	A	always allowed
BEHons(Mech)(Space)	A	75

Degree/Stream	Flexible entry program	AAM requirement
BEHons(Mechatronics)	B	70
BEHons(Mechatronics)(Space)	B	75
BEHons(Project Mgt)(Civil)	A	65
BEHons(Software)	B	65
BCST	B	always allowed
BCST(Adv)	B	70
BIT	B	70

3 Transferring Streams or Degrees

(1) Students admitted to specific undergraduate Engineering, IT or Project Management single degrees or streams, and the combined BEHons/BPM can apply for transfer between these degrees or stream. Approval is required from the Dean (or his/her delegate) for any case; or by the Head of School (or his/her delegate) or the program director responsible for the particular stream or degree. Students in combined degrees can change the stream of the BEHons portion of their combined degree in accordance with this sub-clause. Students will be assessed based on the above Flexible First Year average mark criteria but will also be required to show that they have met progression requirements in their current degree or stream as specified by the school and that they will able to complete the new stream in the normal time period.

(2) Students who wish to transfer into or between any of the faculty's undergraduate combined degrees (except into BEHons/BPM as covered in part(1) above) or any other course outside the administration of the Faculty must apply to the Universities Admissions Center or International Office as appropriate.

(3) Students admitted to specific postgraduate degrees or streams wishing to transfer between degrees or streams managed by the faculty need to apply to the Director of the Graduate School of Engineering. Students will be assessed based on their progress in their current degree or stream and that they will able to complete the new stream in the normal time period.

4 Time limits

(1) Unless the course rules specify differently:

(a) A student must complete all the requirements for a coursework doctorate, within ten calendar years of first enrolment;

(b) A student must complete all the requirements for a combined BEHons, single or combined BIT, and BCST within ten calendar years of first enrolment;

(c) A student must complete all the requirements for a single (non combined) BEHons or BPM within the lesser of 16 enrolled semesters or ten calendar years of first enrolment;

(d) A student must complete all the requirements for a graduate certificate within two calendar years of first enrolment; a minimum of 1 semester and a maximum of 4 semesters

(e) A student must complete all the requirements for a graduate diploma within four calendar years of first enrolment; a minimum of 2 semesters and a maximum of 6 semesters

(f) A student must complete all the requirements for a master's degree within six calendar years of first enrolment. A minimum of 2 semesters and a maximum of 8 semesters.

(2) Periods of suspension, exclusion or lapsed candidature will be added to maximum completion times except that no completion time will exceed 10 years from first enrolment.

(3) Credit will not be granted for recognised prior learning older than 10 years at the time of first enrolment.

5 Suspension, discontinuation and lapse of candidature

The Coursework Rule specifies the conditions for suspending or discontinuing candidature, and return to candidature after these events. The Rule also defines the circumstances when candidature is deemed to have lapsed. Students should pay careful attention to the significant dates in these processes and their effect on results and financial liability. Students seeking to suspend, discontinue or apply for a return to candidature after a lapse must apply to the Dean of Engineering and Infomation Technologies for permission, supplying detailed reasons and evidence to support the request.

6 Credit for previous study

(1) Conditions for the granting of credit for previous study are in accordance with the Coursework Rule, except:

(a) the maximum credit that may be granted to the Bachelor of Engineering degree, Bachelor of Engineering Honours/Combined degrees, Bachelor of Information Technology degree or Bachelor of information Technology/Combined degrees is 96 credit points;

(b) the maximum credit that may be granted to the Bachelor of Computer Science and Technology or Bachelor of Science and Technology(Advanced) or Bachelor of Project Management is 48 credit points; and

(c) For prior learning at the University of Sydney at postgraduate level credit may be given subject to the approval of the Faculty and to the following conditions:

(i) where no award has been conferred, credit may be transferred in full to the Graduate Diploma and Master degree;

(ii) if an award has been conferred credit to a limit of 12 credit points may be transferred.

(d) For prior learning at postgraduate level at an external institution recognised by the University of Sydney

(i) where no award has been conferred credit to a maximum of 50 percent of the degree may be approved, provided units of study have been completed at credit average and are equivalent to units of study offered under the degree being taken;

(ii) if an award has been conferred credit to a maximum of 12 credit points may be approved provided units of study have been completed at credit average and are equivalent to units of study offered under the degree being taken;

(iii) credit will not be granted for recognised prior learning older than 10 years at the time of first enrolment.

(e) where Course resolutions make other specifications.

Part 2: Unit of study enrolment

7 Cross-institutional study

(1) Provided permission has been obtained in advance, the Dean may permit a student to complete a unit of study at another institution and have that unit credited to the student's course requirements, provided that:

(a) the resolutions of the student's course of enrolment do not specifically exclude cross-institutional study; and

(b) the unit of study content is not taught in any corresponding unit of study at the University; or

(c) the student is unable, for good reason, to attend a corresponding unit of study at the University.

8 International exchange

The faculty encourages students to participate in international exchange programs, unless specified otherwise in the resolutions for a particular course. Students must apply to the Head of the relevant School of Engineering and Information Technologies to obtain approval for their planned enrolment while on exchange. This guarantees that the units completed externally will be correctly matched to the core requirements of their Course.

Part 3: Studying and Assessment

9 Attendance

(1) Students are required to be in attendance at the correct time and place of any formal or informal examinations. Non attendance on any grounds insufficient to claim special consideration will result in the forfeiture of marks associated with the assessment. Participation in a minimum number of assessment items may be a requirement of any unit of study.

(2) Students are expected to attend a minimum of 90 percent of timetabled activities for a unit of study, unless granted exemption by the Dean or Head of School most concerned. The Dean or Head of School most concerned may determine that a student fails a unit of study because of inadequate attendance. Alternatively, at their discretion, they may set additional assessment items where attendance is lower than 90 percent.

10 Special consideration for illness, injury or misadventure

Special consideration is a process that affords equal opportunity to students who have experienced circumstances that adversely impact their ability to adequately complete an assessment task in a unit of study. The Coursework Rule provides full details of the University policy and procedures.

11 Concessional pass

In this Faculty the grade PCON (Concessional Pass) is not awarded.

12 Re-assessment

The Faculty does not offer opportunities for re-assessment other than on the grounds of approved special consideration.

Part 4: Progression, Results and Graduation

13 Satisfactory progress

The faculty will monitor students for satisfactory progress towards the completion of their award course. In addition to the common triggers used to identify students not meeting academic progression requirements (as defined by the Progression requirements of the Coursework Rule), students must pass any unit of study identified in the course resolutions as being critical to progression through the course.

14 Award of the Bachelor's degree with Honours

Honours is available to meritorious students as either appended honours or integrated honours. Admission, requirements and award for the honours courses are in accordance with the relevant course resolutions.

15 Faculty of Engineering and Information Technologies specific Weighted Average Mark Indicators.

(1) The Engineering Weighted Average Mark (EWAM) is calculated by the formula:

Formula
EWAM= (Wi x CPi x Mi) / (Wi x CPi)

where

(a) Wi is the weighting given by 0 for 1000 level units of study, 2 for 2000 level units, 3 for 3000 level units and 4 for 4000 level or above units.

(b) CPi is the number of credit points for the unit of study.

(c) Mi is the mark achieved for the unit of study.

All attempts at units of study are included except for: pass/fail units of study; units of study with a grade of DNF; and credited units of study from other institutions.The mark used for units of study with a grade of AF or DF is zero. For combined degree students, units of study taken as part of the second degree are included.

(2) The Engineering Integrated Honours Weighted Average Mark (EIHWAM) is calculated using the same formula as the EWAM in Clause 15.1 with the additional condition that thesis units of study are given a double weighting of 8.

(3) The Weighted Average Mark is calculated by the formula:

Formula
WAM= (CPi x Mi) / (CPi)

Part 5: Other

16 Transitional provisions

(1) These resolutions apply to students who commenced their candidature after 1 January, 2015 and students who commenced their candidature prior to 1 January, 2015 who elect to proceed under these resolutions.

(2) Students who commenced prior to 1 January, 2015 may complete the requirements in accordance with the resolutions in force at the time of their commencement.

Bachelor of Computer Science and Technology

Bachelor of Computer Science and Technology

Bachelor of Computer Science and Technology (Advanced)

Bachelor of Computer Science and Technology (Honours)

These resolutions must be read in conjunction with applicable University By-laws, Rules and policies including (but not limited to) the University of Sydney (Coursework) Rule 2000 (the 'Coursework Rule'), the Resolutions of the Faculty, the University of Sydney (Student Appeals against Academic Decisions) Rule 2006 (as amended) and the Academic Board policies on Academic Dishonesty and Plagiarism.

Course resolutions

1 Course codes

Code	Course title
BPCSTECN-03	Bachelor of Computer Science and Technology
BPCSTECN-03	Bachelor of Computer Science and Technology (Advanced)
BHCSTECH-02	Bachelor of Computer Science and Technology (Honours)
BHCSTECH-02	Bachelor of Computer Science and Technology (Advanced) (Honours)

2 Attendance pattern

The attendance pattern for this course is full-time or part-time. Part time students must still follow appropriate enrolment progression and are subject to the same degree time limits as full time students. International students are required to follow the enrolment pattern as specified by their visa. The Faculty strongly recommends full time enrolment as the preferred option for all undergraduate students unless exceptional circumstances exist.

3 Admission to candidature

(1) Admission to these courses is on the basis of a secondary school leaving qualification such as the NSW Higher School Certificate (including national and international equivalents), tertiary study or an approved preparation program. English language requirements must be met where these are not demonstrated by sufficient qualifications taught in English. Special admission pathways are open for mature aged applicants who do not possess a school leaving qualification, educationally disadvantaged applicants and for Aboriginal and Torres Strait Islander people. Applicants are ranked by merit and offers for available places are issued according to the ranking. Details of admission policies are found in the Coursework Rule.

(2) Candidates for the Bachelor of Science at the University of Sydney may apply to transfer their candidature to the Bachelor of Computer Science and Technology, or the Advanced degree, providing that the applicant has completed 1000-level units of study in mathematics and computer science equivalent to the those specified in the Bachelor of Computer Science and Technology table of units.

4 Requirements for award

(1) The units of study that may be taken for the degrees are set out in the table of units of study: Bachelor of Computer Science and Technology.

(2) To qualify for the award of the Bachelor of Computer Science and Technology, a candidate must successfully complete 144 credit points, comprising:

(a) at least 114 credit points from core and recommended elective units;

(b) 18 credit points of selected Mathematics and Statistics units, with at least six credit points at 2000-level or above;

(c) a maximum of 30 credit points of elective units of study for either a Computer Science stream or an Information Systems stream shown in the units of study tables for this course;

(d) and ensuring

(I) no more than 72 credit points in junior (1000-level) units of study; and

(II) at least 36 credit points in 3000-level or above.

(3) To qualify for the award of the Bachelor of Computer Science and Technology (Advanced), a candidate must successfully complete 144 credit points specified in the Bachelor of Computer Science and Technology above, except:

(a) a minimum of 12 credit points of 2000-level core and recommended elective units are at the Advanced level; and

(b) a minimum of 12 credit points of 3000-level core and recommended elective units are at the Advanced level.

5 Streams

(1) Completion of a stream is a requirement of the course. Candidates have the option of completing up to two streams. Candidates must follow the progression of study as prescribed by the table of units of study for the stream. Units of study counted towards one stream may not count toward any other stream completed. The streams available are:

(a) Computer Science

(b) Information Systems.

6 Progression rules

Candidates for the Bachelor of Computer Science and Technology (Advanced) must maintain a credit average in each year of enrolment. If this level of result is not achieved, candidates will be transferred to the Bachelor of Computer Science and Technology degree program with full credit for units of study already completed.

7 Requirements for the Honours degree

(1) Honours is available to meritorious candidates who complete an additional year of full-time study, after the completion of the pass degree. Part-time study is permitted if the Head of School is satisfied the candidate cannot undertake full-time study.

(2) To qualify for admission to the honours year a candidate should:

(a) have qualified for, or been awarded, the pass degree or an equivalent degree from another university, including a stream or major in the intended area of study;

(b) Admission to the Honours program is by permission of the program coordinator after the completion of the necessary pre-requisites of the Honours Thesis and any other other applicable progression requirements. Admission requires an HWAM of at least 65 calculated at the end of the semester immediately prior to the commencement of Honours.

(c) have the permission of the relevant Head of School.

(3) To qualify for the award of the honours degree a candidate must complete 48 credit points of honours units of study from the Honours Table, as prescribed by the Head of School. The honours mark is determined by calculating a WAM from the 48 credit points of honours level units of study.

(4) Candidates qualified to enrol in two honours streams may either:

(a) complete the honours courses in the two streams separately and in succession; or

(b) complete a joint honours course, equivalent to an honours course in a single stream, in the two streams.

(5) A joint honours course shall comprise such parts of the two honours courses as may be decided by the Head of School.

8 Award of the degree

(1) The Bachelor of Computer Science and Technology and the Bachelor of Computer Science and Technology (Advanced) are awarded in the grades of either Pass or Honours. The honours degree is awarded in classes ranging from First Class to Third Class as below:

Description	Honours Mark Range
Honours Class I	80 <= WAM
Honours Class II (Division 1)	75 <= WAM < 80
Honours Class II (Division 2)	70 <= WAM < 75
Honours Class III	65 <= WAM < 70
Honours not awarded	WAM < 65

(2) Candidates for the award of the Honours degree who do not meet the requirements, and who have not already graduated, will be awarded the pass degree.

9 University Medal

A student with an honours mark of 90 or above and a minimum ISWAM of 80 may be awarded a university medal. The medal is awarded at the discretion of the Faculty to the highest achieving students who in the opinion of the Faculty have an outstanding academic record, in accordance with the Coursework Rule.

10 Transitional provisions

(1) These resolutions apply to students who commenced their candidature after 1 January, 2013 and students who commenced their candidature prior to 1 January, 2013 who elect to proceed under these resolutions.

(2) Candidates who commenced prior to 1 January, 2013 may complete the requirements in accordance with the resolutions in force at the time of their commencement.

Bachelor of Engineering Honours

Bachelor of Engineering Honours

These resolutions must be read in conjunction with applicable University By-laws, Rules and policies including (but not limited to) the University of Sydney (Coursework) Rule 2000 (the 'Coursework Rule'), the Resolutions of the Faculty, the University of Sydney (Student Appeals against Academic Decisions) Rule 2006 (as amended) and the Academic Board policies on Academic Dishonesty and Plagiarism.

Course resolutions

Terminology: In the following resolutions, all references to the Bachelor of Engineering degree apply to both the Bachelor of Engineering and Bachelor of Engineering Honours degrees, except where otherwise indicated.

1 Course codes

Code	Course title
BHENGINE	Bachelor of Engineering Honours
BUENGINE	Bachelor of Engineering

2 Attendance pattern

The attendance pattern for this course is full time or part time. Part time students must still follow appropriate enrolment progression and are subject to the same degree time limits as full time students. International students are required to follow the enrolment pattern as specified by their visa. The Faculty strongly recommends full time enrolment as the preferred option for all undergraduate students unless exceptional circumstances exist.

3 Streams

(1) The Bachelor of Engineering Honours is available in the following streams:
(a) *School of Aerospace, Mechanical and Mechatronic Engineering*
(I) Aeronautical Engineering
(II) Aeronautical Engineering (Space)
(III) Mechanical Engineering
(IV) Mechanical Engineering (Space)
(V) Mechatronic Engineering
(VI) Mechatronic Engineering (Space)
(b) *School of Chemical and Biomolecular Engineering*
(I) Chemical and Biomolecular Engineering
(c) *School of Civil Engineering*
(I) Civil Engineering
(II) Civil Engineering (Construction Management)
(III) Civil Engineering (Environmental)
(IV) Civil Engineering (Geotechnical)
(V) Civil Engineering (Structures)
(VI) Project Engineering and Management (Civil)
(d) *School of Electrical and Information Engineering*
(I) Electrical Engineering
(II) Electrical Engineering (Computer)
(III) Electrical Engineering (Power)
(IV) Electrical Engineering (Telecommunications)
(V) Software Engineering
(e) Faculty wide stream
(I) Biomedical Engineering
(2) Completion of a stream is a requirement of the course.

4 Admission to candidature

(1) Admission to this course is on the basis of a secondary school leaving qualification such as the NSW Higher School Certificate (including national and international equivalents), tertiary study or an approved preparation program. English language requirements must be met where these are not demonstrated by sufficient qualifications taught in English. Special admission pathways are open for mature aged applicants who do not possess a school leaving qualification, educationally disadvantaged applicants and for Aboriginal and Torres Strait Islander people. Applicants are ranked by merit and offers for available places are issued according to the ranking. Details of admission policies are found in the Coursework Rule.
(2) In addition, applicants who have completed the requirements of a Bachelor of Science or equivalent qualification, with a minimum WAM of 50, may apply for admission to the Bachelor of Engineering.

5 Requirements for award

(1) The units of study that may be taken for the course are set out in the Bachelor of Engineering Flexible First Year table of units of study, and the tables of units of study for the specialised stream in the degree.
(2) To qualify for the award of the Bachelor of Engineering Honours degree, a candidate must:
(a) successfully complete 192 credit points comprising:
(I) core and elective units of study relating to the specialist stream, as prescribed by the table of units of study for the stream; and
(II) any additional free elective units of study as may be necessary to gain credit to complete the award; and
(b) have an EWAM of at least 65 immediately prior to the semester in which a thesis unit of study is first attempted; and
(c) have an EIHWAM of at least 65 at the completion of the degree; and

(d) complete the requirements within a time limit of 5 years for a single Bachelor of Engineering Honours degree or complete the requirements within a time limit of 6 years for a combined Engineering Honours degree.

(3) Candidates who satisfy Clause 5.2(a), but who have not satisfied all of Clauses 5.2(b), 5.2(c) and 5.2(d), will qualify for the award of the Bachelor of Engineering degree (i.e. the pass degree, awarded without Honours).

(4) The class of Honours will be determined by the EIHWAM.

(5) In exceptional circumstances, the Dean may vary the conditions for the award of Honours after seeking the advice of the relevant Head of School.

6 Level of Honours Awarded

(1) The Bachelor of Engineering Honours degree is awarded in classes ranging from First Class to Second Class, Division Two. The various classes of Honours are awarded on the basis of a candidate's EIHWAM.

Description	HWAM Range
Honours Class I	75 <= EIHWAM
Honours Class II (Division 1)	70 <= EIHWAM < 75
Honours Class II (Division 2)	65 <= EIHWAM < 70

7 University Medal

A student with an EIHWAM of 85 or above and who meets the criteria for Honours may be awarded a university medal. The medal is awarded at the discretion of the Faculty to the highest achieving student in each stream who in the opinion of the Faculty has an outstanding academic record, in accordance with the Coursework Rule.

8 Transitional provisions

(1) These resolutions apply to students who commenced their candidature after 1 January, 2015 and students who commenced their candidature prior to 1 January, 2015 who elect to proceed under these resolutions.

(2) Candidates who commenced prior to 1 January, 2015 may complete the requirements in accordance with the resolutions in force at the time of their commencement.

Bachelor of Information Technology

Bachelor of Information Technology

Bachelor of Information Technology (Honours)

These resolutions must be read in conjunction with applicable University By-laws, Rules and policies including (but not limited to) the University of Sydney (Coursework) Rule 2000 (the 'Coursework Rule'), the Resolutions of the Faculty, the University of Sydney (Student Appeals against Academic Decisions) Rule 2006 (as amended) and the Academic Board policies on Academic Dishonesty and Plagiarism.

Course resolutions

1 Course codes

Code	Course title
BPINFTEC-02	Bachelor of Information Technology
BHINFTEH-02	Bachelor of Information Technology (Honours)

2 Attendance pattern

The attendance pattern for this course is full time or part time. Part time students must still follow appropriate enrolment progression and are subject to the same degree time limits as full time students. International students are required to follow the enrolment pattern as specified by their visa. The Faculty strongly recommends full time enrolment as the preferred option for all undergraduate students unless exceptional circumstances exist.

3 Admission to candidature

(1) Admission to this course is on the basis of a secondary school leaving qualification such as the NSW Higher School Certificate (including national and international equivalents), tertiary study or an approved preparation program. English language requirements must be met where these are not demonstrated by sufficient qualifications taught in English. Special admission pathways are open for mature aged applicants who do not possess a school leaving qualification, educationally disadvantaged applicants and for Aboriginal and Torres Strait Islander people. Applicants are ranked by merit and offers for available places are issued according to the ranking. Details of admission policies are found in the Coursework Rule.

(2) Applicants from other Engineering and Information Technologies or Science degree programs at the University of Sydney who have completed at least 48 credit points may be permitted to transfer to the Bachelor of Information Technology degree if their mark averaged over all attempted units of study is 70 or greater.

4 Requirements for award

(1) The units of study that may be taken for the courses are set out in the Bachelor of Information Technology units of study table.

(2) To qualify for the award of the pass degree, a candidate must successfully complete 192 credit points, comprising:

(a) a minimum of 144 credit points of core and selected core units of study in the chosen stream; and

(b) 18 credit points of selected Mathematics and Statistics units, with at least six credit points at 2000-level or above; and

(c) 30 credit points of elective units of study;

(d) and ensuring:

(I) no more than 72 credit points in junior (1000-level) units of study, and

(II) at least 84 credit points in 3000-level or above units of study.

5 Streams

(1) Completion of a stream is a requirement of the course. Candidates have the option of completing up to two streams. Candidates must follow the progression of study as prescribed by the table of units of study for the stream. The streams available are:

(a) Computer Science

(b) Information Systems.

6 Progression rules

Candidates must maintain a credit average in 1000 and 2000-level core units. If this level of result is not achieved, candidates will be transferred to the Bachelor of Computer Science and Technology degree program with full credit for units of study already completed.

7 Requirements for the Honours degree

(1) Honours is available to meritorious candidates who complete an alternative set of units of study in the final year of the program. Candidates shall complete the requirements for the honours course full-time over two consecutive semesters. Part-time study is permitted if the Head of Department/ Discipline/ Program Coordinator is satisfied the candidate cannot undertake full-time study.

(2) Admission to the honours program is by permission of the program coordinator after the completion of third year. Admission to the Honours program is by permission of the program coordinator after the completion of the necessary pre-requisites of the Honours Thesis and any other applicable progression requirements. Admission requires an HWAM of at least 65 calculated at the end of the semester immediately prior to the commencement of Honours.

(3) To qualify for the award of the honours degree a candidate must complete the requirements for the pass degree but include the alternative 24 credit point honours pathway described in the table of units for the degree, 24 credit points in 4000 or 5000-level selected core units of study and achieve a Computer Science Honours Result of 65 or above. Completion of the degree is required in the minimum standard full time duration. The honours mark will be determined by calculating the WAM in all 4000 and 5000-level units completed.

(4) Candidates qualified to enrol in two honours courses may either:

(a) complete the honours courses in the two streams separately and in succession; or

(b) complete a joint honours course, equivalent to an honours course in a single stream, in the two streams.

(5) A joint honours course shall comprise such parts of the two honours courses as may be decided by the Dean.

8 Award of the degree

(1) The Bachelor of Information Technology is awarded in the grades of either Pass or Honours. The honours degree is awarded in classes ranging from First Class to Third Class as below:

Description	Honours Mark Range
Honours Class I	80 <= WAM
Honours Class II (Division 1)	75 <= WAM < 80
Honours Class II (Division 2)	70 <= WAM < 75
Honours Class III	65 <= WAM < 70
Honours not awarded	WAM < 65

(2) A candidate who does not meet the requirements for the award of honours but who have otherwise satisfied the requirements of the Bachelor of Information Technology shall graduate with the pass degree.

9 University Medal

A student with an honours mark of 90 or above and a minimum ISWAM of 80 may be awarded a university medal. The medal is awarded at the discretion of the Faculty to the highest achieving students who in the opinion of the Faculty have an outstanding academic record, in accordance with the Coursework Rule.

10 Course transfer

(1) Candidates may apply to the Dean for permission to transfer candidature to the Bachelor of Computer Science and Technology. There is no WAM requirement for candidates wishing to transfer to the standard Bachelor of Computer Science and Technology degree.

(2) Candidates enrolled in the Bachelor of Information Technology who have satisfied the requirements of the Bachelor of Science, Bachelor of Science (Advanced), Bachelor of Computer Science and Technology or Bachelor of Computer Science and Technology (Advanced) may elect to transfer to such degree with the permission of the faculty.

11 Transitional provisions

(1) These resolutions apply to students who commenced their candidature after 1 January, 2011 and students who commenced their candidature prior to 1 January, 2011 who elect to proceed under these resolutions.

(2) Candidates who commenced prior to 1 January, 2011 may complete the requirements in accordance with the resolutions in force at the time of their commencement.

Bachelor of Project Management

Bachelor of Project Management

These resolutions must be read in conjunction with applicable University By-laws, Rules and policies including (but not limited to) the University of Sydney (Coursework) Rule 2000 (the 'Coursework Rule'), the Resolutions of the Faculty, the University of Sydney (Student Appeals against Academic Decisions) Rule 2006 (as amended) and the Academic Board policies on Academic Dishonesty and Plagiarism.

Course resolutions

1 Course codes

Code	Course title
BPPRJMGT-01	Bachelor of Project Management

2 Attendance pattern

The attendance pattern for this course is full time or part time. Part time students must still follow appropriate enrolment progression and are subject to the same degree time limits as full time students. International students are required to follow the enrolment pattern as specified by their visa. The Faculty strongly recommends full time enrolment as the preferred option for all undergraduate students unless exceptional circumstances exist.

3 Streams

(1) Completion of a stream is a requirement of the Bachelor of Project Management course unless it is taken as part of a combined degree program. The streams available are:

(a) Civil Engineering Science
(b) Built Environment
(c) Software

4 Admission to candidature

(1) Admission to this course is on the basis of a secondary school leaving qualification such as the NSW Higher School Certificate (including national and international equivalents), tertiary study or an approved preparation program. English language requirements must be met where these are not demonstrated by sufficient qualifications taught in English. Special admission pathways are open for mature aged applicants who do not possess a school leaving qualification, educationally disadvantaged applicants and for Aboriginal and Torres Strait Islander people. Applicants are ranked by merit and offers for available places are issued according to the ranking. Details of admission policies are found in the Coursework Rule.

5 Requirements for award

(1) To qualify for the award of the pass degree, a candidate must successfully complete 144 credit points, comprising:

(a) The core units of study as set out in the Bachelor of Project Management unit of study table;
(b) The units of study specified for the relevant stream of the degree and
(c) Any additional elective units of study that are applicable to the Bachelor of Project Management; and/or a maximum of 12 credit points of free electives; as may be necessary to gain credit to complete the requirements of the degree.

6 Requirements for the Honours degree

(1) Honours is available to meritorious candidates who complete an additional year of full-time study, after the completion of the pass degree. Part-time study is permitted if the Head of School is satisfied the candidate cannot undertake full-time study.

(2) To qualify for admission to the honours year a candidate should:

(a) have qualified for, or been awarded, the pass degree or an equivalent degree from another university, including a stream or major in the intended area of study;
(b) Admission to the Honours program is by permission of the program coordinator after the completion of the necessary pre-requisites of the Honours Thesis and any other applicable progression requirements. Admission requires an HWAM of at least 65 calculated at the end of the semester immediately prior to the commencement of Honours.
(c) have the permission of the relevant Head of School.

(3) To qualify for the award of the honours degree a candidate must complete 48 credit points of honours units of study from the Honours Table, as prescribed by the Head of School. The honours mark is determined by calculating a WAM from the 48 credit points of honours level units of study.

7 Award of the degree

(1) The Bachelor of Project Management is awarded in the grades of either Pass or Honours. The honours degree is awarded in classes ranging from First Class to Third Class as below:

Description	HWAM Range
Honours Class I	80 >=HWAM
Honours Class II (Division 1)	75 <= HWAM < 80
Honours Class II (Division 2)	70 <= HWAM < 75
Honours Class III	65 <= WAM < 70
Honours not awarded	WAM < 65

(2) Candidates for the award of the Honours degree who do not meet the requirements, and who have not already graduated, will be awarded the pass degree.

8 University Medal

A student with an honours mark of 90 or above and a minimum ISWAM of 80 may be awarded a university medal. The medal is awarded at the discretion of the Faculty to the highest achieving student in each stream who in the opinion of the Faculty have an outstanding academic record, in accordance with the Coursework Rule.

9 Transitional provisions

(1) These resolutions apply to students who commenced their candidature after 1 January, 2012 and students who commenced their candidature prior to 1 January, 2012 who elect to proceed under these resolutions.

(2) Candidates who commenced prior to 1 January, 2012 may complete the requirements in accordance with the resolutions in force at the time of their commencement.

Bachelor of Engineering Honours/Bachelor of Arts

Bachelor of Engineering Honours and Bachelor of Arts

These resolutions must be read in conjunction with applicable University By-laws, Rules and policies including (but not limited to) the University of Sydney (Coursework) Rule 2000 (the 'Coursework Rule'), the Resolutions of the Faculty, the University of Sydney (Student Appeals against Academic Decisions) Rule 2006 (as amended) and the Academic Board policies on Academic Dishonesty and Plagiarism.

Terminology: In the following resolutions, all references to the Bachelor of Engineering degree apply to both the Bachelor of Engineering and Bachelor of Engineering Honours degrees, except where otherwise indicated.

Course resolutions

1 Course codes

Code	Course title
BHENGART1000	Bachelor of Engineering Honours and Bachelor of Arts
BHENGART1000	Bachelor of Engineering and Bachelor of Arts

2 Attendance pattern

The attendance pattern for this course is full time or part time. Part time students must still follow appropriate enrolment progression and are subject to the same degree time limits as full time students. International students are required to follow the enrolment pattern as specified by their visa. The Faculty strongly recommends full time enrolment as the preferred option for all undergraduate students unless exceptional circumstances exist.

3 Streams

(1) Streams available for the Bachelor of Engineering are listed under the course resolution for the Bachelor of Engineering.
(2) Completion of a stream is a requirement of the Bachelor of Engineering.

4 Cross faculty management

(1) Candidates in this combined degree program will be under the general supervision of the Faculty of Engineering and Information Technologies for the duration of the combined program.
(2) The Deans of the Faculty of Engineering and Information Technologies and the Faculty of Arts and Social Sciences shall jointly exercise authority in any matter concerned with the combined course not otherwise dealt with in these resolutions.

5 Admission to candidature

Admission to this course is on the basis of a secondary school leaving qualification such as the NSW Higher School Certificate (including national and international equivalents), tertiary study or an approved preparation program. English language requirements must be met where these are not demonstrated by sufficient qualifications taught in English. Special admission pathways are open for mature aged applicants who do not possess a school leaving qualification, educationally disadvantaged applicants and for Aboriginal and Torres Strait Islander people. Applicants are ranked by merit and offers for available places are issued according to the ranking. Details of admission policies are found in the Coursework Rule.

6 Requirements for award

(1) The units of study that may be taken for the Bachelor of Engineering are set out in the tables of units of study for the specialised streams from the Faculty of Engineering and Information Technologies.
(2) The units of study that may be taken for the Bachelor of Arts are set out in Table A from the Faculty of Arts and Social Sciences Tables of units of study.
(3) To qualify for the award of the combined degree, a candidate must complete 240 credit points.
(4) For the Bachelor of Engineering a candidate must complete all units of study prescribed in the table of units for the Bachelor of Engineering stream the candidate is pursuing.
(5) For the Bachelor of Arts a candidate must complete a total of 84 credit points from Table A, including:
(a) a major from Table A;
(b) a minimum 54 credit points of 2000/3000 level units of study.

7 Majors

Completion of a Table A major is a requirement of the Bachelor of Arts component of the combined degree. The list of Table A majors is specified in the resolutions of the Faculty of Arts and Social Sciences.

8 Requirements for the Honours degree

(1) Honours is available to meritorious candidates, in either or both the Bachelor of Engineering or Bachelor of Arts. The Bachelor of Arts Honours program may be completed part time over two years with permission of the administering department or program.
(2) Award requirements for Honours in the Bachelor of Engineering Honours are as listed in clauses 5.2(b)-(d) and clause 6 of the resolutions for the Bachelor of Engineering Honours degree.
(3) Admission and award requirements for Honours in the Bachelor of Arts are listed in the resolutions of the Faculty of Arts and Social Sciences.

9 Award of the degrees

(1) Candidates will be awarded a separate testamur for each degree completed.
(2) The Bachelor of Engineering and the Bachelor of Arts are awarded in the grades of either Pass or Honours. The Bachelor of Engineering honours degree is awarded in classes ranging from First Class to Second Class, and the Bachelor of Arts honours degree is awarded in classes ranging from First Class to Third Class, according to the rules specified in the Resolutions of the Faculty of Engineering and Information Technologies and Faculty of Arts and Social Sciences.

(3) Candidates who do not meet the requirements for the award of the Bachelor of Engineering (Honours) but who have otherwise satisfied the requirements of the Bachelor of Engineering shall graduate with the pass degree.

(4) Candidates for the award of the Bachelor of Arts (Honours) who do not meet the requirements, and who have not already graduated, will be awarded the pass degree.

10 Course transfer

A candidate may abandon the combined program and elect to complete either the Bachelor of Engineering or the Bachelor of Arts in accordance with the resolutions governing that degree. Completion of the abandoned degree in the future will require a new application for admission to candidature for that course and completion in accordance with the resolutions governing that degree.

11 Transitional provisions

(1) These resolutions apply to students who commenced their candidature after 1 January, 2015 and students who commenced their candidature prior to 1 January, 2015 who elect to proceed under these resolutions.

(2) Candidates who commenced prior to 1 January, 2015 may complete the requirements in accordance with the resolutions in force at the time of their commencement.

Bachelor of Engineering Honours/Bachelor of Commerce

Bachelor of Engineering Honours and Bachelor of Commerce

These resolutions must be read in conjunction with applicable University By-laws, Rules and policies including (but not limited to) the University of Sydney (Coursework) Rule 2000 (the 'Coursework Rule'), the Resolutions of the Faculty, the University of Sydney (Student Appeals against Academic Decisions) Rule 2006 (as amended) and the Academic Board policies on Academic Dishonesty and Plagiarism.

Terminology: In the following resolutions, all references to the Bachelor of Engineering degree apply to both the Bachelor of Engineering and Bachelor of Engineering Honours degrees, except where otherwise indicated.

Course resolutions

1 Course codes

Code	Course title
BHENGCOM1000	Bachelor of Engineering Honours and Bachelor of Commerce
BHENGCOM1000	Bachelor of Engineering and Bachelor of Commerce

2 Attendance pattern

The attendance pattern for this course is full time or part time. Part time students must still follow appropriate enrolment progression and are subject to the same degree time limits as full time students. International students are required to follow the enrolment pattern as specified by their visa. The Faculty strongly recommends full time enrolment as the preferred option for all undergraduate students unless exceptional circumstances exist.

3 Streams

(1) Streams available for the Bachelor of Engineering are listed under the course resolution for the Bachelor of Engineering.

(2) Completion of a stream is a requirement of the Bachelor of Engineering.

4 Cross faculty management

(1) Candidates in this combined degree will be under the general supervision of the Faculty of Engineering and Information Technologies for the duration of the combined program.

(2) The Deans of the Faculty of Engineering and Information Technologies and The University of Sydney Business School shall jointly exercise authority in any matter concerned with the combined course not otherwise dealt with in these resolutions.

5 Admission to candidature

Admission to this course is on the basis of a secondary school leaving qualification such as the NSW Higher School Certificate (including national and international equivalents), tertiary study or an approved preparation program. English language requirements must be met where these are not demonstrated by sufficient qualifications taught in English. Special admission pathways are open for mature aged applicants who do not possess a school leaving qualification, educationally disadvantaged applicants and for Aboriginal and Torres Strait Islander people. Applicants are ranked by merit and offers for available places are issued according to the ranking. Details of admission policies are found in the Coursework Rule.

6 Requirements for award

(1) The units of study that may be taken for the Bachelor of Engineering are set out in the tables of units of study for the specialised streams from the Faculty of Engineering and Information Technologies.

(2) The units of study that may be taken for the Bachelor of Commerce are set out in the Table of undergraduate units of study from The University of Sydney Business School.

(3) To qualify for the award of the combined degree, a candidate must successfully complete 240 credit points.

(4) For the Bachelor of Engineering / Bachelor of Engineering Honours, candidates must complete all units of study prescribed in the table of units for the Bachelor of Engineering / Bachelor of Engineering Honours stream the candidate is pursuing.

(5) For the Bachelor of Commerce, candidates must complete 96 credit points of units of study selected from the Table of undergraduate units of study from The University of Sydney Business School including:

(a) 36 credit points of core units of study (30 junior credit points and six senior credit points); and

(b) a major; and

(c) at least 48 credit points at 2000 and/or 3000 levels.

7 Majors

Completion of a major is a requirement of the Bachelor of Commerce component of the combined degree. The majors available and requirements are outlined in the resolutions for the Bachelor of Commerce.

8 Requirements for the Honours degree

(1) Honours is available to meritorious candidates, in either or both the Bachelor of Engineering or Bachelor of Commerce. The Bachelor of Commerce Honours program may be completed part time over two years with the permission of The University of Sydney Business School.

(2) Award requirements for Honours in the Bachelor of Engineering Honours are as listed in clauses 5.2(b)-(d) and clause 6 of the resolutions for the Bachelor of Engineering Honours degree.

(3) Admission and award requirements for Honours in the Bachelor of Commerce are listed in the resolutions of The University of Sydney Business School.

9 Award of the degrees

(1) Candidates will be awarded a separate testamur for each degree completed.

(2) The Bachelor of Engineering and the Bachelor of Commerce are awarded in the grades of either Pass or Honours. The Bachelor of Engineering honours degree is awarded in classes ranging from First Class to Second Class, and the Bachelor of Commerce honours

degree is awarded in classes ranging from First Class to Third Class, according to the rules specified in the Resolutions of the Faculty of Engineering and Information Technologies and The University of Sydney Business School.

(3) Candidates who do not meet the requirements for the award of the Bachelor of Engineering (Honours) but have otherwise satisfied the requirements of the Bachelor of Engineering shall graduate with the pass degree.

(4) Candidates for the award of the Bachelor of Commerce (Honours) who do not meet the requirements, and who have not already graduated, will be awarded the pass degree.

10 Course transfer

A candidate may abandon the combined program and elect to complete either the Bachelor of Engineering or the Bachelor of Commerce in accordance with the resolutions governing that degree. Transfer from a combined degree to the Bachelor of Commerce is also conditional on the student having met the entry requirements of the Bachelor of Commerce in force at the time of their enrolment in the combined degree. Completion of the abandoned degree in the future will require a new application for admission to that course and completion in accordance with the resolutions governing that degree.

11 Transitional provisions

(1) These resolutions apply to students who commenced their candidature after 1 January, 2015 and students who commenced their candidature prior to 1 January, 2015 who elect to proceed under these resolutions.

(2) Candidates who commenced prior to 1 January, 2015 may complete the requirements in accordance with the resolutions in force at the time of their commencement.

Bachelor of Engineering Honours/Bachelor of Design in Architecture

Bachelor of Engineering Honours and Bachelor of Design in Architecture

These resolutions must be read in conjunction with applicable University By-laws, Rules and policies including (but not limited to) the University of Sydney (Coursework) Rule 2000 (the 'Coursework Rule'), the Resolutions of the Faculty, the University of Sydney (Student Appeals against Academic Decisions) Rule 2006 (as amended) and the Academic Board policies on Academic Dishonesty and Plagiarism.

Terminology: In the following resolutions, all references to the Bachelor of Engineering degree apply to both the Bachelor of Engineering and Bachelor of Engineering Honours degrees, except where otherwise indicated.

Course resolutions

1 Course codes

Code	**Course title**
BHENGDAR1000	Bachelor of Engineering Honours and Bachelor of Design in Architecture
BHENGDAR1000	Bachelor of Engineering and Bachelor of Design in Architecture

2 Attendance pattern

The attendance pattern for this course is full time only.

3 Streams

(1) The Bachelor of Engineering is available only in the Civil Engineering stream in this combined degree program. Completion of a stream is a requirement of the Bachelor of Engineering.

(2) Streams available for the Bachelor of Design in Architecture are listed under the course resolution for the Bachelor of Design in Architecture. Completion of a stream is not a requirement of the course. Candidates may transfer between streams in the Bachelor of Design in Architecture.

4 Cross faculty management

(1) Candidates in this combined degree program will be under the general supervision of the Faculty of Engineering and Information Technologies for the duration of the combined program.

(2) The Deans of the Faculty of Engineering and Information Technologies and the Faculty of Architecture, Design and Planning shall jointly exercise authority in any matter concerned with the combined course not otherwise dealt with in these resolutions.

5 Admission to candidature

Admission to this course is on the basis of a secondary school leaving qualification such as the NSW Higher School Certificate (including national and international equivalents), tertiary study or an approved preparation program. English language requirements must be met where these are not demonstrated by sufficient qualifications taught in English. Special admission pathways are open for mature aged applicants who do not possess a school leaving qualification, educationally disadvantaged applicants and for Aboriginal and Torres Strait Islander people. Applicants are ranked by merit and offers for available places are issued according to the ranking. Details of admission policies are found in the Coursework Rule.

6 Requirements for award

To qualify for the award of the combined degree, a candidate must successfully complete 240 credit points in accordance with the unit of study tables for the Civil Engineering combined with Design in Architecture degree.

7 Requirements for the Honours degree

(1) Honours is available to meritorious candidates, in either or both the Bachelor of Engineering Honours or the Bachelor of Design in Architecture.

(2) Award requirements for Honours in the Bachelor of Engineering Honours are as listed in clauses 5.2(b)-(d) and clause 6 of the resolutions for the Bachelor of Engineering Honours degree.

(3) Admission and award requirements for Honours in the Bachelor of Design in Architecture are listed in the resolutions of the Faculty of Architecture, Design and Planning.

8 Award of the degrees

(1) Candidates will be awarded a separate testamur for each degree completed.

(2) The Bachelor of Engineering and the Bachelor Design in Architecture are awarded in the grades of either Pass or Honours. The honours degrees are awarded in classes ranging from First Class to Second Class according to the rules specified in the Resolutions of the Faculty of Engineering and Information Technologies and the Faculty of Architecture, Design and Planning.

(3) Candidates who do not meet the requirements for the award of the Bachelor of Engineering (Honours) but have otherwise satisfied the requirements of the Bachelor of Engineering shall graduate with the pass degree.

(4) Candidates for the award of the Bachelor of Design in Architecture (Honours) who do not meet the requirements, and who have not already graduated, will be awarded the pass degree.

9 Course transfer

A candidate may abandon the combined program and elect to complete either the Bachelor of Engineering or the Bachelor of Design in Architecture in accordance with the resolutions governing that degree. Completion of the abandoned degree in the future will require a new application for admission to that course and completion in accordance with the resolutions governing that degree.

10 Transitional provisions

(1) These resolutions apply to persons who commenced their candidature after 1 January, 2015 and persons who commenced their candidature prior to 1 January, 2015 who elect to proceed under these resolutions.

(2) Candidates who commenced prior to 1 January, 2015 may complete the requirements in accordance with the resolutions in force at the time of their commencement.

Bachelor of Engineering Honours/Bachelor of Laws

Bachelor of Engineering Honours and Bachelor of Laws

These resolutions must be read in conjunction with applicable University By-laws, Rules and policies including (but not limited to) the University of Sydney (Coursework) Rule 2000 (the 'Coursework Rule'), the Resolutions of the Faculty, the University of Sydney (Student Appeals against Academic Decisions) Rule 2006 (as amended) and the Academic Board policies on Academic Dishonesty and Plagiarism.

Terminology: In the following resolutions, all references to the Bachelor of Engineering degree apply to both the Bachelor of Engineering and Bachelor of Engineering Honours degrees, except where otherwise indicated.

Course resolutions

1 Course codes

Code	Course title
BHENGLAW1000	Bachelor of Engineering Honours and Bachelor of Laws
BHENGLAW1000	Bachelor of Engineering and Bachelor of Laws

2 Attendance pattern

The attendance pattern for this course is full time only.

3 Streams

Completion of a stream is a requirement of the Bachelor of Engineering. Streams available for the Bachelor of Engineering are listed under the course resolution for the Bachelor of Engineering.

4 Cross-faculty management

(1) Candidates in this combined degree program will be under the general supervision of the Faculty of Engineering and Information Technologies until the end of the semester in which they complete the requirements for the Bachelor of Engineering. They will then be under the supervision of the Faculty of Law.

(2) The Deans of the Faculty of Engineering and Information Technologies and the Faculty of Law shall jointly exercise authority in any matter concerned with the combined course not otherwise dealt with in these resolutions.

5 Admission to candidature

Admission to this course is on the basis of a secondary school leaving qualification such as the NSW Higher School Certificate (including national and international equivalents), tertiary study or an approved preparation program. English language requirements must be met where these are not demonstrated by sufficient qualifications taught in English. Special admission pathways are open for educationally disadvantaged applicants and for Aboriginal and Torres Strait Islander people. Applicants are ranked by merit and offers for available places are issued according to the ranking. Details of admission policies are found in the Coursework Rule.

6 Requirements for award

(1) The units of study that may be taken for this combined degree are set out in the tables of units of study for the specialised streams from the Faculty of Engineering and Information Technologies and in the Faculty of Law Undergraduate Table.

(2) To qualify for the award of the pass degrees in the combined program, a candidate must complete 288 credit points, comprising:

(a) 144 credit points of units of study from the table of units for the Bachelor of Engineering, appropriate to the stream the candidate is pursuing; and

(b) 144 credit points of Law units of study, of which 48 credit points are Combined Law compulsory units of study for years 1, 2 and 3 and are credited towards the requirements for both the Bachelor of Engineering and the Bachelor of Laws.

(3) *Requirements for the Bachelor of Engineering*

To qualify for the award of the Bachelor of Engineering, candidates must complete 192 credit points comprising:

(I) 48 credit points of Combined Law compulsory units of study for Years 1, 2, and 3; and

(II) 144 credit points of units of study from the table of units for the Bachelor of Engineering, appropriate to the stream the candidate is pursuing.

(4) *Requirements for the Bachelor of Laws*

To qualify for the award of the Bachelor of Laws, candidates must complete 144 credit points taken from the Faculty of Law Undergraduate Table, comprising:

(I) 102 credit points of compulsory units of study; and

(II) 42 credit points of elective units of study, of which a maximum of 36 credit points are taken from Part 1 and a minimum of 6 credit points are taken from Part 2.

7 Progression rules

(1) Candidates in a combined law program must successfully complete LAWS1006 Foundations of Law before enrolling in any other Bachelor of Laws units of study.

(2) Candidates are required to complete the Bachelor of Laws units of study in the order listed in the Faculty of Law Undergraduate Table.

(3) Except with permission of the Dean of the Faculty of Law, candidates must complete the requirements for the Bachelor of Engineering before proceeding to Year Five of the Bachelor of Laws.

8 Requirements for the Honours degree

(1) Both the Bachelor of Engineering Honours and the Bachelor of Laws may be awarded with Honours.

(2) Award requirements for Honours in the Bachelor of Engineering Honours are as listed in clauses 5.2(b)-(d) and clause 6 of the resolutions for the Bachelor of Engineering Honours degree.

(3) Honours in the Bachelor of Laws is available to meritorious students who complete an alternative set of units of study in the final year of the program.

(4) The admission and award requirements for Honours in Law are listed in the resolutions of the Bachelor of Laws.

9 Award of the degrees

(1) The Bachelor of Engineering and Bachelor of Laws are awarded in the grades of either Pass or Honours.
(2) Honours in the Bachelor of Engineering is awarded in First or Second Class in accordance with the resolutions of the Bachelor of Engineering.
(3) Honours in the Bachelor of Laws is awarded in First Class or Second Class in accordance with the resolutions of the Bachelor of Laws.

10 Course transfer

A candidate may withdraw from the combined degree program and elect to transfer to the Bachelor of Engineering, by written application to the Faculty of Engineering and Information Technologies, and complete the requirements in accordance with the resolutions governing that degree at the time of transfer. Candidature in the Bachelor of Laws will cease in these circumstances.

11 Transitional provisions

(1) These resolutions apply to students who commenced their candidature on or after 1 January, 2015.
(2) Candidates who commenced prior to 1 January, 2015 may complete the requirements in accordance with the resolutions in force at the time of their commencement.
(3) Notwithstanding sub-rule (2), the admission and award requirements for Honours in the Bachelor of Laws will be determined according to the transitional provisions in rule 11 of the resolutions of the Bachelor of Laws.

Bachelor of Engineering Honours/Bachelor of Medical Science

Bachelor of Engineering Honours and Bachelor of Medical Science

These resolutions must be read in conjunction with applicable University By-laws, Rules and policies including (but not limited to) the University of Sydney (Coursework) Rule 2000 (the 'Coursework Rule'), the Resolutions of the Faculty, the University of Sydney (Student Appeals against Academic Decisions) Rule 2006 (as amended) and the Academic Board policies on Academic Dishonesty and Plagiarism.

Terminology: In the following resolutions, all references to the Bachelor of Engineering degree apply to both the Bachelor of Engineering and Bachelor of Engineering Honours degrees, except where otherwise indicated.

Course resolutions

1 Course codes

Code	Course title
BHENGMSC1000	Bachelor of Engineering Honours and Bachelor of Medical Science
BHENGMSC1000	Bachelor of Engineering and Bachelor of Medical Science

2 Attendance pattern

The attendance pattern for this course is full time or part time. Part time students must still follow appropriate enrolment progression and are subject to the same degree time limits as full time students. International students are required to follow the enrolment pattern as specified by their visa. The Faculty strongly recommends full time enrolment as the preferred option for all undergraduate students unless exceptional circumstances exist.

3 Streams

(1) Streams available for the Bachelor of Engineering are listed under the course resolution for the Bachelor of Engineering.
(2) Completion of a stream is a requirement of the Bachelor of Engineering.

4 Cross faculty management

(1) Candidates in this combined degree program will be under the general supervision of the Faculty of Engineering and Information Technologies for the duration of the combined program.
(2) The Deans of the Faculty of Engineering and Information Technologies and the Faculty of Science shall jointly exercise authority in any matter concerned with the combined course not otherwise dealt with in these resolutions.

5 Admission to candidature

Admission to this course is on the basis of a secondary school leaving qualification such as the NSW Higher School Certificate (including national and international equivalents), tertiary study or an approved preparation program. English language requirements must be met where these are not demonstrated by sufficient qualifications taught in English. Special admission pathways are open for mature aged applicants who do not possess a school leaving qualification, educationally disadvantaged applicants and for Aboriginal and Torres Strait Islander people. Applicants are ranked by merit and offers for available places are issued according to the ranking. Details of admission policies are found in the Coursework Rule.

6 Progression rules

General progression rules for the combined degree are covered by the resolutions of the Faculty of Engineering and Information Technologies.

7 Requirements for award

(1) The units of study that may be taken for the Bachelor of Engineering are set out in the tables of units of study for the specialised streams from the Faculty of Engineering and Information Technologies.
(2) The units of study that may be taken for the Bachelor of Medical Science are listed in Table IV for the Bachelor of Medical Science from the Faculty of Science.
(3) To qualify for the award of the combined degree, a candidate must successfully complete 240 credit points.
(4) For the Bachelor of Engineering, candidates must complete all units of study prescribed in the table of units for the Bachelor of Engineering stream the candidate is pursuing, noting that the mathematics requirement for this degree will also satisfy the mathematics requirements for the Bachelor of Medical Science.
(5) For the Bachelor of Medical Science a candidate must complete 102 credit points of units including:
(a) A minimum of 30 credit points from junior Science units of study, including
(i) 12 credit points from Mathematics; and
(ii) 12 credit points from Chemistry; and
(iii) MBLG1001/1901 Introductory Molecular Biology and Genetics;
(b) 48 credit points from intermediate Science units of study, comprising
(i) 36 credit points of BMED240X units from Table IVB for the Bachelor of Medical Science; and
(ii) MBLG2X71 Molecular Biology and Genetics A; and
(iii) MBLG2X72 Molecular Biology and Genetics B.
(c) A minimum of 24 credit points of senior Science units of study selected from the subject areas of Anatomy/Histology, Biology (Genetics), Biochemistry, Cell Pathology, Histology, Immunology, Infectious Diseases, Microbiology, Neuroscience, Nutrition & Metabolism, Pharmacology, Physiology and Virology.

8 Requirements for the Honours degree

(1) Honours is available to meritorious candidates, in either or both the Bachelor of Engineering Honours or Bachelor of Medical Science. Honours requires the completion of one additional full time year of study for the Bachelor of Medical Science degree. The Resolutions of the Faculty of Science allow for part time Honours in certain circumstances.

(2) Award requirements for Honours in the Bachelor of Engineering Honours are as listed in clauses 5.2(b)-(d) and clause 6 of the resolutions for the Bachelor of Engineering Honours degree.
(3) Admission and award requirements for Honours in the Bachelor of Medical Science are listed in the resolutions of the Faculty of Science.

9 Award of the degrees

(1) Candidates will be awarded a separate testamur for each degree completed.
(2) The Bachelor of Engineering and the Bachelor of Medical Science are awarded in the grades of either Pass or Honours. The Bachelor of Engineering honours degree is awarded in classes ranging from First Class to Second Class, and the Bachelor of Medical Science honours degree is awarded in classes ranging from First Class to Third Class, according to the rules specified in the Resolutions of the Faculty of Engineering and Information Technologies and the Faculty of Science.
(3) Candidates who do not meet the requirements for the award of the Bachelor of Engineering (Honours) but who have otherwise satisfied the requirements of the Bachelor of Engineering shall graduate with the pass degree.
(4) Candidates for the award of the Bachelor of Medical Science (Honours) who do not meet the requirements, and who have not already graduated, will be awarded the pass degree.
(5) If the senior Science units of study completed by a candidate to satisfy section 7(5)(c) form a Science Table 1 major, the candidate shall have that major recorded on the Bachelor of Medical Science testamur at the completion of the degree.

10 Course transfer

A candidate may abandon the combined program and elect to complete either the Bachelor of Engineering or the Bachelor of Medical Science in accordance with the resolutions governing that degree. Completion of the abandoned degree in the future will require a new application for admission to that course and completion in accordance with the resolutions governing that degree.

11 Transitional provisions

(1) These resolutions apply to students who commenced their candidature after 1 January, 2015 and students who commenced their candidature prior to 1 January, 2015 who elect to proceed under these resolutions.
(2) Candidates who commenced their candidature prior to 1 January, 2015 may complete the requirements in accordance with the resolutions in force at the time of their commencement.
(3) Candidates who have completed some, but not all, of the intermediate core units listed in Table IV prior to 1 January 2012 should consult the transitional provisions in the resolutions for the Bachelor of Medical Science degree, for information on completion of the required 36 credit points of BMED240X units.

Bachelor of Engineering Honours/Bachelor of Project Management

Bachelor of Engineering Honours and Bachelor of Project Management

These resolutions must be read in conjunction with applicable University By-laws, Rules and policies including (but not limited to) the University of Sydney (Coursework) Rule 2000 (the 'Coursework Rule'), the Resolutions of the Faculty, the University of Sydney (Student Appeals against Academic Decisions) Rule 2006 (as amended) and the Academic Board policies on Academic Dishonesty and Plagiarism.

Course Resolutions

Terminology: In the following resolutions, all reference to the Bachelor of Engineering degree applies to both the Bachelor of Engineering and Bachelor of Engineering Honours degrees, except where otherwise indicated.

1 Course Codes

Code	Course Title
BHENGPRM1000	Bachelor of Engineering Honours and Bachelor of Project Management
BHENGPRM1000	Bachelor of ENgineering and Bachelor of Project Management

2 Attendance Pattern

The attendance pattern for this course is full time or part time. Part time students must still follow appropriate enrolment progression and are subject to the same degree time limits as full time students. International students are required to follow the enrolment pattern as specified by their visa. The Faculty strongly recommends full time enrolment as the preferred option for all undergraduate students unless exceptional circumstances exist.

3 Streams

(1) Completion of an Engineering stream is a requirement of the combined degree program. Completion of a Project Management stream is not a requirement for the combined degree. The Engineering streams available are the same as those available for the Bachelor of Engineering Honours.

4 Admission to Candidature

(1) Admission to this course is on the basis of a secondary school leaving qualification such as the NSW Higher School Certificate (including national and international equivalents), tertiary study or an approved preparation program. English language requirements must be met where these are not demonstrated by sufficient qualifications taught in English. Special admission pathways are open for mature aged applicants and for Torres Strait Islander people. Applicants are ranked by merit, and offers for available places are issued according to the ranking. Details of admission policies are found in the Coursework rule.

5 Requirements for Award

(1) To qualify for the award of the Pass degree, a candidate must successfully complete 240 credit points, comprising:
(a) The core units of study as set out in the Bachelor of Project Management unit of study table;
(b) The units of study specified for the relevant stream of Engineering and
(c) Any additional elective units of study as may be necessary to gain credit to complete the requirements of the degree.

6 Requirements for Honours

(1) The rules covering the award of Honours for Engineering are listed in the resolutions for the Bachelor of Engineering Honours degree.
(2) Honours in Project Management is available to meritorious candidates who complete an additional year of full time study, after the completion of the combined degree. The rules for Honours in Project Management are detailed in the resolutions for the Bachelor of Project Management degree.

7 Transitional provisions

(1) These resolutions apply to students who commenced their candidature after 1 January 2015 and students who commenced their candidature prior to 1 January 2015 who elect to proceed under these resolutions.
(2) Candidates who commenced prior to 1 January 2015 may complete the requirements in accordance with the resolutions in force at the time of their commencement.

Bachelor of Engineering Honours/Bachelor of Science (Combined)

Bachelor of Engineering and Bachelor of Science

These resolutions must be read in conjunction with applicable University By-laws, Rules and policies including (but not limited to) the University of Sydney (Coursework) Rule 2000 (the 'Coursework Rule'), the Resolutions of the Faculty, the University of Sydney (Student Appeals against Academic Decisions) Rule 2006 (as amended) and the Academic Board policies on Academic Dishonesty and Plagiarism.

Course resolutions

1 Course codes

Code	Course title
BPENGSCI-01	Bachelor of Engineering and Bachelor of Science

2 Attendance pattern

The attendance pattern for this course is full time or part time. Part time students must still follow appropriate enrolment progression and are subject to the same degree time limits as full time students. International students are required to follow the enrolment pattern as specified by their visa. The Faculty strongly recommends full time enrolment as the preferred option for all undergraduate students unless exceptional circumstances exist.

3 Streams

(1) Streams available for the Bachelor of Engineering are listed in the course resolution for the Bachelor of Engineering. Completion of a stream is a requirement of the Bachelor of Engineering.
(2) The Bachelor of Science degree is available in the following streams:
(a) Advanced
(b) Advanced Mathematics.
(3) Completion of a stream is not a requirement of the Bachelor of Science. Candidates wishing to transfer between streams should contact the Faculty student office.

4 Cross faculty management

(1) Candidates in this combined degree program will be under the general supervision of the Faculty of Engineering and Information Technologies for the duration of the combined program.
(2) The Deans of the Faculty of Engineering and Information Technologies and the Faculty of Science shall jointly exercise authority in any matter concerned with the combined course not otherwise dealt with in these resolutions.

5 Admission to candidature

Admission to this course is on the basis of a secondary school leaving qualification such as the NSW Higher School Certificate (including national and international equivalents), tertiary study or an approved preparation program. English language requirements must be met where these are not demonstrated by sufficient qualifications taught in English. Special admission pathways are open for mature aged applicants who do not possess a school leaving qualification, educationally disadvantaged applicants and for Aboriginal and Torres Strait Islander people. Applicants are ranked by merit and offers for available places are issued according to the ranking. Details of admission policies are found in the Coursework Rule.

6 Requirements for award

(1) The units of study that may be taken for the Bachelor of Engineering are set out in the tables of units of study for the specialised streams from the Faculty of Engineering and Information Technologies.
(2) The units of study that may be taken for the Bachelor of Science are listed in Table 1 from the Faculty of Science.
(3) To qualify for the award of the combined degree, a candidate must successfully complete 240 credit points, comprising:
(a) a minimum of 144 credit points of units of study prescribed for the Bachelor of Engineering stream the candidate is pursuing; and
(b) 96 credit points of Science units of study, including one major in a Science subject area.
(4) Candidates completing the Bachelor of Science in the Advanced or the Advanced Mathematics stream must include as part of the above requirements:
(a) a minimum of 54 credit points of intermediate or senior Science units of study, of which at least 36 credit points shall be completed at either the Advanced level or as Talented Student Program (TSP) units of study; and
(b) a minimum of 24 credit points of senior Science units of study at either the Advanced level or as TSP units in a single Science subject area.

7 Majors

Completion of a major is a requirement of the Bachelor of Science component of the combined degree. The list of majors available in the Bachelor of Science is specified in the course resolutions for the Bachelor of Science.

8 Progression rules

(1) Candidates enrolled in the Bachelor of Science (Advanced) or Bachelor of Science (Advanced Mathematics) are required to maintain a minimum average mark of 65 in all intermediate and senior units of study in Science subject areas in each year of enrolment. Failure to maintain the required average will result in candidates being transferred to the Bachelor of Science in their next year of enrolment with full credit for the units of study completed.
(2) Candidates enrolled in the Bachelor of Science (Advanced) or Bachelor of Science (Advanced Mathematics) who fail to achieve an average mark of 65 across all Science units of study attempted in their final year but have otherwise completed all the requirements of the degree will be awarded the Bachelor of Science.
(3) General progression rules for the combined degree are covered by the resolutions of the Faculty of Engineering and Information Technologies.

9 Requirements for the Honours degree

(1) Honours is available to meritorious candidates, in either or both the Bachelor of Engineering or Bachelor of Science. Honours requires the completion of an alternative set of units in the final year of the Bachelor of Engineering degree and of one additional full time year of study for the Bachelor of Science degree. The Science honours course may be undertaken part time over two years if the Faculty of Science is satisfied the candidate cannot undertake honours full time.

(2) Admission and award requirements for honours in the Bachelor of Engineering are listed in the resolution for the Bachelor of Engineering degree. Admission and award requirements for honours in the Bachelor of Science are listed in the resolutions of the Faculty of Science.

10 Award of the degree

(1) Candidates will be awarded a separate testamur for each degree completed.

(2) The Bachelor of Engineering and the Bachelor of Science are awarded in the grades of either Pass or Honours. The Bachelor of Engineering honours degree is awarded in classes ranging from First Class to Second Class, and the Bachelor of Science honours degree is awarded in classes ranging from First Class to Third Class, according to the rules specified in the Resolutions of the Bachelor of Engineering and the Faculty of Science.

(3) Candidates who do not meet the requirements for the award of the Bachelor of Engineering (Honours) but who have otherwise satisfied the requirements of the Bachelor of Engineering shall graduate with the pass degree.

(4) Candidates for the award of the Bachelor of Science (Honours) who do not meet the requirements, and who have not already graduated, will be awarded the pass degree.

11 Course transfer

A candidate may abandon the combined program and elect to complete the either the Bachelor of Engineering or the Bachelor of Science in accordance with the resolutions governing that degree. Completion of the abandoned degree in the future will require a new application for admission to that course and completion in accordance with the resolutions governing that degree.

12 Transitional provisions

(1) These resolutions apply to persons who commenced their candidature after 1 January, 2011 and persons who commenced their candidature prior to 1 January, 2011 who elect to proceed under these resolutions.

(2) Candidates who commenced prior to 1 January, 2011 may complete the requirements in accordance with the resolutions in force at the time of their commencement.

Bachelor of Engineering Honours and Bachelor of Science (Double)

Bachelor of Engineering Honours and Bachelor of Science

These resolutions must be read in conjunction with applicable University By-laws, Rules and policies including (but not limited to) the University of Sydney (Coursework) Rule 2000 (the 'Coursework Rule'), the Resolutions of the Faculty, the University of Sydney (Student Appeals against Academic Decisions) Rule 2006 (as amended) and the Academic Board policies on Academic Dishonesty and Plagiarism.

Terminology: In the following resolutions, all references to the Bachelor of Engineering degree apply to both the Bachelor of Engineering and Bachelor of Engineering Honours degrees, except where otherwise indicated.

Double degree course resolutions

1 Course codes

Code	Course title
HH000	Bachelor of Engineering
LH000	Bachelor of Science

2 Admission to candidature for the Bachelor of Science after partial completion of the Bachelor of Engineering

(1) A student, at the end of second or third year of candidature for the Bachelor of Engineering, may be admitted to candidature for the Bachelor of Science, to complete the Bachelor of Science degree, if:
(a) all units of study attempted in the Bachelor of Engineering degree to date have been completed with a grade of pass or better;
(b) at least 96 credit points from units of study in the Bachelor of Engineering degree have been completed, of which no more than 12 credit points are from units of study with the grade of pass (concessional);
(c) the candidate is qualified to enrol in a major in a Science area;
(d) for admission to the advanced streams, the candidate satisfies the relevant requirements in the course resolution for the Bachelor of Science degree.
(2) After completion of the Bachelor of Science, the candidate will return to complete the Bachelor of Engineering according to the resolutions for that degree.

3 Attendance pattern

The attendance pattern for the Bachelor of Science is full time over one year, or part time over two years, according to candidate choice.

4 Streams

(1) The Bachelor of Science degree is available in the following streams:
(a) Advanced
(b) Advanced Mathematics.
(2) Completion of a stream is not a requirement of the Bachelor of Science. Candidates wishing to transfer between Science streams should contact the Faculty student office.

5 Cross faculty management

(1) Candidates in this double degree program will be under the supervision of the Faculty of Engineering and Information Technologies for the period of Bachelor of Engineering degree enrolment, and under the supervision of the Faculty of Science for the Bachelor of Science enrolment.
(2) The Deans of the Faculty of Engineering and Information Technologies and the Faculty of Science shall jointly exercise authority in any matter concerned with the combined course not otherwise dealt with in these resolutions.

6 Requirements for award

(1) The units of study that may be taken for the Bachelor of Engineering are set out in the Flexible First Year table of units of study, and the tables of units of study for the specialised streams from the Faculty of Engineering and Information Technologies.
(2) The units of study that may be taken for the Bachelor of Science are listed in Table 1 from the Faculty of Science. The Dean of the Faculty of Science may permit a candidate of exceptional merit who is admitted to the Talented Student Program (TSP) to undertake a unit or units of study within the Faculty other than those specified in the tables.
(3) To qualify for the award of the Bachelor of Science in the double degree program, a candidate must successfully complete a total of 48 credit points, including:
(a) a minimum of 42 credit points of intermediate/senior units of study in Science subject areas; and
(b) a major in a Science area.
(4) Candidates completing the Bachelor of Science in the Advanced stream must include as part of the above requirements:
(a) a minimum of 24 credit points of senior Science units of study at the Advanced level or as TSP units in a single Science subject area.
(5) Candidates completing the Bachelor of Science in the Advanced Mathematics stream must include as part of the above requirements:
(a) a major in Mathematics, Statistics or Financial Mathematics and Statistics;
(b) a minimum of 12 credit points of intermediate units of study at either the advanced level or as TSP units in the Science subject areas of Mathematics and Statistics;
(c) a minimum of 24 credit points of senior Science units of study at the Advanced level or as TSP units in the Science subject areas of Mathematics and Statistics.

7 Majors

Completion of a major is a requirement of the Bachelor of Science. The list of majors available in the Bachelor of Science is specified in the course resolutions for the Bachelor of Science.

8 Progression rules

(1) The requirements for Bachelor of Science must be completed in one year of full-time study or two years of part-time study. Candidates who complete at least 42 but less than 48 credit points in the prescribed time limits may, in the following year of enrolment in the Bachelor of Engineering, complete the remaining credit points to satisfy the requirements of the Bachelor of Science. Candidates who complete less than 42 credit points will resume their candidature in the Bachelor of Engineering in the following semester of enrolment.

(2) Candidates enrolled in the Bachelor of Science (Advanced) or Bachelor of Science (Advanced Mathematics) are required to maintain a minimum average mark of 65 in all intermediate and senior units of study in Science. Failure to maintain the required average will result in candidates being transferred to the Bachelor of Science.

(3) General progression rules for the combined degree are covered by the resolutions of the Faculty of Engineering and Information Technologies.

9 Requirements for the Honours degree

(1) Honours in the Bachelor of Science is available to meritorious candidates who complete an additional year of full time study, after the completion of the pass degree. Part time study over two years may be permitted if the Faculty is satisfied the candidate cannot undertake honours full time. Admission, requirements and award of honours are according to the Resolutions of the Faculty of Science.

(2) Candidates for the Bachelor of Science (Honours) must suspend their candidature in the Bachelor of Engineering. On completion of the requirements of the Bachelor of Science (Honours) degree, candidates will be eligible to resume their enrolment toward the Bachelor of Engineering degree according the Faculty of Engineering and Information Technologies course resolutions for the degree. Alternatively, honours in the Bachelor of Science may be undertaken after successful completion of both the Bachelor of Science and Bachelor of Engineering degrees.

(3) Admission and award requirements for honours in the Bachelor of Engineering are listed in the resolution for the Bachelor of Engineering degree.

10 Award of the degree

(1) Candidates will be awarded a separate testamur for the Bachelor of Science and the Bachelor of Engineering.

(2) The Bachelor of Science is awarded with the grade Pass or Honours. The honours degree is awarded in classes ranging from First Class to Third Class, according to the rules specified in the Resolutions of the Faculty of Science.

(3) Candidates for the award of the Bachelor of Science (Honours) who do not meet the requirements, and who have not already graduated, will be awarded the pass degree.

11 Course transfer

Candidates may abandon the Bachelor of Science degree at any stage and resume their enrolment in the Bachelor of Engineering. Completion of the Bachelor of Science in the future will require a new application for admission to that course and completion in accordance with the resolutions governing that degree.

12 Transitional provisions

(1) These resolutions apply to persons who commenced their candidature after 1 January, 2011 and persons who commenced their candidature prior to 1 January, 2011 who elect to proceed under these resolutions.

(2) Candidates who commenced prior to 1 January, 2011 may complete the requirements in accordance with the resolutions in force at the time of their commencement.

Bachelor of Information Technology/Bachelor of Arts

Bachelor of Information Technology and Bachelor of Arts

These resolutions must be read in conjunction with applicable University By-laws, Rules and policies including (but not limited to) the University of Sydney (Coursework) Rule 2000 (the 'Coursework Rule'), the Resolutions of the Faculty, the University of Sydney (Student Appeals against Academic Decisions) Rule 2006 (as amended) and the Academic Board policies on Academic Dishonesty and Plagiarism.

Course resolutions

1 Course codes

Code	Course title
BPITCART-01	Bachelor of Information Technology and Bachelor of Arts

2 Attendance pattern

The attendance pattern for this course is full time or part time. Part time students must still follow appropriate enrolment progression and are subject to the same degree time limits as full time students. International students are required to follow the enrolment pattern as specified by their visa. The Faculty strongly recommends full time enrolment as the preferred option for all undergraduate students unless exceptional circumstances exist.

3 Streams

(1) Completion of a stream is a requirement of the Bachelor of Information Technology. The streams available and requirements are outlined in the resolutions for the Bachelor of Information Technology.

(2) Candidates wishing to transfer between streams should contact the Faculty student office.

4 Cross-faculty management

(1) Candidates in this combined degree program will be under the general supervision of the Faculty of Engineering and Information Technologies for the duration of the combined program.

(2) The Deans of the Faculty of Engineering and Information Technologies and the Faculty of Arts and Social Sciences shall jointly exercise authority in any matter concerned with the combined course not otherwise dealt with in these resolutions.

5 Admission to candidature

Admission to this course is on the basis of a secondary school leaving qualification such as the NSW Higher School Certificate (including national and international equivalents), tertiary study or an approved preparation program. English language requirements must be met where these are not demonstrated by sufficient qualifications taught in English. Special admission pathways are open for mature aged applicants who do not possess a school leaving qualification, educationally disadvantaged applicants and for Aboriginal and Torres Strait Islander people. Applicants are ranked by merit and offers for available places are issued according to the ranking. Details of admission policies are found in the Coursework Rule.

6 Requirements for award

(1) The units of study that may be taken for the Bachelor of Information Technology are set out in the Bachelor of Information Technology units of study table.

(2) The units of study that may be taken for the Bachelor of Arts are set out in Table A from the Faculty of Arts and Social Sciences Tables of units of study.

(3) To qualify for the award of the combined Bachelor of Information Technology and Bachelor of Arts degree, a candidate must successfully complete a total of 240 credit points.

(4) For the Bachelor of Information Technology a candidate must complete 144 credit points of core and 12 credit points of elective units selected from the table of units for the Bachelor of Information Technology stream the candidate is pursuing.

(5) For the Bachelor of Arts a candidate must complete a total of 84 credit points from Table A, including:

(a) a major from Table A;

(b) a minimum 54 credit points of 2000/3000 level units of study.

7 Majors

Completion of a Table A major is a requirement for the Bachelor of Arts. The majors available and requirements are outlined in the resolutions of the Faculty of Arts.

8 Requirements for the Honours degree

(1) Honours is available to meritorious candidates, in either or both the Bachelor of Information Technology or the Bachelor of Arts. Honours requires the completion an alternative set of units in the final year of the Bachelor of Information Technology degree and of one additional full time year of study for the Bachelor of Arts degree. The Bachelor of Arts Honours program may be completed part time over two years with permission of the administering department or program.

(2) Admission and award requirements for honours in the Bachelor of Information Technology are listed in the resolution for the Bachelor of Information Technology degree. Admission and award requirements for honours in the Bachelor of Arts are listed in the resolutions of the Faculty of Arts and Social Sciences.

9 Award of the degrees

(1) Candidates will be awarded a separate testamur for each degree completed.

(2) The Bachelor of Information Technology and the Bachelor of Arts are awarded in the grade of either Pass or Honours. The honours degrees are awarded in classes ranging from First Class to Third Class according to the rules specified in the course resolutions for the Bachelor of Information Technology and the Resolutions of the Faculty of Arts and Social Sciences.

(3) Candidates who do not meet the requirements for the award of the Bachelor of Information Technology (Honours) but who have otherwise satisfied the requirements of the Bachelor of Information Technology shall graduate with the pass degree.

(4) Candidates for the award of the Bachelor of Arts (Honours) who do not meet the requirements, and who have not already graduated, will be awarded the pass degree.

10 Course transfer

A candidate may abandon the combined program and elect to complete either the Bachelor of Information Technology or the Bachelor of Arts in accordance with the resolutions governing that degree. Completion of the abandoned degree in the future will require a new application for admission to that course and completion in accordance with the resolutions governing that degree.

11 Transitional provisions

(1) These resolutions apply to students who commenced their candidature after 1 January, 2011 and students who commenced their candidature prior to 1 January, 2011 who elect to proceed under these resolutions.

(2) Candidates who commenced prior to 1 January, 2011 may complete the requirements in accordance with the resolutions in force at the time of their commencement.

Bachelor of Information Technology/Bachelor of Commerce

Bachelor of Information Technology and Bachelor of Commerce

These resolutions must be read in conjunction with applicable University By-laws, Rules and policies including (but not limited to) the University of Sydney (Coursework) Rule 2000 (the 'Coursework Rule'), the Resolutions of the Faculty, the University of Sydney (Student Appeals against Academic Decisions) Rule 2006 (as amended) and the Academic Board policies on Academic Dishonesty and Plagiarism.

Course resolutions

1 Course codes

Code	Course title
BPITCCOM-02	Bachelor of Information Technology and Bachelor of Commerce

2 Attendance pattern

The attendance pattern for this course is full time or part time. Part time students must still follow appropriate enrolment progression and are subject to the same degree time limits as full time students. International students are required to follow the enrolment pattern as specified by their visa. The Faculty strongly recommends full time enrolment as the preferred option for all undergraduate students unless exceptional circumstances exist.

3 Streams

(1) Completion of a stream is a requirement of the Bachelor of Information Technology. The streams available and requirements are outlined in the resolutions for the Bachelor of Information Technology.

(2) Candidates wishing to transfer between streams should contact the Faculty student office.

4 Cross faculty management

(1) Candidates in this combined degree program will be under the general supervision of the Faculty of Engineering and Information Technologies for the duration of the combined program.

(2) The Deans of the Faculty of Engineering and Information Technologies and The University of Sydney Business School shall jointly exercise authority in any matter concerned with the combined course not otherwise dealt with in these resolutions.

5 Admission to candidature

Admission to this course is on the basis of a secondary school leaving qualification such as the NSW Higher School Certificate (including national and international equivalents), tertiary study or an approved preparation program. English language requirements must be met where these are not demonstrated by sufficient qualifications taught in English. Special admission pathways are open for mature aged applicants who do not possess a school leaving qualification, educationally disadvantaged applicants and for Aboriginal and Torres Strait Islander people. Applicants are ranked by merit and offers for available places are issued according to the ranking. Details of admission policies are found in the Coursework Rule.

6 Requirements for award

(1) The units of study that may be taken for the Bachelor of Information Technology are set out in the Bachelor of Information Technology units of study table.

(2) The units of study that may be taken for the Bachelor of Commerce are set out in the Table of undergraduate units of study from The University of Sydney Business School.

(3) To qualify for the award of the combined degree, a candidate must successfully complete 240 credit points.

(4) For the Bachelor of Information Technology a candidate must

(a) complete 144 credit points of core units selected from the table of units for the Bachelor of Information Technology stream the candidate is pursuing;

(b) complete at least 78 credits of 3000-level or above IT units of study.

(5) For the Bachelor of Commerce a candidate must complete 96 credit points selected from the Table of undergraduate units of study from The University of Sydney Business School including:

(a) 36 credit points of core units of study (30 junior credit points and six senior credit points); and

(b) a major; and

(c) at least 48 credit points at 2000 and/or 3000 levels.

7 Majors

Completion of a major is a requirement for the Bachelor of Commerce. The majors available and requirements are outlined in the resolutions for the Bachelor of Commerce.

8 Requirements for the Honours degree

(1) Honours is available to meritorious candidates, in either or both the Bachelor of Information Technology or the Bachelor of Commerce. Honours requires the completion an alternative set of units in the final year of the Bachelor of Information Technology degree and of one additional full time year of study for the Bachelor of Commerce degree. The Bachelor of Commerce Honours program may be completed part time over two years with the permission of The University of Sydney Business School.

(2) Admission and award requirements for honours in the Bachelor of Information Technology are listed in the course resolution for the Bachelor of Information Technology degree. Admission and award requirements for honours in the Bachelor of Commerce are listed in the resolutions of The University of Sydney Business School.

9 Award of the degrees

(1) Candidates will be awarded a separate testamur for each degree completed.

(2) The Bachelor of Information Technology and the Bachelor of Commerce are awarded in the grades of either Pass or Honours. The honours degrees are awarded in classes ranging from First Class to Third Class according to the rules specified in the Resolutions of the Faculty of Engineering and Information Technologies and The University of Sydney Business School.

(3) Candidates who do not meet the requirements for the award of the Bachelor of Information Technology (Honours) but who have otherwise satisfied the requirements of the Bachelor of Information Technology shall graduate with the pass degree.

(4) Candidates for the award of the Bachelor of Commerce (Honours) who do not meet the requirements, and who have not already graduated, will be awarded the pass degree.

10 Course transfer

A candidate may abandon the combined program and elect to complete either the Bachelor of Engineering or the Bachelor of Commerce in accordance with the resolutions governing that degree. Transfer from a combined degree to the Bachelor of Commerce is also conditional on the student having met the entry requirements of the Bachelor of Commerce in force at the time of their enrolment in the combined degree. Completion of the abandoned degree in the future will require a new application for admission to that course and completion in accordance with the resolutions governing that degree.

11 Transitional provisions

(1) These resolutions apply to candidates who commenced their candidature after 1 January, 2011 and candidates who commenced their candidature prior to 1 January, 2011 who elect to proceed under these resolutions.

(2) Candidates who commenced prior to 1 January, 2011 may complete the requirements in accordance with the resolutions in force at the time of their commencement.

Bachelor of Information Technology/Bachelor of Laws

Bachelor of Information Technology and Bachelor of Laws

These resolutions must be read in conjunction with applicable University By-laws, Rules and policies including (but not limited to) the University of Sydney (Coursework) Rule 2000 (the 'Coursework Rule'), the Resolutions of the Faculty, the University of Sydney (Student Appeals against Academic Decisions) Rule 2006 (as amended) and the Academic Board policies on Academic Dishonesty and Plagiarism.

Course resolutions

1 Course codes

Code	Course title
BPITCLAW-01	Bachelor of Information Technology and Bachelor of Laws

2 Attendance pattern

The attendance pattern for this course is full time only.

3 Streams

(1) Completion of a stream is a requirement of the Bachelor of Information Technology in this combined degree. The streams available are:
(a) Computer Science
(b) Information Systems
(2) The table of units for the Bachelor of Information Technology specifies the units required for each stream.

4 Cross-faculty management

(1) Candidates in this combined degree program will be under the general supervision of the Faculty of Engineering and Information Technologies until the end of the semester in which they complete the requirements for the Bachelor of Information Technology. They will then be under the supervision of the Faculty of Law.
(2) The Deans of the Faculty of Engineering and Information Technologies and the Faculty of Law shall jointly exercise authority in any matter concerned with the combined course not otherwise dealt with in these resolutions.

5 Admission to candidature

Admission to this course is on the basis of a secondary school leaving qualification such as the NSW Higher School Certificate (including national and international equivalents), tertiary study or an approved preparation program. English language requirements must be met where these are not demonstrated by sufficient qualifications taught in English. Special admission pathways are open for educationally disadvantaged applicants and for Aboriginal and Torres Strait Islander people. Applicants are ranked by merit and offers for available places are issued according to the ranking. Details of admission policies are found in the Coursework Rule.

6 Requirements for award

(1) The units of study that may be taken for this combined degree are set out in the Bachelor of Information Technology units of study table and in the Faculty of Law Undergraduate Table.
(2) To qualify for the award of the pass degrees in the combined program, a candidate must complete 288 credit points, comprising:
(a) 144 credit points of Law units of study, of which 48 credit points are Combined Law compulsory units of study for years 1, 2 and 3 and are credited towards the requirements for both the Bachelor of Information Technology and the Bachelor of Laws; and
(b) 144 credit points of core units of study from the table of units for the Bachelor of Information Technology, appropriate to the stream the candidate is pursuing.
(3) *Requirements for the Bachelor of Information Technology*: To qualify for the award of the Bachelor of Information Technology, a candidate must complete 192 credit points comprising:
(a) 48 credit points of Combined Law compulsory units of study for Years 1, 2 and 3;
(b) 144 credit points of core units of study from the table of units for the Bachelor of Information Technology, appropriate to the stream the candidate is pursuing, ensuring:
(I) no more than 72 credit points of junior (1000 level) units of study, and
(II) at least 78 credit points of 3000-level or above units of study; and
(III) at least 18 credit points of Mathematics and Statistics units of study, of which at least six credit points must be 2000 level or above.
(4) *Requirements for the Bachelor of Laws*
To qualify for the award of the Bachelor of Laws, a candidate must complete 144 credit points taken from the Faculty of Law Undergraduate Table, comprising:
(I) 102 credit points of compulsory units of study; and
(II) 42 credit points of elective units of study, of which a maximum of 36 credit points are taken from Part 1 and a minimum of 6 credit points are taken from Part 2.

7 Progression rules

(1) Candidates in a combined law program must successfully complete LAWS1006 Foundations of Law before enrolling in any other Bachelor of Laws units of study.
(2) Candidates are required to complete the Bachelor of Laws units of study in the order listed in the Faculty of Law Undergraduate Table.
(3) Except with the permission of the Dean of the Faculty of Law, candidates must complete the requirements for the Bachelor of Information Technology before proceeding to Year Five of the Bachelor of Laws.

8 Requirements for the Honours degree

(1) Both the Bachelor of Information Technology and the Bachelor of Laws may be awarded with honours.
(2) Honours in the Bachelor of Information Technology is available to meritorious students who complete an alternative set of units in the final year of the program.

(3) Honours in the Bachelor of Laws is available to meritorious students who complete an alternative set of units of study in the final year of the program.

(4) The admission and award requirements for honours in either Information Technology or Law are listed in the resolutions of the Bachelor of Information Technology and Bachelor of Laws respectively.

9 Award of the degrees

(1) The Bachelor of Information Technology and Bachelor of Laws are awarded in the grades of either Pass or Honours.

(2) Honours in the Bachelor of Information Technology is awarded in classes ranging from First Class to Third Class in accordance with the resolutions of the Bachelor of Information Technology.

(3) Honours in the Bachelor of Laws is awarded in First Class or Second Class in accordance with the resolutions of the Bachelor of Laws.

10 Course transfer

A candidate may withdraw from the combined program and elect to transfer to the Bachelor of Information Technology, by written application to the Faculty of Engineering and Information Technologies, and complete the requirements in accordance with the resolutions governing that degree at the time of transfer. Candidature in the Bachelor of Laws will cease in these circumstances.

11 Transitional provisions

(1) These resolutions apply to students who commenced their candidature on or after 1 January, 2011.

(2) Candidates who commenced prior to 1 January, 2011 may complete the requirements in accordance with the resolutions in force at the time of their commencement.

Bachelor of Information Technology/Bachelor of Medical Science

Bachelor of Information Technology and Bachelor of Medical Science

These resolutions must be read in conjunction with applicable University By-laws, Rules and policies including (but not limited to) the University of Sydney (Coursework) Rule 2000 (the 'Coursework Rule'), the Resolutions of the Faculty, the University of Sydney (Student Appeals against Academic Decisions) Rule 2006 (as amended) and the Academic Board policies on Academic Dishonesty and Plagiarism.

Course resolutions

1 Course codes

Code	Course title
BPITCMSC-01	Bachelor of Information Technology and Bachelor of Medical Science

2 Attendance pattern

The attendance pattern for this course is available in full time or part time. Part time students must still follow appropriate enrolment progression and are subject to the same degree time limits as full time students. International students are required to follow the enrolment pattern as specified by their visa. The Faculty strongly recommends full time enrolment as the preferred option for all undergraduate students unless exceptional circumstances exist.

3 Streams

Completion of a stream is a requirement for the Bachelor of Information Technology. The streams available and requirements are outlined in the resolutions for the Bachelor of Information Technology.

4 Cross faculty management

(1) Candidates in this combined degree program will be under the general supervision of the Faculty of Engineering and Information Technologies for the duration of the combined program.
(2) The Deans of the Faculty of Engineering and Information Technologies and the Faculty of Science shall jointly exercise authority in any matter concerned with the combined course not otherwise dealt with in these resolutions.

5 Admission to candidature

Admission to this course is on the basis of a secondary school leaving qualification such as the NSW Higher School Certificate (including national and international equivalents), tertiary study or an approved preparation program. English language requirements must be met where these are not demonstrated by sufficient qualifications taught in English. Special admission pathways are open for mature aged applicants who do not possess a school leaving qualification, educationally disadvantaged applicants and for Aboriginal and Torres Strait Islander people. Applicants are ranked by merit and offers for available places are issued according to the ranking. Details of admission policies are found in the Coursework Rule.

6 Progression rules

General progression rules for the combined degree are covered by the resolutions of the Faculty of Engineering and Information Technologies.

7 Requirements for award

(1) The units of study that may be taken for the Bachelor of Information Technology are set out in the Bachelor of Information Technology units of study table.
(2) The units of study that may be taken for the Bachelor of Medical Science are listed in Table IV for the Bachelor of Medical Science from the Faculty of Science.
(3) To qualify for the award of the pass degree, a candidate must successfully complete 240 credit points.
(4) For the Bachelor of Information Technology a candidate must complete 144 credit points in accordance with the Bachelor of Information Technology Table, consisting of all Core units of study together with additional Selected Core units for the Bachelor of Information Technology stream the candidate is pursuing, noting that:
(a) Students must complete at least 78 credit points of 3000-level or above IT units of study.
(b) The mathematics requirement for this degree will also satisfy the mathematics requirements for the Bachelor of Medical Science; and
(c) The core INFO1XXX requirement for this degree will also satisfy the computer science requirements for the Bachelor of Medical Science degree.
(5) For the Bachelor of Medical Science a candidate must complete 120 credit points of units comprising:
(a) a minimum 48 credit points from junior Science units of study, including:
(I) 12 credit points from Mathematics; and
(II) 12 credit points from Chemistry; and
(III) 12 credit points from Computer Science; and
(IV) 6 credit points from Biology; and
(V) MBLG1001/1901 Introductory Molecular Biology & Genetics.
(b) 48 credit points from intermediate Science units of study comprising
(1) 36 credit points of BMED240X units from Table IVB for the Bachelor of Medical Science; and
(2) MBLG2X71 Molecular Biology and Genetics A ; and
(3) MBLG2X72 Molecular Biology and Genetics B
(c) A minimum of 24 credit points of senior Science units of study selected from the subject areas of Anatomy, Biology (Genetics), Biochemistry, Cell Pathology, Histology, Immunology, Infectious Diseases, Microbiology, Neuroscience, Nutrition and Metabolism, Pharmacology, Physiology and Virology.

8 Requirements for the Honours degree

(1) Honours is available to meritorious candidates, in either or both the Bachelor of Information Technology or Bachelor of Medical Science. Honours requires the completion an alternative set of units in the final year of the Bachelor of Information Technology degree and of

one additional full time year of study for the Bachelor of Medical Science degree. The Resolutions of the Faculty of Science allow for part time honours in certain circumstances.

(2) Admission and award requirements for honours in the Bachelor of Information Technology are listed in the resolution for the Bachelor of Information Technology degree. Admission and award requirements for honours in the Bachelor of Medical Science are listed in the resolutions of the Faculty of Science.

9 Award of the degrees

(1) Candidates will be awarded a separate testamur for each degree completed.

(2) The Bachelor of Information Technology and the Bachelor of Medical Science are awarded in the grades of either Pass or Honours. The honours degrees are awarded in classes ranging from First Class to Third Class according to the rules specified in the Resolutions of the Faculty of Engineering and Information Technologies and Faculty of Science.

(3) Candidates who do not meet the requirements for the award of the Bachelor of Information Technology (Honours) but who have otherwise satisfied the requirements of the Bachelor of Information Technology shall graduate with the pass degree.

(4) Candidates for the award of the Bachelor of Medical Science (Honours) who do not meet the requirements, and who have not already graduated, will be awarded the pass degree.

(5) If the senior Science units of study completed by a candidate to satisfy section 7(5)(c) form a Science Table 1 major, the candidate shall have that major recorded on the Bachelor of Medical Science testamur at the completion of the degree.

10 Course transfer

A candidate may abandon the combined program and elect to complete either the Bachelor of Informational Technology or the Bachelor of Medical Science in accordance with the resolutions governing that degree. Completion of the abandoned degree in the future will require a new application for admission to that course and completion in accordance with the resolutions governing that degree.

11 Transitional provisions

(1) These resolutions apply to students who commenced their candidature after 1 January, 2012 and students who commenced their candidature prior to 1 January, 2012 who elect to proceed under these resolutions.

(2) Candidates who commenced their candidature prior to 1 January, 2012 may complete the requirements in accordance with the resolutions in force at the time of their commencement.

(3) Candidates who have complete some, but not all, of the intermediate core units listed in Table IV prior to January 2012 should consult the transitional provisions in the resolutions for the Bachelor of Medical Science degree, for information on completion of the required 36 credit points of BMED240X units.

Bachelor of Information Technology/Bachelor of Science

Bachelor of Information Technology and Bachelor of Science

These resolutions must be read in conjunction with applicable University By-laws, Rules and policies including (but not limited to) the University of Sydney (Coursework) Rule 2000 (the 'Coursework Rule'), the Resolutions of the Faculty, the University of Sydney (Student Appeals against Academic Decisions) Rule 2006 (as amended) and the Academic Board policies on Academic Dishonesty and Plagiarism.

Course resolutions

1 Course codes

Code	Course title
BPITCSCI-01	Bachelor of Information Technology and Bachelor of Science

2 Attendance pattern

The attendance pattern for this course is full time or part time. Part time students must still follow appropriate enrolment progression and are subject to the same degree time limits as full time students. International students are required to follow the enrolment pattern as specified by their visa. The Faculty strongly recommends full time enrolment as the preferred option for all undergraduate students unless exceptional circumstances exist.

3 Streams

(1) Completion of a stream is a requirement of the Bachelor of Information Technology. The streams available and requirements are outlined in the resolutions for the Bachelor of Information Technology.
(2) The Bachelor of Science degree is available in the following streams:
(a) Advanced
(b) Advanced Mathematics.
(3) Completion of a stream is not a requirement of the Bachelor of Science. Candidates wishing to transfer between streams should contact the Faculty student office.

4 Cross faculty management

(1) Candidates in this combined degree program will be under the general supervision of the Faculty of Engineering and Information Technologies for the duration of the combined program.
(2) The Deans of the Faculty of Engineering and Information Technologies and the Faculty of Science shall jointly exercise authority in any matter concerned with the combined course not otherwise dealt with in these resolutions.

5 Admission to candidature

Admission to this course is on the basis of a secondary school leaving qualification such as the NSW Higher School Certificate (including national and international equivalents), tertiary study or an approved preparation program. English language requirements must be met where these are not demonstrated by sufficient qualifications taught in English. Special admission pathways are open for mature aged applicants who do not possess a school leaving qualification, educationally disadvantaged applicants and for Aboriginal and Torres Strait Islander people. Applicants are ranked by merit and offers for available places are issued according to the ranking. Details of admission policies are found in the Coursework Rule.

6 Requirements for award

(1) The units of study that may be taken for the Bachelor of Information Technology are set out in the Bachelor of Information Technology units of study table.
(2) The units of study that may be taken for the Bachelor of Science are listed in Table 1 from the Faculty of Science.
(3) To qualify for the award of the combined degree, a candidate must successfully complete 240 credit points, comprising:
(a) units of study from the table of units for the Bachelor of Information Technology stream the candidate is pursuing, and ensuring:
(I) no more than 72 credit points in junior (1000 level) units of study;
(II) at least 84 credit points in 3000-level or above units of study; and
(b) a minimum of 96 credit points Science units of study, including at least 18 credit points of Mathematics and Statistics units of study; and
(c) a major in a Science area listed in Table 1 excluding Computer Science and Information Systems;
(d) and ensuring at least 54 credit points in the intermediate and senior Science units of study.
(4) Candidates completing the Bachelor of Science in the Advanced or the Advanced Mathematics stream must include as part of the above requirements:
(a) a minimum of 54 credit points of intermediate or senior Science units of study, of which at least 36 credit points at either the Advanced level or as Talented Student Program (TSP) units of study; and
(b) a minimum of 24 credit points of senior Science units of study at either the Advanced level or as TSP units in a single Science subject area; and
(c) a minimum of 66 credit points from the intermediate and senior Science units of study.
(5) Candidates completing the Bachelor of Science in the Advanced Mathematics stream must include as part of the above requirements a minimum of 48 credit points of senior units of study in Mathematics and Statistics, including at least 24 credit points of units of study at the Advanced level or as TSP units of study.

7 Majors

Completion of a major is a requirement the Bachelor of Science. The majors available and requirements are outlined in the resolutions for the Bachelor of Science.

8 Progression rules

(1) Candidates enrolled in the Bachelor of Science (Advanced) or Bachelor of Science (Advanced Mathematics) are required to maintain a minimum average mark of 65 in all intermediate and senior units of study in Science subject areas in each year of enrolment. Failure

to maintain the required average will result in candidates being transferred to the Bachelor of Science in their next year of enrolment with full credit for the units of study completed.

(2) Candidates enrolled in the Bachelor of Science (Advanced) or Bachelor of Science (Advanced Mathematics) who fail to achieve an average mark of 65 across all Science units of study attempted in their final year but have otherwise completed all the requirements of the degree will be awarded the Bachelor of Science.

(3) General progression rules for the combined degree are covered by the resolutions of the Faculty of Engineering and Information Technologies.

9 Requirements for the Honours degree

(1) Honours is available to meritorious candidates, in either or both the Bachelor of Information Technology or the Bachelor of Science. Honours requires the completion of an alternative set of units in the final year of the Bachelor of Information Technology degree and of one additional full time year of study for the Bachelor of Science degree. The Resolutions of the Faculty of Science allow for part time honours in certain circumstances.

(2) Admission and award requirements for honours in the Bachelor of Information Technology are listed in the resolution for the Bachelor of Information Technology degree. Admission and award requirements for honours in the Bachelor of Science are listed in the resolutions of the Faculty of Science.

10 Award of the degree

(1) Candidates will be awarded a separate testamur for each degree completed.

(2) The Bachelor of Information Technology and the Bachelor of Science are awarded in the grades of either Pass or Honours. The honours degrees are awarded in classes ranging from First Class to Third Class according to the rules specified in the Resolutions of the Faculty of Engineering and Information Technologies and Faculty of Science.

(3) Candidates who do not meet the requirements for the award of the Bachelor of Information Technology (Honours) but who have otherwise satisfied the requirements of the Bachelor of Information Technology shall graduate with the pass degree.

(4) Candidates for the award of the Bachelor of Science (Honours) who do not meet the requirements, and who have not already graduated, will be awarded the pass degree merited.

11 Course transfer

A candidate may abandon the combined program and elect to complete the either the Bachelor of Information Technology or the Bachelor of Science in accordance with the resolutions governing that degree. Completion of the abandoned degree in the future will require a new application for admission to that course and completion in accordance with the resolutions governing that degree.

12 Transitional provisions

(1) These resolutions apply to persons who commenced their candidature after 1 January, 2011 and persons who commenced their candidature prior to 1 January, 2011 who elect to proceed under these resolutions.

(2) Candidates who commenced prior to 1 January, 2011 may complete the requirements in accordance with the resolutions in force at the time of their commencement.

Bachelor of Engineering Flexible First-Year Entry

The Bachelor of Engineering Flexible First Year allows you to explore different engineering disciplines before deciding upon your ultimate course of study. You will undertake a common set of units of study and achieve minimum average results and grades before transferring to a stream.

The Bachelor of Engineering may be undertaken and awarded in the following streams:

- Aeronautical (including Space)
- Biomedical
- Chemical and Biomolecular
- Civil (including Construction Management, Environmental, Geotechnical, Project Management, and Structures)
- Electrical (including Computer, Power, and Telecommunications)
- Mechanical (including Space)
- Mechatronic (including Space)
- Software.

For a standard enrolment plan for Flexible First Year (Stream A) visit http://cusp.sydney.edu.au/students/view-degree-page/name/FFY(A)

For a standard enrolment plan for Flexible First Year (Stream B) visit http://cusp.sydney.edu.au/students/view-degree-page/name/FFY(B)

Flexible First Year Entry Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Bachelor of Engineering Flexible First Year Entry			
Students wishing to proceed to the degrees of Bachelor of Information Technology, Bachelor of Computer Science and Technology, Bachelor of Engineering or combined degrees with Science, Arts, Commerce, Law or Medical Science may choose to enrol in one of the two options of the Flexible First Year program. For details on eligibility for entry to this program and second year stream entry requirements consult the Faculty resolutions pertaining to Flexible First Year. Students must decide on the stream of Engineering or Information Technologies to pursue, once they have completed the Flexible First Year program. Students will not need to decide their choice of Engineering or IT specialisation until the end of their first semester or the end of their first year, depending on their stream of choice.			
Core units of study for Stream A specialisations			
Core units of study for Stream A specialisations in the Engineering areas of Aeronautical, Aeronautical(Space), Biomedical, Chemical and Biomolecular, Civil, Mechanical or Mechanical(Space) can elect to choose this option.			
First year			
ENGG1800 **Engineering Disciplines (Intro) Stream A**	6		Semester 1
ENGG1801 **Engineering Computing**	6		Semester 1 Summer Late
ENGG1802 **Engineering Mechanics**	6		Semester 2 Summer Main
ENGG1803 **Professional Engineering 1**	6	**N** ENGG1061	Semester 1 Semester 2
MATH1001 **Differential Calculus**	3	**A** HSC Mathematics Extension 1 **N** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001	Semester 1 Summer Main
MATH1002 **Linear Algebra**	3	**A** HSC Mathematics or MATH1111 **N** MATH1902, MATH1012, MATH1014	Semester 1 Summer Main
MATH1003 **Integral Calculus and Modelling**	3	**A** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **N** MATH1013, MATH1903, MATH1907	Semester 2 Summer Main
MATH1005 **Statistics**	3	**A** HSC Mathematics **N** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021	Semester 2 Summer Main Winter Main
PHYS1001 **Physics 1 (Regular)**	6	**A** HSC Physics **P** HSC Physics with a minimum mark of 65 **N** PHYS1002, EDUH1017, PHYS1901	Semester 1
Students wishing to proceed into the streams of Biomedical or Chemical should replace PHYS1001 with CHEM1101 Chemistry 1A as an alternate core unit.			
Alternative units of study			
Most units of study offered by the Faculty of Science shown in the tables can be replaced by an equivalent advanced level unit, subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing advanced options should seek advice from their school before enrolling.			
Elective unit of study			
In addition, a 6 credit point junior level unit of study must be chosen to complete the second semester enrolment. This is a free choice elective unit subject only to enrolment restrictions imposed by faculties on some specific junior level units.			
Notes			
1. Students wishing to proceed to the degree of Bachelor of Engineering in Biomedical or Chemical and Biomolecular Engineering should complete the first semester of this program and enrol in their chosen specialisation in Semester 2. 2. It is strongly advised that before choosing the second semester elective, students consult the requirements for the specialisation that they plan to enter as an appropriate choice of elective will help with core progression and prerequisite requirements for many areas.			
Core units of study for Stream B specialisations			
Core units of study for Stream B specialisations in the Engineering areas of Electrical, Electrical(Computer), Electrical(Power), Electrical(Telecommunications), Mechatronics, Mechatronics (Space), Software and Bachelor of Information Technology or Bachelor of Computer Science and Technology can elect to choose this option.			
First year			
ENGG1805 **Professional Engineering and IT**	6		Semester 1
MATH1001 **Differential Calculus**	3	**A** HSC Mathematics Extension 1 **N** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001	Semester 1 Summer Main
MATH1002 **Linear Algebra**	3	**A** HSC Mathematics or MATH1111 **N** MATH1902, MATH1012, MATH1014	Semester 1 Summer Main

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
PHYS1001 **Physics 1 (Regular)**	6	**A** HSC Physics **P** HSC Physics with a minimum mark of 65 **N** PHYS1002, EDUH1017, PHYS1901	Semester 1
INFO1103 **Introduction to Programming**	6		Semester 1 Semester 2
Student wishing to proceed into the Engineering stream of Mechatronics or Mechatronics(Space) should replace INFO1103 with ENGG1801 an alternative core unit.			

Alternative units of study

Most units of study offered by the Faculty of Science or the School of IT shown in the tables can be replaced by an equivalent advanced level unit, subject to prerequisite conditions being met. Students considering doing advanced options should seek advice from their school before enrolling.

Note

Students in this option will choose their specialisation at the end of Semester 1 and continue in the specialist program or IT degree in Semester 2.

For a standard enrolment plan for Flexible First Year (Stream A) visit http://cusp.sydney.edu.au/students/view-degree-page/name/FFY(A)

For a standard enrolment plan for Flexible First Year (Stream B) visit http://cusp.sydney.edu.au/students/view-degree-page/name/FFY(B)

Flexible First Year Unit of Study Descriptions

Bachelor of Engineering Flexible First Year Entry

Students wishing to proceed to the degrees of Bachelor of Information Technology, Bachelor of Computer Science and Technology, Bachelor of Engineering or combined degrees with Science, Arts, Commerce, Law or Medical Science may choose to enrol in one of the two options of the Flexible First Year program. For details on eligibility for entry to this program and second year stream entry requirements consult the Faculty resolutions pertaining to Flexible First Year.Students must decide on the stream of Engineering or Information Technologies to pursue, once they have completed the Flexible First Year program.Students will not need to decide their choice of Engineering or IT specialisation until the end of their first semester or the end of their first year, depending on their stream of choice.

Core units of study for Stream A specialisations

Core units of study for Stream A specialisations in the Engineering areas of Aeronautical, Aeronautical(Space), Biomedical, Chemical and Biomolecular, Civil, Mechanical or Mechanical(Space) can elect to choose this option.

First year

ENGG1800
Engineering Disciplines (Intro) Stream A

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 1 hr/week; Laboratory 3 hrs/week. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces students to specialisations in the Engineering discipline areas of Aeronautical, Biomedical Chemical, Civil, Mechanical and Mechatronic Engineering, and Project Engineering and Management. By providing first-year students with an experience of these various engineering streams, the unit aims to develop the students' professional identity as an engineer and thus provide a suitable basis on which students can choose their discipline for further study.

Introductory sessions in the School of Aerospace,

Mechanical and Mechatronic Engineering

-4 weeks-

An overview of the degree requirements in each stream. The roles of the engineer in each stream (employments, skills, etc). How each of the subjects taught relate to the skills/knowledge and applications required of the engineers. Basically make sure students fully understand what engineers are in the discipline areas and why the students do the subjects they do. In each stream, one engineering technical topic will be taught as a problem solving exercise, and this topic will be the focus of the laboratory.

School of Civil Engineering

-4 weeks-

Introductory lectures in Engineering Economics and Construction Planning, Foundation Engineering, Structural Engineering, Materials, Environmental Engineering. Each student will be involved in the erection and dismantling of an 8 metre high steel and timber tower in the Civil Engineering Courtyard. Preliminary lectures related to the tower will include safety issues, loading, statical analysis, foundation calculations, construction management, engineering drawings and detailing, geometric calculations, and survey measurements. Exercises related to these issues will be performed before assembly and disassembly of the tower.

School of Chemical and Biomolecular Engineering

-4 weeks-

This course will enable students to gain an appreciation of: the methods and materials of construction of items of process equipment; the role of this equipment in building an entire chemical processing plant: its operation and maintenance and safety requirements and procedures. Students will dismantle, disassemble and operate items of process equipment. They will present written answers to questions, supplemented by drawings of process flowsheets, diagrams of dismantled equipment, and discussions of heat and mass balances and of process parameters.

ENGG1801
Engineering Computing

Credit points: 6 **Session:** Semester 1, Summer Late **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will introduce students to fundamental principles of programming. The language used will be Matlab but the principles taught are readily portable to other languages like C and Java. The unit material will be presented in a manner which will help students to draw a connection between programming constructs and real engineering applications. The unit will use engineering inspired case-studies : especially from Civil, Chemical, Aerospace and Mechanical streams, to motivate new material. There will be a major project which uses programming to solve a real world engineering problem. The extensive Matlab library for visualization will also be introduced. Matlab will cover two-thirds of the unit. The remaining one-third will be devoted to the use of Excel in engineering scenarios. Furthermore, cross integration between Matlab and Excel will also be highlighted.

ENGG1802
Engineering Mechanics

Credit points: 6 **Session:** Semester 2, Summer Main **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit aims to provide students with an understanding of and competence in solving statics and introductory dynamics problems in engineering. Tutorial sessions will help students to improve their group work and problem solving skills, and gain competency in extracting a simplified version of a problem from a complex situation. Emphasis is placed on the ability to work in 3D as well as 2D, including the 2D and 3D visualization of structures and structural components, and the vectorial 2D and 3D representations of spatial points, forces and moments. Introduction to kinematics and dynamics topics includes position, velocity and acceleration of a point; relative motion, force and acceleration, momentum, collisions and energy methods.

ENGG1803
Professional Engineering 1

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prohibitions:** ENGG1061 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Professional Engineering 1 is an introductory Unit of Study within the Faculty of Engineering. The semester 1 course is aimed at students from the School of Aerospace, Mechanical and Mechatronic Engineering. It seeks to introduce newly admitted undergraduates to general principles of professional engineering practice, a range of contemporary professional engineering issues, plus outline skills related to academic study within an engineering environment. The subject is structured around a team based design and build project, in which students apply the professional engineering concepts they are learning to an engineering project. Professional engineering topics to be covered include: accessing information, teamwork, creativity, leadership, written and oral communication, project management, problem solving, ethics, liability, work health and safety and environmental issues.

MATH1001
Differential Calculus

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001 **Assumed knowledge:** HSC Mathematics Extension 1 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1001 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study looks at complex numbers, functions of a single variable, limits and continuity, vector functions and functions of two variables. Differential calculus is extended to functions of two variables. Taylor's theorem as a higher order mean value theorem.

Textbooks
As set out in the Junior Mathematics Handbook.

MATH1002
Linear Algebra

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1902, MATH1012, MATH1014 **Assumed knowledge:** HSC Mathematics or MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1002 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study introduces vectors and vector algebra, linear algebra including solutions of linear systems, matrices, determinants, eigenvalues and eigenvectors.

Textbooks
As set out in the Junior Mathematics Handbook

MATH1003
Integral Calculus and Modelling

Credit points: 3 **Session:** Semester 2, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1013, MATH1903, MATH1907 **Assumed knowledge:** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1003 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.This unit of study first develops the idea of the definite integral from Riemann sums, leading to the Fundamental Theorem of Calculus. Various techniques of integration are considered, such as integration by parts.The second part is an introduction to the use of first and second order differential equations to model a variety of scientific phenomena.

Textbooks
As set out in the Junior Mathematics Handbook

MATH1005
Statistics

Credit points: 3 **Session:** Semester 2, Summer Main, Winter Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021 **Assumed knowledge:** HSC Mathematics **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1005 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit offers a comprehensive introduction to data analysis, probability, sampling, and inference including t-tests, confidence intervals and chi-squared goodness of fit tests.

Textbooks
As set out in the Junior Mathematics Handbook

PHYS1001
Physics 1 (Regular)

Credit points: 6 **Session:** Semester 1 **Classes:** Three 1-hour lectures, one 3-hour laboratory per week for 9 weeks and one 1-hour tutorial per week. **Prerequisites:** HSC Physics with a minimum mark of 65 **Prohibitions:** PHYS1002, EDUH1017, PHYS1901 **Assumed knowledge:** HSC Physics **Assessment:** 3 hour exam plus laboratories, assignments and mid-semester tests (100%). **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for students who gained 65 marks or better in HSC Physics or equivalent. The lecture series contains three modules on the topics of mechanics, thermal physics, and oscillations and waves.

Textbooks
Young & Freedman. University Physics. 13th edition, with Mastering Physics, Addison-Wesley. 2012. Course lab manual.

Students wishing to proceed into the streams of Biomedical or Chemical should replace PHYS1001 with CHEM1101 Chemistry 1A as an alternate core unit.

Alternative units of study

Most units of study offered by the Faculty of Science shown in the tables can be replaced by an equivalent advanced level unit, subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing advanced options should seek advice from their school before enrolling.

Elective unit of study

In addition, a 6 credit point junior level unit of study must be chosen to complete the second semester enrolment. This is a free choice elective unit subject only to enrolment restrictions imposed by faculties on some specific junior level units.

Notes

1. Students wishing to proceed to the degree of Bachelor of Engineering in Biomedical or Chemical and Biomolecular Engineering should complete the first semester of this program and enrol in their chosen specialisation in Semester 2.2. It is strongly advised that before choosing the second semester elective, students consult the requirements for the specialisation that they plan to enter as an appropriate choice of elective will help with core progression and prerequisite requirements for many areas.

Core units of study for Stream B specialisations

Core units of study for Stream B specialisations in the Engineering areas of Electrical, Electrical(Computer), Electrical(Power), Electrical(Telecommunications), Mechatronics, Mechatronics (Space), Software and Bachelor of Information Technology or Bachelor of Computer Science and Technology can elect to choose this option.

First year

ENGG1805
Professional Engineering and IT

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week; Project Work - own time 2 hrs. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

ENGG1805 aims to introduce students to the fundamental principles that underlie the study of engineering and information technologies. It lays the foundation for later studies, and presents to the students challenges common to a multidisciplinary engineering environment. The subject also provides students with the opportunity to develop an understanding of engineering ethics and of working as a part of a team.

Professional Engineering and IT (6CP) is composed from the following five parts: (a) Introduction to engineering: the engineer as problem solver, critical analysis of greatest engineering achievements and failure. (b) Introduction to common engineering software tools: word processors, project management tools (c) Ethics and workplace health and safety. (d) Testing - concepts of destructive and not destructive tests will be given on samples. (e) "Meet the professionals" - A selection of guest speakers will address students on the most important aspects of the engineering profession. (f) Design Process - The process of design synthesis as an important part of engineering: students will be required to complete an engineering design (from conception, to implementation and testing) maintaining proper lab notes.

MATH1001
Differential Calculus

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001 **Assumed knowledge:** HSC Mathematics Extension 1 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1001 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study looks at complex numbers, functions of a single variable, limits and continuity, vector functions and functions of two variables. Differential calculus is extended to functions of two variables. Taylor's theorem as a higher order mean value theorem.

Textbooks

As set out in the Junior Mathematics Handbook.

MATH1002
Linear Algebra

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1902, MATH1012, MATH1014 **Assumed knowledge:** HSC Mathematics or MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1002 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study introduces vectors and vector algebra, linear algebra including solutions of linear systems, matrices, determinants, eigenvalues and eigenvectors.

Textbooks

As set out in the Junior Mathematics Handbook

PHYS1001
Physics 1 (Regular)

Credit points: 6 **Session:** Semester 1 **Classes:** Three 1-hour lectures, one 3-hour laboratory per week for 9 weeks and one 1-hour tutorial per week. **Prerequisites:** HSC Physics with a minimum mark of 65 **Prohibitions:** PHYS1002, EDUH1017, PHYS1901 **Assumed knowledge:** HSC Physics **Assessment:** 3 hour exam plus laboratories, assignments and mid-semester tests (100%). **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for students who gained 65 marks or better in HSC Physics or equivalent. The lecture series contains three modules on the topics of mechanics, thermal physics, and oscillations and waves.

Textbooks

Young & Freedman. University Physics. 13th edition, with Mastering Physics, Addison-Wesley. 2012. Course lab manual.

INFO1103
Introduction to Programming

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Laboratory 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Programming in a legible, maintainable, reusable way is essential to solve complex problems in the pervasive computing environments. This unit will equip students with foundation of programming concepts that are common to widely used programming languages. The "fundamentals-first & objects-later" strategy is used to progressively guide this introductory unit from necessary and important building blocks of programming to the object-oriented approach. Java, one of the most popular programming languages, is used in this unit. It provides interdisciplinary approaches, applications and examples to support students from broad backgrounds such as science, engineering, and mathematics.

Student wishing to proceed into the Engineering stream of Mechatronics or Mechatronics(Space) should replace INFO1103 with ENGG1801 an alternative core unit.

Alternative units of study

Most units of study offered by the Faculty of Science or the School of IT shown in the tables can be replaced by an equivalent advanced level unit, subject to prerequisite conditions being met. Students considering doing advanced options should seek advice from their school before enrolling.

Note

Students in this option will choose their specialisation at the end of Semester 1 and continue in the specialist program or IT degree in Semester 2.
For a standard enrolment plan for Flexible First Year (Stream A) visit http://cusp.sydney.edu.au/students/view-degree-page/name/FFY(A)

For a standard enrolment plan for Flexible First Year (Stream B) visit http://cusp.sydney.edu.au/students/view-degree-page/name/FFY(B)

Faculty-wide Units of Study

In this section you will find tables for: Faculty-wide units of study that are not specific to any sub-discipline of Engineering or Information Technology, the Advanced Engineering program, the Talented Information Technology program, and the Faculty's Exchange units of study.

Engineering (ENGG) Units of Study

The ENGG units are designed to have broad appeal to students of any Engineering discipline, to whom they are available as core, alternative or elective units of study in any discipline of Engineering or Information Technology.

The Advance Engineering Program

Engineering students are eligible for the award of Advanced Engineering by completing a minimum of 18 cp of advanced units as listed in the following table. Only one Advanced unit can be selected from a particular year. Entry to the Advanced Engineering program is by invitation of the Dean and is based on a ATAR of 98+ in the NSW HSC or equivalent, or by obtaining a Distinction average in Years 1, 2 and 3 of their engineering course.

The Talented Information Technology Program

Information technology degree students are eligible to join the talented IT student program by invitation of the Dean. Entry is based on a ATAR of 98+ in the NSW HSC or equivalent, or by obtaining a Distinction average in Years 1, 2 or 3 of their information technologies course.

Exchange Units of Study

This table consists of the Exchange units of study from each of the Faculty's schools. Students who wish to go on an exchange program must consult with their academic advisors and obtain permission from their Head of School beforehand.

Faculty-wide Units of Study

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Faculty-wide units of study These units of study are available as core, alternative or elective units of study as the case may be in any discipline of Engineering or Information Technology.			
ENGG1000 History and Philosophy of Engineering	6		Semester 1 Semester 2
ENGG1800 Engineering Disciplines (Intro) Stream A	6		Semester 1
ENGG1801 Engineering Computing	6		Semester 1 Summer Late
ENGG1802 Engineering Mechanics	6		Semester 2 Summer Main
ENGG1803 Professional Engineering 1	6	**N** ENGG1061	Semester 1 Semester 2
ENGG1805 Professional Engineering and IT	6		Semester 1
ENGG1850 Introduction to Project Management	6	**N** QBUS2350, CIVL3805	Semester 1
ENGG4000 Practical Experience		**P** 36 Credit Points of Senior Units *Students should have completed three years of their BE program before enrolling in this unit.*	Semester 1 Semester 2

Faculty-wide Units of Study

Faculty-wide units of study

These units of study are available as core, alternative or elective units of study as the case may be in any discipline of Engineering or Information Technology.

ENGG1000
History and Philosophy of Engineering

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Tutorial 1 hr/week; Independent research/study 5 hrs/week; E-Learning 2 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

ENGG1000 is a unique course that aims to provide students with an understanding of the historical development of Engineering with relation to societal expectations of the period. Engineering as a field of study and profession has developed over millennia from simple (yet significant) advances in technology such as the lever and wheel, to modern day examples such as advanced computers, nanomaterials and space flight.

Interaction between human society and Engineers has helped develop and guide the advancement of engineering technology; with society posing problems for Engineers to solve and Engineers developing new technology that changed the course of human history, and helped shape the world we live in.

The general philosophy behind Engineering is that Engineers work to fulfil the needs of society (water, electricity, technological improvements etc.), and as such Engineers are expected to act ethically towards society. The role of Engineers in society will be analysed and discussed from a humanistic perspective, with relation to the current Engineers Australia code of ethics. Other relevant philosophical analyses of Engineering as a skill and profession will also be examined such as, aesthetics, creativity, the epistemology of Engineering and more.

This course will use online resources extensively and help develop research and communication skills of students, whilst providing an overview of the historical significance of Engineers in society, and what it means to be an Engineer.

ENGG1800
Engineering Disciplines (Intro) Stream A

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 1 hr/week; Laboratory 3 hrs/week. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces students to specialisations in the Engineering discipline areas of Aeronautical, Biomedical Chemical, Civil, Mechanical and Mechatronic Engineering, and Project Engineering and Management. By providing first-year students with an experience of these various engineering streams, the unit aims to develop the students' professional identity as an engineer and thus provide a suitable basis on which students can choose their discipline for further study.

Introductory sessions in the School of Aerospace,

Mechanical and Mechatronic Engineering

-4 weeks-

An overview of the degree requirements in each stream. The roles of the engineer in each stream (employments, skills, etc). How each of the subjects taught relate to the skills/knowledge and applications required of the engineers. Basically make sure students fully understand what engineers are in the discipline areas and why the students do the subjects they do. In each stream, one engineering technical topic will be taught as a problem solving exercise, and this topic will be the focus of the laboratory.

School of Civil Engineering

-4 weeks-

Introductory lectures in Engineering Economics and Construction Planning, Foundation Engineering, Structural Engineering, Materials, Environmental Engineering. Each student will be involved in the erection and dismantling of an 8 metre high steel and timber tower in the Civil Engineering Courtyard. Preliminary lectures related to the tower will include safety issues, loading, statical analysis, foundation calculations, construction management, engineering drawings and detailing, geometric calculations, and survey measurements. Exercises related to these issues will be performed before assembly and disassembly of the tower.

School of Chemical and Biomolecular Engineering

-4 weeks-

This course will enable students to gain an appreciation of: the methods and materials of construction of items of process equipment; the role of this equipment in building an entire chemical processing plant: its operation and maintenance and safety requirements and procedures. Students will dismantle, disassemble and operate items of process equipment. They will present written answers to questions, supplemented by drawings of process flowsheets, diagrams of dismantled equipment, and discussions of heat and mass balances and of process parameters.

ENGG1801
Engineering Computing

Credit points: 6 **Session:** Semester 1, Summer Late **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will introduce students to fundamental principles of programming. The language used will be Matlab but the principles taught are readily portable to other languages like C and Java. The unit material will be presented in a manner which will help students to draw a connection between programming constructs and real engineering applications. The unit will use engineering inspired case-studies : especially from Civil, Chemical, Aerospace and Mechanical streams, to motivate new material. There will be a major project which uses programming to solve a real world engineering problem. The extensive Matlab library for visualization will also be introduced. Matlab will cover two-thirds of the unit. The remaining one-third will be devoted to the use of Excel in engineering scenarios. Furthermore, cross integration between Matlab and Excel will also be highlighted.

ENGG1802
Engineering Mechanics

Credit points: 6 **Session:** Semester 2, Summer Main **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit aims to provide students with an understanding of and competence in solving statics and introductory dynamics problems in engineering. Tutorial sessions will help students to improve their group work and problem solving skills, and gain competency in extracting a simplified version of a problem from a complex situation. Emphasis is placed on the ability to work in 3D as well as 2D, including the 2D and 3D visualization of structures and structural components, and the vectorial 2D and 3D representations of spatial points, forces and moments. Introduction to kinematics and dynamics topics includes position, velocity and acceleration of a point; relative motion, force and acceleration, momentum, collisions and energy methods.

ENGG1803
Professional Engineering 1

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prohibitions:** ENGG1061 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Professional Engineering 1 is an introductory Unit of Study within the Faculty of Engineering. The semester 1 course is aimed at students from the School of Aerospace, Mechanical and Mechatronic Engineering. It seeks to introduce newly admitted undergraduates to general principles of professional engineering practice, a range of contemporary professional engineering issues, plus outline skills related to academic study within an engineering environment. The subject is structured around a team based design and build project, in which students apply the professional engineering concepts they are learning to an engineering project. Professional engineering topics to be covered include: accessing information, teamwork, creativity, leadership, written and oral communication, project management, problem solving, ethics, liability, work health and safety and environmental issues.

ENGG1805
Professional Engineering and IT

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week; Project Work - own time 2 hrs. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

ENGG1805 aims to introduce students to the fundamental principles that underlie the study of engineering and information technologies. It lays the foundation for later studies, and presents to the students challenges common to a multidisciplinary engineering environment. The subject also provides students with the opportunity to develop an understanding of engineering ethics and of working as a part of a team.

Professional Engineering and IT (6CP) is composed from the following five parts: (a) Introduction to engineering: the engineer as problem solver, critical analysis of greatest engineering achievements and failure. (b) Introduction to common engineering software tools: word processors, project management tools (c) Ethics and workplace health and safety. (d) Testing - concepts of destructive and not destructive tests will be given on samples. (e) "Meet the professionals" - A selection of guest speakers will address students on the most important aspects of the engineering profession. (f) Design Process - The process of design synthesis as an important part of engineering: students will be required to complete an engineering design (from conception, to implementation and testing) maintaining proper lab notes.

ENGG1850
Introduction to Project Management

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Laboratory 1 hr/week. **Prohibitions:** QBUS2350, CIVL3805 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Organisations today are heavily reliant on projects as part of their daily operations. A project is a temporary endeavour undertaken with limited resources to achieve organisational goals that are linked to broader organisational strategies and missions. Project management is therefore the process of planning, scheduling, resourcing, budgeting and monitoring the various phases of a project.

"Introduction to Project Management" is an introductory course that teaches students essential principles and concepts of project management, its application and related technologies. Students will learn about the project organisation, its structure, and role of the project manager, project sponsor and project committee. In addition, students will also learn how to identify business problems that require project-based solutions, how to select and evaluate projects, develop a business case, and manage the project at a basic level.

At completion of the course, students will have a high-level understanding of project management concepts, which equips them with basic technical and managerial skills required for project-based organisations.

ENGG4000
Practical Experience

Session: Semester 1, Semester 2 **Classes:** Practical Experience, **Prerequisites:** 36 Credit Points of Senior Units **Assessment:** Through semester assessment (100%) **Mode of delivery:** Professional practice

Note: Students should have completed three years of their BE program before enrolling in this unit.

The aim of this unit is to give students exposure to work in an engineering organisation and gain some professional experience; to enhance a student's abilities and experience in report writing; to encourage self-evaluation in the context of applying their theoretical knowledge to real industry practise. Students will gain a better appreciation of the role of engineers in the workplace. The assessment will enhance the student's ability to present structured observations and reflections in the mode of a formal written report.

Each student is required to gain exposure to professional engineering practice and environments and to submit a satisfactory written report of his or her work. The report will include the requirement of a detail logbook recording tasks given and timelines set for achieving these. Self-evaluation of a student's personal level of knowledge and its applicability to the workplace is a major component of the reporting. Normally 12 weeks (60 days) of practical work experience is required, though the Faculty may accept alternatives that are judged as equivalent. Students are strongly encouraged to undertake their work experience in the break between Year 3 and 4 and definitely prior to commencing their final semester of study, however any engineering work taken after completing 28 credit points of 3rd year units of study may be accepted for the requirements of this unit. The University Careers and Appointments Service is available to assist students to obtain suitable employment. This unit of study is a core unit of study in all BE programs and must be passed in order to graduate from those programs.

Advanced Engineering Units of Study

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Advanced Engineering Program			
Engineering students are eligible for the award of Advanced Engineering by completing a minimum of 18 cp of advanced units as listed in the following table. Only one Advanced unit can be selected from a particular year. Entry to the Advanced Engineering program is by invitation of the Dean and is based on a ATAR of 98+ in the NSW HSC or equivalent, or by obtaining a Distinction average in Years 1, 2 and 3 of their engineering course.			
ENGG1061 **Advanced Engineering 1A**	6	*Note: Department permission required for enrolment* *Enrolment by Dean`s invitation for high achieving HSC students (ATAR equivalent score of 98 or higher).*	Semester 1 Semester 2
ENGG2062 **Engineering Project: Business Plan 2 Adv**	6	**P** Distinction average WAM *Note: Department permission required for enrolment*	Semester 1 Semester 2
AERO2711 **Space Engineering Project 1**	6	**A** Completed the junior years (first 2 years) of Aero(Space), Mechanical(Space) or Mechatronic(Space) Engineering. *Note: Department permission required for enrolment* *Note1: A WAM of > 75% is required as well as an Invitation from the Dean to participate in the Advanced Engineering Program. Note2: There is a cap on the number of students allowed to do this subject in any one semester - depending on resources available.*	Semester 1 Semester 2
ENGG3062 **Technology Education (Advanced)**	6	**P** Distinction average WAM *Note: Department permission required for enrolment*	Semester 2
AERO3711 **Space Engineering Project 2**	6	**A** Completed the junior years (first 2 years) of Aero(Space), Mechanical(Space) or Mechatronic(Space) Engineering. *Note: Department permission required for enrolment* *Note1: A WAM of > 75% is required as well as departmental permission from the Space Engineering coordinator. Note2: There is a cap on the number of students allowed to do this subject in any one semester - depending on resources available.*	Semester 1 Semester 2
AERO4711 **Space Engineering Project 3**	6	**A** Completed the first three years of Aero(Space), Mechanical(Space) or Mechatronic(Space) Engineering. *Note: Department permission required for enrolment* *Note1: A WAM of > 75% is required as well as departmental permission from the Space Engineering coordinator. Note2: There is a cap on the number of students allowed to do this subject in any one semester - depending on resources available.*	Semester 1 Semester 2
AERO4712 **Space Engineering Project 4** *This unit of study is not available in 2015*	6	**P** AERO4711. *Note: Department permission required for enrolment* *Note1: A WAM of > 75% is required as well as departmental permission from the Space Engineering coordinator. Note2: There is a cap on the number of students allowed to do this subject in any one semester - depending on resources available.*	Semester 1 Semester 2
ENGG4064 **Advanced Engineering Design A**	6	**P** Distinction average WAM *Note: Department permission required for enrolment* *Only students with an AAM of > 75% at the end of Year 3 will be invited to join this interdisciplinary group*	Semester 2
ENGG4065 **Advanced Engineering Design B**	6	**P** Distinction average WAM **C** ENGG4064 *Note: Department permission required for enrolment* *Only students with an AAM of > 75% at the end of Year 3 will be invited to join this interdisciplinary group*	Semester 2

Advanced Engineering Units of Study

Advanced Engineering Program

Engineering students are eligible for the award of Advanced Engineering by completing a minimum of 18 cp of advanced units as listed in the following table. Only one Advanced unit can be selected from a particular year. Entry to the Advanced Engineering program is by invitation of the Dean and is based on a ATAR of 98+ in the NSW HSC or equivalent, or by obtaining a Distinction average in Years 1, 2 and 3 of their engineering course.

ENGG1061
Advanced Engineering 1A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment. Note: Enrolment by Dean`s invitation for high achieving HSC students (ATAR equivalent score of 98 or higher).

Real engineering in 1st year! The course is designed to introduce Advanced engineering students to the essential generic engineering skills of communication, problem identification and solution, design, teamwork, and understanding of the social, cultural, global, ethical and environment responsibilities of the professional engineer. These skills are pursued through a real world Engineers Without Borders Challenge project in a developing country.

ENGG2062
Engineering Project: Business Plan 2 Adv

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Project Work - in class 2 hrs/week; Project Work - own time 6 hrs; Research 4 hrs; Presentation 6 hrs. **Prerequisites:** Distinction average WAM **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This course aims to extend student experience beyond the design and build phase of engineering to the business planning necessary to transform a good idea into a commercial reality. It will provide the opportunity for students to develop a range of skills used by professional engineers in a business environment, including planning, strategy development and assessment, business environment and market analysis together with financial management and resource allocation.

AERO2711
Space Engineering Project 1

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Meeting 2 hrs/week; Project Work - own time 6 hrs/week. **Assumed knowledge:** Completed the junior years (first 2 years) of Aero(Space), Mechanical(Space) or Mechatronic(Space) Engineering. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment. Note: Note1: A WAM of > 75% is required as well as an Invitation from the Dean to participate in the Advanced Engineering Program. Note2: There is a cap on the number of students allowed to do this subject in any one semester - depending on resources available.

This unit of study aims to develop deeper practical knowledge in the area of Space systems engineering. Students who take this subject would be interested in developing design skills by working on the sub-system of a real satellite or launch vehicle.

ENGG3062
Technology Education (Advanced)

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 1 hr/week; Project Work - in class 2 hrs/week; Project Work - own time 6 hrs; Research 4 hrs; Presentation 6 hrs. **Prerequisites:** Distinction average WAM **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This UoS aims to give the student experience in critically engaging an audience in the theoretical and practical understanding of engineering and technology. Students will learn professional skills in client relationship management, teaching and presenting, project management, leadership and teamwork. This work will be carried out with partner schools to enhance the engineering knowledge and understanding of Stage 5 high school students. This UoS places students in an environment with which they are familiar, albeit in a very different and challenging role. It allows them the opportunity to deliver a project for a professional external client and in doing so showcase engineering, the faculty and the University to the wider community.

AERO3711
Space Engineering Project 2

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Meeting 2 hrs/week; Project Work - own time 6 hrs/week. **Assumed knowledge:** Completed the junior years (first 2 years) of Aero(Space), Mechanical(Space) or Mechatronic(Space) Engineering. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment. Note: Note1: A WAM of > 75% is required as well as departmental permission from the Space Engineering coordinator. Note2: There is a cap on the number of students allowed to do this subject in any one semester - depending on resources available.

This unit of study is for those students who have completed Space Engineering Project 1, and who wish to extend their design into the prototype phase. Students who take this subject would be interested in manufacturing a sub-system for a real satellite or launch vehicle. This unit allows students to develop a deeper appreciation for the complexities of designing and building space sub-systems, and if completed successfully will allow the student to take further Space Engineering Projects towards the final development of a sub-system ready for launch.

AERO4711
Space Engineering Project 3

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Meeting 2 hrs/week; Project Work - own time 6 hrs/week. **Assumed knowledge:** Completed the first three years of Aero(Space), Mechanical(Space) or Mechatronic(Space) Engineering. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment. Note: Note1: A WAM of > 75% is required as well as departmental permission from the Space Engineering coordinator. Note2: There is a cap on the number of students allowed to do this subject in any one semester - depending on resources available.

This unit of study is for those students who have completed Space Engineering Projects 2, and who wish to formalise their design into the launch phase. Students who take this subject would be interested in manufacturing the final sub-system for a real satellite or launch vehicle. This unit allows students to develop a deeper appreciation for the complexities of designing and building space sub-systems, and provide an opportunity for the actual launch of the sub-system. Launch of the sub-system will be dependent on the current opportunities existing with international collaborators.

AERO4712
Space Engineering Project 4

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Meeting 2 hrs/week; Project Work - own time 6 hrs/week. **Prerequisites:** AERO4711. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment. Note: Note1: A WAM of > 75% is required as well as departmental permission from the Space Engineering coordinator. Note2: There is a cap on the number of students allowed to do this subject in any one semester - depending on resources available.

This unit of study is for those students who have completed Space Engineering Projects 3, and who wish to finalise their design by developing the interfacing and insertion phases into Satellite or Launch Vehicle system. Students who take this subject would have completed the previous three Space Engineering Projects, and have been provided with the opportunity to place their system into an actual system. Launch of the sub-system will be dependent on the current opportunities existing with international collaborators.

ENGG4064
Advanced Engineering Design A

Credit points: 6 **Session:** Semester 2 **Classes:** Project Work - own time 10 hrs. **Prerequisites:** Distinction average WAM **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: Only students with an AAM of > 75% at the end of Year 3 will be invited to join this interdisciplinary group

The aim to this unit is to develop an understanding of the practice of engineering, utilising a diverse range of skills to solve complex problems. Students will gain skills in design, analysis and management by undertaking a significant project in a multi-disciplinary team comprising students from across the faculty. Each student will be required to work in a team to produce an integrated design in greater detail than is possible in ordinary classes and to write a significant design report presenting the results of the process. The ability to work in a team of engineers from different disciplines will be assessed as part of this design project.

We try to centre projects around a client, which can be an industrial facility, the Campus and Property Services Office of the University, Research departments within the university, or outside clients including non-profits and community groups.

Elements drawn from: Introduction to the design process, Clarification of the Brief, Inquiry, brainstorming, Design philosophy, Design optimization, Equipment design and costing, Hazard assessment, Environmental Impact Assessment, Project financial Analysis, Business planning.

ENGG4065
Advanced Engineering Design B

Credit points: 6 **Session:** Semester 2 **Classes:** Project Work - own time 10 hrs. **Prerequisites:** Distinction average WAM **Corequisites:** ENGG4064 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: Only students with an AAM of > 75% at the end of Year 3 will be invited to join this interdisciplinary group

The aim to this unit is to develop an understanding of the practice of engineering, utilising a diverse range of skills to solve complex problems.

Students will gain skills in design, analysis and management by undertaking a significant project in a multi-disciplinary team comprising students from across the faculty. Each student will be required to work in a team to produce an integrated design in greater detail than is possible in ordinary classes and to write a significant design report presenting the results of the process. The ability to work in a team of engineers from different disciplines will be assessed as part of this design project.

We try to centre projects around a client, which can be an industrial facility, the Campus and Property Services Office of the University, Research departments within the university, or outside clients (e.g. Nature Conservation Council NSW).

Elements drawn from: Introduction to the design process, Clarification of the Brief, Inquiry, brainstorming, Design philosophy, Design optimization, Equipment design and costing, Hazard assessment, Environmental Impact Assessment, Project financial Analysis, Business planning.

Talented Information Technology Units of Study

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Talented Information Technology Student Program			
Information technology degree students are eligible to join the talented IT student program by invitation of the Dean. Entry is based on a ATAR of 98+ in the NSW HSC or equivalent, or by obtaining a Distinction average in Years 1, 2 or 3 of their information technologies course.			
INFO1911 **IT Special Project 1A**	6	**A** Only by invitation from the School of IT. *Note: Department permission required for enrolment*	Semester 1
INFO1912 **IT Special Project 1B**	6	**P** UAI score of at least 98 AND 85% average in Junior IT units of study AND 75% average in non-IT junior units of study AND Special permission by the School of IT *Note: Department permission required for enrolment*	Semester 2
INFO2911 **IT Special Project 2A**	6	**P** 85% average in IT units of study in previous year AND 75% average in other non-IT units of study in previous year AND Special permission by the School of IT. *Note: Department permission required for enrolment*	Semester 1
INFO2912 **IT Special Project 2B**	6	*Note: Department permission required for enrolment*	Semester 2
INFO3911 **IT Special Project 3A**	6	*Note: Department permission required for enrolment* *Enrolment by department permission for students with 85% average in School of IT units plus minimum 75% average in other units*	Semester 1
INFO3912 **IT Special Project 3B**	6	*Note: Department permission required for enrolment* *Enrolment by department permission for students with 85% average in School of IT units plus minimum 75% average in other units*	Semester 2

Talented Information Technology Units of Study

Talented Information Technology Student Program

Information technology degree students are eligible to join the talented IT student program by invitation of the Dean. Entry is based on a ATAR of 98+ in the NSW HSC or equivalent, or by obtaining a Distinction average in Years 1, 2 or 3 of their information technologies course.

INFO1911
IT Special Project 1A

Credit points: 6 **Session:** Semester 1 **Classes:** Meeting 1 hr/week; Project Work - own time 8 hrs/week. **Assumed knowledge:** Only by invitation from the School of IT. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This is a unit of study for the junior student who is an academic high achiever as well as talented in IT areas. Students will be involved in advance projects (which may be research-oriented). They need to apply their problem solving and IT skills in the project. As a result, their horizon in computer science and information system is broadened.

INFO1912
IT Special Project 1B

Credit points: 6 **Session:** Semester 2 **Classes:** Meeting 1 hr/week; Project Work - own time 8 hrs/week. **Prerequisites:** UAI score of at least 98 AND 85% average in Junior IT units of study AND 75% average in non-IT junior units of study AND Special permission by the School of IT **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This is a unit of study for the junior students who is an academic high achiever and is talentd in IT areas. Students will involve in advance projects which have research components, so that they can further demonstrate their IT and problem solving capabilities.

INFO2911
IT Special Project 2A

Credit points: 6 **Session:** Semester 1 **Classes:** Meeting 1 hr/week; Project Work - own time 8 hrs/week. **Prerequisites:** 85% average in IT units of study in previous year AND 75% average in other non-IT units of study in previous year AND Special permission by the School of IT. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit enables talented students to apply their IT knowledge from the junior years to do more exciting projects. Students are provided with the opportunities to get involved in projects which are research intensive.

INFO2912
IT Special Project 2B

Credit points: 6 **Session:** Semester 2 **Classes:** Meeting 1 hr/week; Project Work - own time 8 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit enables talented students to apply their It knowledge from their junior years to do more exciting projects. Students are provided with the opportunities to get involved in projects which are research intensive.

INFO3911
IT Special Project 3A

Credit points: 6 **Session:** Semester 1 **Classes:** Meeting 1 hr/week; Project Work - own time 8 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment. Note: Enrolment by department permission for students with 85% average in School of IT units plus minimum 75% average in other units

This unit enables talents students with maturing IT knowledge to integrate various IT skills and techniques to carry out projects. These projects are largely research intensive.

INFO3912
IT Special Project 3B

Credit points: 6 **Session:** Semester 2 **Classes:** Meeting 1 hr/week; Project Work - own time 8 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment. Note: Enrolment by department permission for students with 85% average in School of IT units plus minimum 75% average in other units

This unit enables talents students with maturing IT knowledge to integrate various IT skills and techniques to carry out projects. These projects are

largely research intensive.

Exchange Units of Study

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Exchange units of study			
Permission from the relevant Head of School must be sought prior to enrolling in exchange units of study.			
School of Aeronautical, Mechanical and Mechatronic Engineering			
AMME0011 **International Exchange B**	6	*Department permission required for enrolment.*	Semester 1 Semester 2
AMME0012 **International Exchange C**	6	*Department permission required for enrolment.*	Semester 1 Semester 2
AMME0013 **International Exchange D**	6	*Department Permission required for enrolment.*	Semester 1 Semester 2
AMME0014 **International Exchange E**	6	*Department Permission required for enrolment.*	Semester 1 Semester 2
AMME0015 **International Exchange F**	6	*Department Permission required for enrolment.*	Semester 1 Semester 2
AMME0016 **International Exchange G**	6	*Department Permission required for enrolment.*	Semester 1 Semester 2
AMME0017 **International Exchange H**	6	*Departmental Permission required for enrolment.*	Semester 1 Semester 2
AMME0018 **International Exchange I**	6	*Department permission required for enrolment.*	Semester 1 Semester 2
School of Chemical and Biomolecular Engineering			
CHNG3041 **Exchange Program 3A**	24	**P** 96 credit points in Chemical Engineering *Department permission required. Enrolment requires completion of all Year 1 and 2 core units of study in Chemical Engineering, and at least 96 credit points towards the degree plus Head of School approval from Chemical and Biomolecular Engineering at the University of Sydney and the host institution.*	Semester 1 Semester 2
CHNG3042 **Exchange Program 3B**	24	**P** 96 credit points in Chemical Engineering *Department permission required. Enrolment requires completion of all Year 1 and 2 core units of study in Chemical Engineering, and at least 96 credit points towards the degree plus Head of School approval from Chemical and Biomolecular Engineering at the University of Sydney and the host institution.*	Semester 1 Semester 2
CHNG4041 **Exchange Program 4A**	24	**P** 144 credit points in Chemical Engineering *Department permission required. Enrolment requires completion of all Year 1, 2 and 3 core units of study in Chemical Engineering, and at least 144 credit points towards the degree plus Head of School approval from Chemical and Biomolecular Engineering at the University of Sydney and the participating exchange institution. Assessment: Students spend either one academic year or semester at the host institution where they take a normal load. Their specific course choices are approved by the Heads of Department of the two institutions. Individual approved subjects at the host institution are assessed according to their standard procedures and a grade of ``R`` satisfied requirements will be recorded on their academic transcript from this institution.*	Semester 1 Semester 2
CHNG4042 **Exchange Program 4B**	24	**P** Completion of all Year 1, 2 and 3 core units of study in Chemical Engineering, and at least 144 credit points towards the degree. *Department permission required for enrolment in sessions 1 & 2 Assessment: Students spend either one academic year or semester at the host institution where they take a normal load. Their specific course choices are approved by the Heads of Department of the two institutions. Individual approved subjects at the host institution are assessed according to their standard procedures and a grade of "R" (satisfied requirements) is recorded on their academic transcript at this institution.*	Semester 1 Semester 2
School of Civil Engineering			
CIVL0011 **Civil Exchange A**	6	*Departmental permission required. Students must have a WAM >65 and to have completed one full year of study, that is 48 credit points.*	Semester 1 Semester 2
CIVL0012 **Civil Exchange B**	6	*Departmental permission required. Students must have a WAM >65 and to have completed one full year of study, that is 48 credit points.*	Semester 1 Semester 2
CIVL0013 **Civil Exchange C**	6	*Departmental permission required. Students must have a WAM >65 and to have completed one full year of study, that is 48 credit points.*	Semester 1 Semester 2
CIVL0014 **Civil Exchange D**	6	*Departmental permission required. Students must have a WAM >65 and to have completed one full year of study, that is 48 credit points.*	Semester 1 Semester 2
CIVL0015 **Civil Exchange E**	6		Semester 1 Semester 2
CIVL0016 **Civil Exchange F**	6	*Departmental permission required. Students must have a WAM >65 and to have completed one full year of study, that is 48 credit points.*	Semester 1 Semester 2
CIVL0017 **Civil Exchange G**	6	*Departmental permission required. Students must have a WAM >65 and to have completed one full year of study, that is 48 credit points.*	Semester 1 Semester 2
CIVL0018 **Civil Exchange H**	6	*Departmental permission required. Students must have a WAM >65 and to have completed one full year of study, that is 48 credit points.*	Semester 1 Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
School of Electrical and Information Engineering			
ELEC3901 **Electrical Exchange Unit 1A**	6		Semester 1
ELEC3902 **Electrical Exchange Unit 1B**	12		Semester 1
ELEC3903 **Electrical Exchange Unit 1C**	24		Semester 1
ELEC3904 **Electrical Exchange Unit 2A**	6		Semester 2
ELEC3905 **Electrical Exchange Unit 2B**	12		Semester 2
ELEC3906 **Electrical Exchange Unit 2C**	24		Semester 2
School of Information Technologies			
COMP2555 **Computer Science Exchange**	6		Semester 1 Semester 2
COMP2556 **Computer Science Exchange**	6		Semester 1 Semester 2
COMP2557 **Computer Science Exchange**	6		Semester 1 Semester 2
COMP2558 **Computer Science Exchange**	6		Semester 1 Semester 2
COMP2591 **Advanced Computer Science Exchange**	6		Semester 1 Semester 1a Semester 1b Semester 2 Semester 2a Semester 2b
COMP2592 **Advanced Computer Science Exchange**	6		Semester 1 Semester 1a Semester 1b Semester 2 Semester 2a Semester 2b
COMP3556 **Computer Science Exchange**	6		Semester 1 Semester 2
COMP3557 **Computer Science Exchange**	6		Semester 1 Semester 2
COMP3558 **Computer Science Exchange**	6		Semester 1 Semester 2
COMP3559 **Computer Science Exchange**	6		Semester 1 Semester 2
COMP3591 **Advanced Computer Science Exchange**	6		Semester 1 Semester 1a Semester 1b Semester 2 Semester 2a Semester 2b
COMP3592 **Advanced Computer Science Exchange**	6		Semester 1 Semester 1a Semester 1b Semester 2 Semester 2a Semester 2b
COMP3593 **Advanced Computer Science Exchange**	6		Semester 1 Semester 1a Semester 1b Semester 2 Semester 2a Semester 2b
COMP3594 **Advanced Computer Science Exchange**	6		Semester 1 Semester 1a Semester 1b Semester 2 Semester 2a Semester 2b
COMP4551 **Computer Science Exchange**	6		Semester 1 Semester 2
COMP4552 **Computer Science Exchange**	6		Semester 1 Semester 2
COMP4553 **Computer Science Exchange**	6		Semester 1 Semester 2
COMP4554 **Computer Science Exchange**	6		Semester 1 Semester 2
INFO1551 **Information Technology Exchange**	6		Semester 1 Semester 2
INFO1552 **Information Technology Exchange**	6		Semester 1 Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
INFO2551 **Information Technology Exchange**	6		Semester 1 Semester 2
INFO2552 **Information Technology Exchange**	6		Semester 1 Semester 2
INFO3551 **Information Technology Exchange**	6	*Department Permission required for enrolment.*	Semester 1 Semester 2
INFO3552 **Information Technology Exchange**	6		Semester 1 Semester 2
INFO3553 **Information Technology Exchange**	6		Semester 1 Semester 2
ISYS1551 **Information Systems Exchange**	6		Semester 1 Semester 2
ISYS1552 **Information Systems Exchange**	6		Semester 1 Semester 2
ISYS2554 **Information Systems Exchange**	6		Semester 1 Semester 2
ISYS2555 **Information Systems Exchange**	6		Semester 1 Semester 2
ISYS2556 **Information Systems Exchange**	6		Semester 1 Semester 2
ISYS2557 **Information Systems Exchange**	6		Semester 1 Semester 2
ISYS3554 **Information Systems Exchange**	6		Semester 1 Semester 2
ISYS3555 **Information Systems Exchange**	6		Semester 1 Semester 2
ISYS3556 **Information Systems Exchange**	6		Semester 1 Semester 2
ISYS3557 **Information Systems Exchange**	6		Semester 1 Semester 2

Exchange Units

Exchange units of study

Permission from the relevant Head of School must be sought prior to enrolling in exchange units of study.

School of Aeronautical, Mechanical and Mechatronic Engineering

AMME0011
International Exchange B
Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day
Note:

An exchange component unit for students going on an International Exchange Program.

AMME0012
International Exchange C
Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day
Note:

An exchange component unit for students going on an International Exchange Program.

AMME0013
International Exchange D
Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day
Note: Department Permission required for enrolment.

An exchange component unit for students going on an International Exchange Program

AMME0014
International Exchange E
Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day
Note: Department Permission required for enrolment.

An exchange component unit for students going on an International Exchange Program

AMME0015
International Exchange F
Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day
Note: Department Permission required for enrolment.

An exchange component unit for students going on an International Exchange Program

AMME0016
International Exchange G
Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day
Note: Department Permission required for enrolment.

An exchange component unit for students going on an International Exchange Program

AMME0017
International Exchange H
Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day
Note: Departmental Permission required for enrolment.

An exchange component unit for students going on an International Exchange Program

AMME0018
International Exchange I
Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day
Note:

An exchange component unit for students going on an International Exchange Program

School of Chemical and Biomolecular Engineering

CHNG3041
Exchange Program 3A
Credit points: 24 **Session:** Semester 1, Semester 2 **Prerequisites:** 96 credit points in Chemical Engineering **Mode of delivery:** Normal (lecture/lab/tutorial) day

Year 3 elective unit of study for the degree in Chemical Engineering. Objectives/Outcomes: The objective of this (single semester) Exchange Program is to provide students with the opportunity to live and learn in a foreign culture while completing the academic and professional requirements of the University of Sydney degree program. Upon completion of the full year-long exchange (i.e. both CHNG3041 and CHNG3042), students will have completed work at least equivalent to Year 3 in the Chemical Engineering degree, including in particular all Year 3 core units of study.

CHNG3042
Exchange Program 3B
Credit points: 24 **Session:** Semester 1, Semester 2 **Prerequisites:** 96 credit points in Chemical Engineering **Mode of delivery:** Normal (lecture/lab/tutorial) day

Year 3 elective unit of study for the degree in Chemical Engineering.Objectives/Outcomes The objective of this (single semester) Exchange Program is to provide students with the opportunity to live and learn in a foreign culture while completing the academic and professional requirements of the University of Sydney degree program. Upon completion of the full year-long exchange (ie both CHNG3041 and CHNG3042), students will have completed work at least equivalent to Year 3 in the Chemical Engineering degree, including in particular all Year 3 core units of study.

CHNG4041
Exchange Program 4A
Credit points: 24 **Session:** Semester 1, Semester 2 **Prerequisites:** 144 credit points in Chemical Engineering **Mode of delivery:** Normal (lecture/lab/tutorial) day

Year 4 elective unit of study for the degree in Chemical Engineering. Objectives/Outcomes: The objective of this (single semester) Exchange Program is to provide students with the opportunity to live and learn in a foreign culture while completing the academic and professional requirements of the University of Sydney degree program. Upon completion of the full year-long exchange (i.e. both CHNG4041 and CHNG4042), students will have completed work at least equivalent to Year 4 in the Chemical Engineering degree, including in particular the Year 4 core units of study, and will have fulfilled all the requirements of their degree from the University of Sydney.

CHNG4042
Exchange Program 4B

Credit points: 24 **Session:** Semester 1, Semester 2 **Prerequisites:** Completion of all Year 1, 2 and 3 core units of study in Chemical Engineering, and at least 144 credit points towards the degree. **Mode of delivery:** Normal (lecture/lab/tutorial) day

Year 4 elective unit of study for the degree in Chemical Engineering. Objectives/Outcomes: The objective of this (single semester) Exchange Program is to provide students with the opportunity to live and learn in a foreign culture while completing the academic and professional requirements of the University of Sydney degree program. Upon completion of the full year-long exchange (i.e. both CHNG4041 and CHNG4042), students will have completed work at least equivalent to Year 4 in the Chemical Engineering degree, including in particular the Year 4 core units of study, and will have fulfilled all the requirements of their degree from the University of Sydney.

School of Civil Engineering

CIVL0011
Civil Exchange A

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Departmental permission required. Students must have a WAM >65 and to have completed one full year of study, that is 48 credit points.

Students undertaking overseas exchange programs enrol in exchange units in place of a normal semester enrolment. Successful completion of the subjects at the external institution will be the criteria for the award or pass or fail in this unit.

CIVL0012
Civil Exchange B

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Departmental permission required. Students must have a WAM >65 and to have completed one full year of study, that is 48 credit points.

Students undertaking overseas exchange programs enrol in exchange units in place of a normal semester enrolment. Successful completion of the subjects at the external institution will be the criteria for the award or pass or fail in this unit.

CIVL0013
Civil Exchange C

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Departmental permission required. Students must have a WAM >65 and to have completed one full year of study, that is 48 credit points.

Students undertaking overseas exchange programs enrol in exchange units in place of a normal semester enrolment. Successful completion of the subjects at the external institution will be the criteria for the award or pass or fail in this unit.

CIVL0014
Civil Exchange D

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Departmental permission required. Students must have a WAM >65 and to have completed one full year of study, that is 48 credit points.

Students undertaking overseas exchange programs enrol in exchange units in place of a normal semester enrolment. Successful completion of the subjects at the external institution will be the criteria for the award or pass or fail in this unit.

CIVL0015
Civil Exchange E

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is a shell unit to be used to cover enrolment in subjects while student is on overseas exchange

CIVL0016
Civil Exchange F

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Departmental permission required. Students must have a WAM >65 and to have completed one full year of study, that is 48 credit points.

Students undertaking overseas exchange programs enrol in exchange units in place of a normal semester enrolment. Successful completion of the subjects at the external institution will be the criteria for the award or pass or fail in this unit.

CIVL0017
Civil Exchange G

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Departmental permission required. Students must have a WAM >65 and to have completed one full year of study, that is 48 credit points.

Students undertaking overseas exchange programs enrol in exchange units in place of a normal semester enrolment. Successful completion of the subjects at the external institution will be the criteria for the award or pass or fail in this unit.

CIVL0018
Civil Exchange H

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Departmental permission required. Students must have a WAM >65 and to have completed one full year of study, that is 48 credit points.

Students undertaking overseas exchange programs enrol in exchange units in place of a normal semester enrolment. Successful completion of the subjects at the external institution will be the criteria for the award or pass or fail in this unit.

School of Electrical and Information Engineering

ELEC3901
Electrical Exchange Unit 1A

Credit points: 6 **Session:** Semester 1 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is a unit of study for the University of Sydney students who have gone on exchange and are doing unit(s) with a syllabus that is equivalent to unit(s) of study in the School of Electrical & Information Engineering. The enrollment in this unit needs to be approved by the school. The enrollment in this unit will be granted for a workload that is equivalent to one quarter of that of a (normal) full time student at the exchange university. Assessment is set by the exchange university. A Pass/Fail grade is awarded by the University of Sydney in this unit. Thus the marks obtained at the exchange university will not be included in any WAM calculations.

ELEC3902
Electrical Exchange Unit 1B

Credit points: 12 **Session:** Semester 1 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is a unit of study for the University of Sydney students who have gone on exchange and are doing unit(s) with a syllabus that is equivalent to unit(s) of study in the School of Electrical & Information Engineering. The enrollment in this unit needs to be approved by the school. The enrollment in this unit will be granted for a workload that is equivalent to one half of that of a (normal) full time student at the exchange university. Assessment is set by the exchange university. A Pass/Fail grade is awarded by the University of Sydney in this unit. Thus the marks obtained at the exchange university will not be included in any WAM calculations.

ELEC3903
Electrical Exchange Unit 1C
Credit points: 24 **Session:** Semester 1 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is a unit of study for the University of Sydney students who have gone on exchange and are doing unit(s) with a syllabus that is equivalent to unit(s) of study in the School of Electrical & Information Engineering. The enrollment in this unit needs to be approved by the school. The enrollment in this unit will be granted for a workload that is equivalent to that of a (normal) full time student at the exchange university. Assessment is set by the exchange university. A Pass/Fail grade is awarded by the University of Sydney in this unit. Thus the marks obtained at the exchange university will not be included in any WAM calculations.

ELEC3904
Electrical Exchange Unit 2A
Credit points: 6 **Session:** Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is a unit of study for the University of Sydney students who have gone on exchange and are doing unit(s) with a syllabus that is equivalent to unit(s) of study in the School of Electrical & Information Engineering. The enrollment in this unit needs to be approved by the school. The enrollment in this unit will be granted for a workload that is equivalent to one quarter of that of a (normal) full time student at the exchange university. Assessment is set by the exchange university. A Pass/Fail grade is awarded by the University of Sydney in this unit. Thus the marks obtained at the exchange university will not be included in any WAM calculations.

ELEC3905
Electrical Exchange Unit 2B
Credit points: 12 **Session:** Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is a unit of study for the University of Sydney students who have gone on exchange and are doing unit(s) with a syllabus that is equivalent to unit(s) of study in the School of Electrical & Information Engineering. The enrollment in this unit needs to be approved by the school. The enrollment in this unit will be granted for a workload that is equivalent to one half of that of a (normal) full time student at the exchange university. Assessment is set by the exchange university. A Pass/Fail grade is awarded by the University of Sydney in this unit. Thus the marks obtained at the exchange university will not be included in any WAM calculations.

ELEC3906
Electrical Exchange Unit 2C
Credit points: 24 **Session:** Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is a unit of study for the University of Sydney students who have gone on exchange and are doing unit(s) with a syllabus that is equivalent to unit(s) of study in the School of Electrical & Information Engineering. The enrollment in this unit needs to be approved by the school. The enrollment in this unit will be granted for a workload that is equivalent to that of a (normal) full time student at the exchange university. Assessment is set by the exchange university. A Pass/Fail grade is awarded by the University of Sydney in this unit. Thus the marks obtained at the exchange university will not be included in any WAM calculations.

School of Information Technologies

COMP2555
Computer Science Exchange
Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

COMP2556
Computer Science Exchange
Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

COMP2557
Computer Science Exchange
Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

COMP2558
Computer Science Exchange
Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

COMP2591
Advanced Computer Science Exchange
Credit points: 6 **Session:** Semester 1, Semester 1a, Semester 1b, Semester 2, Semester 2a, Semester 2b **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

COMP2592
Advanced Computer Science Exchange
Credit points: 6 **Session:** Semester 1, Semester 1a, Semester 1b, Semester 2, Semester 2a, Semester 2b **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

COMP3556
Computer Science Exchange
Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

COMP3557
Computer Science Exchange
Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

COMP3558
Computer Science Exchange
Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

COMP3559
Computer Science Exchange
Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

COMP3591
Advanced Computer Science Exchange

Credit points: 6 **Session:** Semester 1, Semester 1a, Semester 1b, Semester 2, Semester 2a, Semester 2b **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

COMP3592
Advanced Computer Science Exchange

Credit points: 6 **Session:** Semester 1, Semester 1a, Semester 1b, Semester 2, Semester 2a, Semester 2b **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

COMP3593
Advanced Computer Science Exchange

Credit points: 6 **Session:** Semester 1, Semester 1a, Semester 1b, Semester 2, Semester 2a, Semester 2b **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

COMP3594
Advanced Computer Science Exchange

Credit points: 6 **Session:** Semester 1, Semester 1a, Semester 1b, Semester 2, Semester 2a, Semester 2b **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

COMP4551
Computer Science Exchange

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

COMP4552
Computer Science Exchange

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

COMP4553
Computer Science Exchange

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

COMP4554
Computer Science Exchange

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

INFO1551
Information Technology Exchange

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

INFO1552
Information Technology Exchange

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

INFO2551
Information Technology Exchange

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

INFO2552
Information Technology Exchange

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

INFO3551
Information Technology Exchange

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department Permission required for enrolment.

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

INFO3552
Information Technology Exchange

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

INFO3553
Information Technology Exchange

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

ISYS1551
Information Systems Exchange

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

ISYS1552
Information Systems Exchange

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

ISYS2554
Information Systems Exchange

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

ISYS2555
Information Systems Exchange

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

ISYS2556
Information Systems Exchange

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

ISYS2557
Information Systems Exchange

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

ISYS3554
Information Systems Exchange

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

ISYS3555
Information Systems Exchange

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

ISYS3556
Information Systems Exchange

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

ISYS3557
Information Systems Exchange

Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for University of Sydney students in the Exchange program studying at an overseas University.

School of Aeronautical, Mechanical and Mechatronic Engineering

The School of Aerospace, Mechanical and Mechatronic Engineering encompasses four broad areas of engineering.

Aeronautical Engineering involves the design, analysis, development, construction, maintenance and operation of flight vehicles. An aeronautical engineer needs a sound understanding of the mathematics, physics, computer science, materials science and design philosophy involved in this field. Aeronautical engineers apply their skills in a variety of cutting-edge areas in the global aerospace industry. They also lead the way in many other fields of science and technology, so graduates of this field are also in demand in other areas, including low-speed aerodynamics such as automobile design, navigation systems, and computer operation and software engineering.

Mechanical Engineering represents a broad branch of professional engineering, with its practitioners applying basic sciences to the development of technologies that enhance our quality of life. Mechanical engineers contribute to almost every type of engineering activity, from the application of nanotechnology to the design of systems crucial to sustainable power generation, air conditioning, transport, steel production and mining.

Mechatronic Engineering is the study of computer-controlled systems that form the basis of the 'intelligent' products that are essential in today's society. Drawing on aspects of disciplines such as mechanical, electrical and systems engineering, as well as computer science, it provides the foundation for cutting-edge technologies in fields including robotics, manufacturing, aerospace and bioengineering.

Space Engineering is an exciting new 21st Century discipline underlying the exploration and conquest of nature's most unforgiving environment. Combining key areas including orbital mechanics, space vehicles, ground station infrastructure, space avionics and space robotics, the space engineering specialisation at the University of Sydney is the only degree of its kind offered in Australia.

The School offers the following Bachelor of Engineering Honours degree streams:

- Aeronautical
- Aeronautical Space
- Mechanical
- Mechanical Space
- Mechatronic
- Mechatronic Space
- Combined degrees with Science, Commerce, Arts, Medical Science, Project Management and Law.

Bachelor of Engineering Honours (Aeronautical)

Course Overview

Aeronautical engineering is the study of the design, development, manufacture, maintenance and control of machines or vehicles operating in the earth's atmosphere or in outer space. You will develop a complex understanding of the design of a flight vehicle and a knowledge of aerodynamics, propulsion systems, structural design, materials, avionics, stability and control systems.

You will also learn that maintaining and operating a flight vehicle requires an understanding of materials, reliability and maintenance, structural analysis for necessary repairs, together with knowledge of the disciplines within the design process.

The Bachelor of Engineering (Aeronautical) includes the opportunity to undertake practical flying training. Specialisation in areas like helicopter design, structural optimisation and experimental aerodynamics may be part of a thesis in the final year of the course. You will complete work placements and practical simulation using wind tunnel technology and flight simulators, and work on actual aircraft and aircraft components to measure structural and aerodynamic characteristics. The course offers an exchange program with leading aerospace universities in the northern hemisphere.

Course Requirements

To meet requirements for the Bachelor of Engineering Honours (Aeronautical), a candidate must successfully complete 192 credit points, comprising:

1. core and elective units of study relating to the specialist stream, as prescribed by the table of units of study for the stream; and
2. any additional free elective units of study as may be necessary to gain credit to complete the award.

For a standard enrolment plan for Aeronautical Engineering visit cusp.sydney.edu.au/students/view-degree-page/name/BE(Aero)

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Bachelor of Engineering Honours (Aeronautical)			
Candidates for the degree of Bachelor of Engineering Honours (Aeronautical) are required to gain credit for the core units of study set out below. Any additional credit necessary shall be gained by completing additional credit points of elective units of study as recommended by the Faculty, as may be necessary to gain credit for a total of not less than 192 credit points.			
Core units of study			
First year			
AERO1560 **Introduction to Aerospace Engineering**	6	**N** MTRX1701, ENGG1800, MECH1560 *Note: Department permission required for enrolment*	Semester 1
MATH1001 **Differential Calculus**	3	**A** HSC Mathematics Extension 1 **N** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001	Semester 1 Summer Main
MATH1002 **Linear Algebra**	3	**A** HSC Mathematics or MATH1111 **N** MATH1902, MATH1012, MATH1014	Semester 1 Summer Main
ENGG1801 **Engineering Computing**	6		Semester 1 Summer Late
ENGG1803 **Professional Engineering 1**	6	**N** ENGG1061	Semester 1 Semester 2
Normally taken in Semester 1, students in combined degrees are exempt from this unit.			
MATH1003 **Integral Calculus and Modelling**	3	**A** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **N** MATH1013, MATH1903, MATH1907	Semester 2 Summer Main
MATH1005 **Statistics**	3	**A** HSC Mathematics **N** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021	Semester 2 Summer Main Winter Main
ENGG1802 **Engineering Mechanics**	6		Semester 2 Summer Main
AERO1400 **Intro to Aircraft Construction & Design**	6	**A** Some basic skills with engineering workshop hand tools is desirable. *Note: Department permission required for enrolment* *Department permission required for enrollment.*	Semester 2
Students in combined degrees are exempt from this unit.			
AMME1362 **Materials 1**	6	**N** AMME2302, CIVL2110	Semester 2
Second year			
MATH2067 **DEs and Vector Calculus for Engineers**	6	**P** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **N** MATH2901, MATH2961, MATH2005, MATH2965, MATH2001, MATH2905, MATH2061, MATH2065	Semester 1
Students in the combined BEHons/BSc degree program can take both MATH2061 and MATH2065 as an alternative.			
AMME2700 **Instrumentation**	6	**A** ENGG1801. Programming Skills, 1st Year maths skills, familiarity with fundamental Aerospace concepts. **P** AERO1560 OR MECH1560 OR MTRX1701 OR ENGG1800	Semester 1
AMME2301 **Mechanics of Solids**	6	**P** ENGG1802, MATH1001, MATH1002, MATH1003	Semester 2
AMME2500 **Engineering Dynamics**	6	**P** ENGG1802 and (MATH1001 or MATH1901) and (MATH1002 or MATH1902)	Semester 1
BE/BSc students can enrol in PHYS2011, PHYS2012 as acceptable alternatives or advanced equivalent.			
AMME2261 **Fluid Mechanics 1**	6	**A** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **N** AMME2200	Semester 1
AMME2262 **Thermal Engineering 1**	6	**A** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **N** AMME2200	Semester 2
MECH2400 **Mechanical Design 1**	6	**A** ENGG1801 and ENGG1802, HSC Maths and Physics	Semester 2
AERO2703 **Aircraft Performance and Operations**	6	**A** AERO1560 OR ENGG1800. Familiarity with fundamental Aerospace concepts. **P** (MATH1001 or MATH1901), (MATH1002 or MATH1902), (MATH1003 or MATH1903), ENGG1801	Semester 2
Combined degree students are exempt from this unit.			

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Third year			
AERO3360 **Aerospace Structures 1**	6	**P** AMME2301	Semester 1
AMME3500 **System Dynamics and Control**	6	**P** ((MATH2061 or MATH2961) and (MATH2065 or MATH2965)) or MATH2067	Semester 1
AERO3460 **Aerospace Design 1**	6	**P** AMME2301 and MECH2400	Semester 1
AERO3260 **Aerodynamics 1**	6	**A** General conservation equations applied to fluid flow; Fundamental elements of potential flow; Vorticity and its effect on ideal flow; Basic mathematical skills required for plotting and graphing data; Linear algebra for solution of simultaneous linear equations; Fourier series; Complex numbers and complex functions. **P** (AMME2200 OR AMME2261) AND (MATH2061 OR MATH2067 OR MATH2961)	Semester 2
AERO3261 **Propulsion**	6	**A** Good knowledge of fluid dynamics and thermodynamics **P** AMME2200 OR (AMME2261 AND AMME2262)	Semester 2
AERO3560 **Flight Mechanics 1**	6	**A** This Unit of Study builds on basic mechanics and aerodynamics material covered in previous Units and focuses it towards the analysis and understanding of aircraft flight mechanics. It is expected that students have satisfactorily completed the following material: ENGG1802 Engineering Mechanics: Forces, moments, equilibrium, momentum, energy, linear and angular motion. AMME2500 Engineering Dynamics 1: Mechanisms, kinematics, frames of reference, mass and inertia, dynamics. If you struggled to pass MECH2500 and/or ENGG1802, you should spend some time revising the material of those Units of Study early in the semester. **P** AMME2500 **C** AMME3500	Semester 1
AERO3465 **Aerospace Design 2**	6	**A** AERO1400 and AMME2302. **P** AMME2301 and MECH2400	Semester 2
Students in combined degrees are exempt from this unit.			
Fourth year			
AERO4460 **Aerospace Design 3**	6	**A** AERO1400, AERO2703 and AERO3465 **P** AERO3260 AND AERO3261 AND AERO3360 AND AERO3460	Semester 1
ENGG4000 **Practical Experience**		**P** 36 Credit Points of Senior Units *Students should have completed three years of their BE program before enrolling in this unit.*	Semester 1 Semester 2
Students should have completed three years of their BEHons program before enrolling in this unit.			
Students must enrol in 12cp of Thesis units			
AMME4111 **Honours Thesis A**	6	**P** 36 credits of 3rd year units of study. **N** AMME4010, AMME4121, AMME4122 *Note: Department permission required for enrolment* *Honours Thesis A is only available to students with an HWAM of 65 or over. HWAM is a weighted average based on all 2000, 3000 and 4000 level units completed prior to enrolment in this unit. Prospective students in Honours Thesis A are expected to have consulted with supervisors and selected a topic of interest at the end of third year, guided by the advertised list of suggested thesis topics and supervisors. Availability of topics is limited and students should undertake to speak with prospective supervisors as soon as possible. Students who are unable to secure a supervisor and topic will be allocated a supervisor by the unit coordinator. Alternatively, students may do a thesis with a supervisor in industry or in another university department. In this case, the student must also find a second supervisor within the School of AMME.*	Semester 1 Semester 2
Normally taken in Semester 1			
AMME4112 **Honours Thesis B**	6	**P** 36 credits of 3rd year units of study and WAM 65 or over **N** AMME4010, AMME4122, AMME4121 *Note: Department permission required for enrolment* *HWAM of 65 or greater required for enrolment. HWAM is the weighted average of all 2000, 3000 and 4000 level units completed prior to enrolment in this unit.*	Semester 1 Semester 2
Normally taken in Semester 2			

Acceptable alternative units of study

BE/BSc students can enrol in PHYS2011, PHYS2012 or advanced equivalent, as acceptable alternative to AMME2500.

Most units of study offered by the Faculty of Science shown in the tables can be replaced by an equivalent advanced level unit, subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing advanced options should seek advice from their department before enrolling.

Students undertaking Study Abroad in a particular year of their degree must enrol in the appropriate International Exchange Program units of study as an alternative to a semester's standard units.

Resolutions of the Faculty of Engineering and Information Technologies relating to this table:

BEHons (Aeronautical)

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete 30 credit points of recommended elective units of study for Aeronautical Engineering and 6 credits points of free elective units of study. A minimum of 192 credit points is required to be eligible for the award of the degree of BE (Aeronautical).

BEHons (Aeronautical)/BSc or BCom or BMedSc or BPM

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete at least 12 credit points of recommended elective units of study for Aeronautical Engineering, and 96 credit points of units of study given by the Faculty of Science for the BE/BSc or BE/BMedSc; or the Business School for the BE/BCom or from the core units table for the BPM. A minimum of 240 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies and the faculty in which they are undertaking the combined degree.

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
BEHons (Aeronautical)/BA			
In addition to gaining credit for the units of study set out in this table, candidates are required to complete at least 18 credit points of recommended elective units of study for Aeronautical Engineering, and 84 credit points of units of study given by the Faculty of Arts and Social Sciences for the BE/BA. A minimum of 240 credit points is required to be eligible for the combined degree. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies and the faculty in which they are undertaking the combined degree.			
BEHons (Aeronautical)/LLB			
In addition to gaining credit for the core units of study set out in this table, candidates are required to complete at least 12 credit points of recommended elective units of study for Aeronautical Engineering and 144 credit points of units of study given by the Faculty of Law for the BE/LLB. A minimum of 288 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies and the Faculty of Law.			
Recommended elective units of study			
AERO3660 **Aerospace Management**	6		Semester 2
AERO4206 **Rotary Wing Aircraft**	6	**A** concepts from 3rd Year Aerodynamics and Flight Mechanics will be applied to Rotary Wing Vehicles in this unit. **P** AERO3260	Semester 2
AERO4260 **Aerodynamics 2**	6	**P** AMME2200	Semester 2
AERO4360 **Aerospace Structures 2**	6	**A** AERO3465 **P** AERO3360	Semester 1
AERO4560 **Flight Mechanics 2**	6	**A** AMME2500 develops the basic principles of engineering mechanics and system dynamics that underpin this course. AERO3560 Flight Mechanics 1 develops the specifics of aircraft flight dynamics and stability. AMME3500 Systems control covers basic system theory and control system synthesis techniques. **P** AERO3560 and AMME3500	Semester 1
AERO5200 **Advanced Aerodynamics**	6	**A** BE in the area of Aerospace Engineering or related Engineering field. **P** AERO5210 OR AERO9260 OR AERO3260 *Note: Department permission required for enrolment*	Semester 1
AERO5400 **Advanced Aircraft Design Analysis**	6	**A** (AERO1400, AERO3260, AERO3261, AERO3360, AERO3465, AERO3560, AERO4460) or equivalent. **P** AERO3460 OR AERO5410 OR AERO9460 **N** : AERO4491	Semester 2
AERO5500 **Flight Mechanics Test and Evaluation Adv**	6	**A** BE in the area of Aerospace Engineering or related Engineering field. **P** AERO5510 OR AERO9560 OR AERO3560	Semester 2
AERO5520 **Aircraft Avionics and Systems** *This unit of study is not available in 2015*	6	**P** AERO5510 or AERO3560 *Note: Department permission required for enrolment*	Semester 2
AMME5202 **Advanced Computational Fluid Dynamics**	6	**A** Partial differential equations; Finite difference methods;Taylor series; Basic fluid mechanics including pressure, velocity, boundary layers, separated and recirculating flows. Basic computer programming skills.	Semester 1
AMME5510 **Vibration and Acoustics**	6	**A** (AMME2301 OR AMME9301) AND AMME2200 AND (AMME2500 OR AMME9500) *Note: Department permission required for enrolment*	Semester 2
Additional Electives			
Students can select from other elective units offered within the University that are approved by the Head of the School of Aerospace, Mechanical and Mechatronic Engineering.			
ENGG1000 **History and Philosophy of Engineering**	6		Semester 1 Semester 2
AMME2000 **Engineering Analysis**	6	**A** (MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) and ENGG1801. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. *Note: Department permission required for enrolment*	Semester 1
Note			
Choice of electives as shown in the above table will depend on subject availability, timetabling and prerequisite conditions.			

For a standard enrolment plan for Aeronautical Engineering visit cusp.sydney.edu.au/students/view-degree-page/name/BE(Aero)

Unit of Study Descriptions

Bachelor of Engineering Honours (Aeronautical)

Candidates for the degree of Bachelor of Engineering Honours (Aeronautical) are required to gain credit for the core units of study set out below. Any additional credit necessary shall be gained by completing additional credit points of elective units of study as recommended by the Faculty, as may be necessary to gain credit for a total of not less than 192 credit points.

Core units of study

First year

AERO1560
Introduction to Aerospace Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Workshop 3 hrs/week. **Prohibitions:** MTRX1701, ENGG1800, MECH1560 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This Unit introduces students to the role of professional aerospace engineers, along with the development of fundamental engineering knowledge and skills for aerospace vehicle design, analysis performance and operation. Students will learn through experience, to develop professional skills in research, interpretation, communication, and presentation of information relating to aerospace engineering. Expected learning includes: introduction to lateral thinking concepts; glossary of aerospace vehicle components and terminology; an introduction to the multiple disciplines related to aerospace engineering, such as aerodynamics, aircraft and spacecraft performance, mechanics of flight, aerospace structures, materials and propulsion systems; how the various disciplines are integrated into the design and development of flight platform systems; the operating characteristics of modern flight vehicles, their uses and limitations; modern developments and future trends in aerospace; the limitations of the aerospace environment; teamwork; and resource management.

Significantly, professional enhancement is introduced through the development of basic hands-on workshop skills. These practical skills enable students to have a better appreciation of the hardware that they are expected to apply their engineering knowledge to, during their aerospace engineering profession. Experiential learning is facilitated working with machine tools and hand tools in a supervised workshop environment, to develop fundamentals of practical aerospace vehicle component manufacture, construction, servicing and repair.

Workshop Technology: On overview is provided of a range of manufacturing processes, with hands-on experience provided. Workshop Technology practical work is undertaken in: (a) Hand tools; (b) Machining; (c) Welding; and (d) Fibreglassing. Safety requirements: All students are required to provide their own personal protective equipment (PPE) and comply with the safety regulations. Students who fail to do this will not be permitted to enter the workshops. In particular, approved industrial footwear must be worn, and long hair must be protected by a hair net. Safety glasses must be worn at all times.

MATH1001
Differential Calculus

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001 **Assumed knowledge:** HSC Mathematics Extension 1 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1001 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study looks at complex numbers, functions of a single variable, limits and continuity, vector functions and functions of two variables. Differential calculus is extended to functions of two variables. Taylor's theorem as a higher order mean value theorem.

Textbooks
As set out in the Junior Mathematics Handbook.

MATH1002
Linear Algebra

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1902, MATH1012, MATH1014 **Assumed knowledge:** HSC Mathematics or MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1002 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study introduces vectors and vector algebra, linear algebra including solutions of linear systems, matrices, determinants, eigenvalues and eigenvectors.

Textbooks
As set out in the Junior Mathematics Handbook

ENGG1801
Engineering Computing

Credit points: 6 **Session:** Semester 1, Summer Late **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will introduce students to fundamental principles of programming. The language used will be Matlab but the principles taught are readily portable to other languages like C and Java. The unit material will be presented in a manner which will help students to draw a connection between programming constructs and real engineering applications. The unit will use engineering inspired case-studies : especially from Civil, Chemical, Aerospace and Mechanical streams, to motivate new material. There will be a major project which uses programming to solve a real world engineering problem. The extensive Matlab library for visualization will also be introduced. Matlab will cover two-thirds of the unit. The remaining one-third will be devoted to the use of Excel in engineering scenarios. Furthermore, cross integration between Matlab and Excel will also be highlighted.

ENGG1803
Professional Engineering 1

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prohibitions:** ENGG1061 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Professional Engineering 1 is an introductory Unit of Study within the Faculty of Engineering. The semester 1 course is aimed at students from the School of Aerospace, Mechanical and Mechatronic Engineering. It seeks to introduce newly admitted undergraduates to general principles of professional engineering practice, a range of contemporary professional engineering issues, plus outline skills related to academic study within an engineering environment. The subject is structured around a team based design and build project, in which students apply the professional engineering concepts they are learning to an engineering project. Professional engineering topics to be covered include: accessing information, teamwork, creativity, leadership, written and oral communication, project management, problem solving, ethics, liability, work health and safety and environmental issues.

Normally taken in Semester 1, students in combined degrees are exempt from this unit.

MATH1003
Integral Calculus and Modelling

Credit points: 3 **Session:** Semester 2, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1013, MATH1903, MATH1907 **Assumed knowledge:** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1003 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.This unit of study first develops the idea of the definite integral from Riemann sums, leading to the Fundamental Theorem of Calculus. Various techniques of integration are considered, such as integration by parts.The second part is an introduction to the use of first and second order differential equations to model a variety of scientific phenomena.

Textbooks
As set out in the Junior Mathematics Handbook

MATH1005
Statistics

Credit points: 3 **Session:** Semester 2, Summer Main, Winter Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021 **Assumed knowledge:** HSC Mathematics **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1005 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit offers a comprehensive introduction to data analysis, probability, sampling, and inference including t-tests, confidence intervals and chi-squared goodness of fit tests.

Textbooks
As set out in the Junior Mathematics Handbook

ENGG1802
Engineering Mechanics

Credit points: 6 **Session:** Semester 2, Summer Main **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit aims to provide students with an understanding of and competence in solving statics and introductory dynamics problems in engineering. Tutorial sessions will help students to improve their group work and problem solving skills, and gain competency in extracting a simplified version of a problem from a complex situation. Emphasis is placed on the ability to work in 3D as well as 2D, including the 2D and 3D visualization of structures and structural components, and the vectorial 2D and 3D representations of spatial points, forces and moments. Introduction to kinematics and dynamics topics includes position, velocity and acceleration of a point; relative motion, force and acceleration, momentum, collisions and energy methods.

AERO1400
Intro to Aircraft Construction & Design

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2hrs/week and Workshop 3 hrs/week. **Assumed knowledge:** Some basic skills with engineering workshop hand tools is desirable. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

The study towards BE(Aeronautical) involves learning about the Design, Analysis, Flight, and Operation of Aircraft and other Flight Platforms. This unit facilitates the training towards becoming professional aeronautical engineers through a globally-unique experiential-learning opportunity to provide a strong background familiarity with aircraft hardware. This unit is designed to educate and facilitate the learning of aircraft design, basic aircraft construction techniques, the operation of light aircraft and the registration and regulations relating to light aircraft. In addition to hands-on skills on the construction phase, this unit facilitates learning in motivations for unique aircraft design, aircraft aerodynamics, flight mechanics, structural aspects and other design-related issues. Teamwork plays a very important role in this unit; the ability to work with peers and supervising staff is an invaluable skill sought after by employers of engineers.

Throughout the semester, students will be actively participating in the construction of a light aircraft, and of aircraft structural components. The aircraft is to be constructed under current Australian Civil Aviation Regulations so that students will gain an insight into all aspects of the process. By being a part of the construction team, students will also experience the organisational requirements necessary to successfully complete a complex engineering project. The aircraft construction workshop component is complemented with lectures, homework, research and assignments to further enhance the learning experience on aircraft. The final outcome will be that students gain a good foundation of: aircraft design and analyses methods; innovative methods of construction; techniques for selecting, sizing and stressing components; regulatory requirements for certification; off-design requirements; construction tolerances; and team-work requirements in undertaking complex engineering projects.

Students in combined degrees are exempt from this unit.

AMME1362
Materials 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/semester. **Prohibitions:** AMME2302, CIVL2110 **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

AMME1362 is an introductory unit in engineering materials. The unit aims to develop students' understanding of the structures, mechanical properties and manufacture of a range of engineering materials as well as how the mechanical properties relate to microstructure and forming and treatment methods. The unit has no prerequisite subject and is therefore intended for those with little or no previous background in engineering materials. However the unit does require students to take a significant degree of independent responsibility for developing their own background knowledge of materials and their properties. The electrical, magnetic, thermal and optical properties of materials are a critical need-to-know area where students are expected to do some independent study.

Second year

MATH2067
DEs and Vector Calculus for Engineers

Credit points: 6 **Session:** Semester 1 **Classes:** Three 1 hour lectures, one 1 hour tutorial and one 1 hour practice class per week. **Prerequisites:** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **Prohibitions:** MATH2901, MATH2961, MATH2005, MATH2965, MATH2001, MATH2905, MATH2061, MATH2065 **Assessment:** One 2 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH2067 starts by introducing students to solution techniques of ordinary and partial differential equations (ODEs and PDEs) relevant to the engineering disciplines: it provides a basic grounding in these techniques to enable students to build on the concepts in their subsequent engineering classes. The main topics are Fourier series, second order ODEs, including inhomogeneous equations and Laplace transforms, and second order PDEs in rectangular domains (solution by separation of variables).

The unit moves on to topics from vector calculus, including vector-valued functions (parametrised curves and surfaces; vector fields; div, grad and curl; gradient fields and potential functions), line integrals (arc length; work; path-independent integrals and conservative fields; flux across a curve), iterated integrals (double and triple integrals; polar, cylindrical and spherical coordinates; areas, volumes and mass; Green's Theorem), flux integrals (flow through a surface; flux integrals through a surface defined by a function of two variables, though cylinders, spheres and parametrised surfaces), Gauss's Divergence Theorem and Stokes' Theorem.

Students in the combined BEHons/BSc degree program can take both MATH2061 and MATH2065 as an alternative.

AMME2700
Instrumentation

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs. **Prerequisites:** AERO1560 OR MECH1560 OR MTRX1701 OR ENGG1800 **Assumed knowledge:** ENGG1801. Programming Skills, 1st Year maths skills, familiarity with fundamental Aerospace concepts. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to develop in students an understanding of the engineering measurements and instrumentation systems. The students will acquire an ability to make accurate and meaningful measurements. It will cover the general areas of electrical circuits and mechanical/electronic instrumentation for strain, force, pressure, moment, torque, displacement, velocity, acceleration, temperature and so on.

AMME2301
Mechanics of Solids

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** ENGG1802, MATH1001, MATH1002, MATH1003 **Assessment:** Through semester assessment (35%) Final Exam (65%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Equilibrium of deformable structures; basic concept of deformation compatibility; stress and strain in bars, beams and their structures subjected to tension, compression, bending, torsion and combined loading; statically determinate and indeterminate structures; energy methods for bar and beam structures; simple buckling; simple vibration; deformation of simple frames and cell box beams; simple two-dimensional stress and Morh's circle; problem-based applications in aerospace, mechanical and biomedical engineering.

AMME2500
Engineering Dynamics

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs **Prerequisites:** ENGG1802 and (MATH1001 or MATH1901) and (MATH1002 or MATH1902) **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to teach: Dynamics of Rigid Bodies: Analysis of Planar mechanisms; Kinematics of rigid bodies; Kinetics of rigid bodies. Students will also develop their skills in: how to model and analyse dynamic systems and the application of theory to real systems through practical/laboratory sessions.

At the end of this unit students will have developed skills in modelling and analysing planar mechanisms and rigid body dynamic systems.

Course content will include planar mechanisms, linkages, mobility; instant centres of rotation, Kennedy's theorem; velocity and acceleration polygons; kinematics of rigid bodies, frames of reference, velocity and acceleration, rotating frame of reference, relative velocity and acceleration, gyroscopic acceleration; kinetics of rigid bodies, linear momentum and Euler's first law; angular momentum and Euler's second law; centre of mass; moments of inertia, parallel axis and parallel plane theorems, principal axes and principal moments of inertia, rotation about an axis; impulse and momentum; work and energy, kinetic and potential energies; applications to orbital and gyroscopic motion; introduction to Lagrangian methods.

BE/BSc students can enrol in PHYS2011, PHYS2012 as acceptable alternatives or advanced equivalent.

AMME2261
Fluid Mechanics 1

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs/semester. **Prohibitions:** AMME2200 **Assumed knowledge:** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit covers the fundamentals of fluid statics and fluid dynamics. At the end of this unit students will have: an understanding of the basic equations governing the statics and dynamics of fluids; the ability to analyze and determine the forces applied by a static fluid; the ability to analyse fluids in motion. The course will cover both inviscid and viscous fluid flow. The course will introduce the relevant parameters for fluid flow in internal engineering systems such as pipes and pumps and external systems such as flow over wings and airfoils. Course content will cover the basic concepts such as viscosity, density, continuum, pressure, force, buoyancy and acceleration; and more detailed methods including continuity, conservation of momentum, streamlines and potential flow theory, Bernoulli equation, Euler equation, Navier-Stokes equation. Experiments will introduce flow measuring devices and flow observation.

AMME2262
Thermal Engineering 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs. **Prohibitions:** AMME2200 **Assumed knowledge:** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to teach the basic laws of thermodynamics and heat transfer. At the end of this unit students will have: an understanding of the basic laws of thermodynamics and heat transfer; The ability to analyze the thermodynamics of a simple open or closed engineering system. The basic knowledge to analyse and design 1D thermal circuits. Course content will include concepts of heat and work, properties of substances, first law of thermodynamics, control mass and control volume analysis, thermal efficiency, entropy, second law of thermodynamics, reversible and irreversible processes, isentropic efficiency, power and refrigeration cycles, heat transfer by conduction, convection and radiation, 1D thermal circuits and transient heat transfer.

MECH2400
Mechanical Design 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 1 hr/week. **Assumed knowledge:** ENGG1801 and ENGG1802, HSC Maths and Physics **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Aim: For students to experience a realistic the design process and to develop good engineering skills.

Course Objectives: To develop an understanding of:

1. the need for and use of standard drawings in the communication and definition of parts and assemblies,
2. Efficient use of a CAD package
3. creativity,
4. the design process from initial idea to finished product
5. Methods used to analyse designs
6. standard components.

AERO2703
Aircraft Performance and Operations

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 1 hr/week; Tutorial 3 hrs/week. **Prerequisites:** (MATH1001 or MATH1901), (MATH1002 or MATH1902), (MATH1003 or MATH1903), ENGG1801 **Assumed knowledge:** AERO1560 OR ENGG1800. Familiarity with fundamental Aerospace concepts. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to develop in students an understanding of the fundamental concepts involved in the operation of aircraft. The students will acquire an ability to make accurate and meaningful measurements of take-off, climb,cruise, turn, descent and landing performance. Students will be shown methods to optimise performance for specific missions. It will also cover modern issues such as airport congestion, noise restrictions, aviation certification requirements for the use of different aircraft categories and novel methods solving these problems.

Combined degree students are exempt from this unit.

Third year

AERO3360
Aerospace Structures 1

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** AMME2301 **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to develop a student's understanding of the theoretical basis of advanced aerospace structural analysis; and introduce students to the solution of real-world aircraft structural problems. This UoS will develop the following attributes: An understanding of the derivation of the fundamental equations of elasticity and their application in certain analytical problems; An understanding of plate theory and the ability to use this to obtain analytical solutions for plate bending and buckling problems; An understanding of energy-method to develop a deeper appreciation for the complexities of designing solution techniques for structural problems; An understanding of the basic principals behind stressed-skin aircraft construction and the practical analysis of typical aircraft components, including the limitations of such techniques.

At the end of this unit students will have an understanding of: 2-D and 3-D elasticity: general equations and solution techniques; Energy methods in structural analysis, including the principles of virtual work and total potential and complimentary energies; Fundamental theory of plates, including in-plane and bending loads as well as buckling and shear instabilities; Solution techniques for plate problems including: Navier solutions for rectangular plates; Combined bending and in-plane loading problems; Energy methods for plate-bending; and Plate buckling for compression and shear loadings; Bending of beams with unsymmetrical cross-sections; Basic principals and theory of stressed-skin structural analysis; Determination of direct stresses and shear flows in arbitrary thin-walled beams under arbitrary loading conditions including: Unsymmetrical sections, Open and closed sections, Single and multi-cell closed sections, Tapered sections, Continuous and idealized sections; The analysis of common aircraft components including fuselages, wings, skin-panels, stringers, ribs, frames and cut-outs; The effects of end constraints and shear-lag on the solutions developed as well as an overall appreciation of the limitations of the solution methods presented.

AMME3500
System Dynamics and Control

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week. **Prerequisites:** ((MATH2061 or MATH2961) and (MATH2065 or MATH2965)) or MATH2067 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to allow students to develop an understanding of methods for modeling and controlling linear, time-invariant systems. Techniques examined will include the use of differential equations and frequency domain approaches to modeling of systems. This will allow students to examine the response of a system to changing inputs and to examine the influence of external stimuli such as disturbances on system behaviour. Students will also gain an understanding of how the responses of these mechanical systems can be altered to meet desired specifications and why this is important in many engineering problem domains.

The study of control systems engineering is of fundamental importance to most engineering disciplines, including Electrical, Mechanical, Mechatronic and Aerospace Engineering. Control systems are found in a broad range of applications within these disciplines, from aircraft and spacecraft to robots, automobiles, computers and process control systems. The concepts taught in this course introduce students to the mathematical foundations behind the modelling and control of linear, time-invariant dynamic systems. In particular, topics addressed in this course will include:

1. Techniques for modelling mechanical systems and understanding their response to control inputs and disturbances. This will include the use of differential equations and frequency domain methods as well as tools such as Root Locus and Bode plots.

2. Representation of systems in a feedback control system as well as techniques for determining what desired system performance specifications are achievable, practical and important when the system is under control

3. Theoretical and practical techniques that help engineers in designing control systems, and an examination of which technique is best in solving a given problem.

AERO3460
Aerospace Design 1

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Project Work - in class 2 hrs/week; Project Work - own time 4 hrs/week. **Prerequisites:** AMME2301 and MECH2400 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to introduce students to the theory and practice of aircraft component design. In doing so it will emphasize all the considerations, trade-offs and decisions inherent in this process and thus enable students to gain an understanding of why aircraft structures are designed in the way they are with respect to aircraft operational, certification, manufacturing and cost considerations. At the end of this unit students will be able to understand the design process, especially as it applies to aircraft individual component design; Have a familiarity with some of the standard industry practices for component design; An increasing familiarity with typical aerospace analysis techniques along with the primary failure modes that need to be considered; An understanding of the importance of different failure modes for different components and how these relate to load-conditions; a farmilarity with the operating environment that must be considered when designing components; and understanding of some off the legal and ethical requirements of aircraft design engineers to give a basic understanding of the regulatory framework in which aircraft design is conducted.

AERO3260
Aerodynamics 1

Credit points: 6 **Session:** Semester 2 **Classes:** Laboratory 3 hrs/week; Lecture 3 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** (AMME2200 OR AMME2261) AND (MATH2061 OR MATH2067 OR MATH2961) **Assumed knowledge:** General conservation equations applied to fluid flow; Fundamental elements of potential flow; Vorticity and its effect on ideal flow; Basic mathematical skills required for plotting and graphing data; Linear algebra for solution of simultaneous linear equations; Fourier series; Complex numbers and complex functions. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This UoS should prepare students to be able to undertake aerodynamic performance calculations for industry design situations.

The unit aims to develop a knowledge and appreciation of the complex behaviour of airflow in the case of two dimensional aerofoil sections and three dimensional wings; To encourage hands-on experimentation with wind-tunnel tests to allow an understanding of these concepts and their range of applicability. To understand the limitations of linearised theory and the effects of unsteady flow.

AERO3261
Propulsion

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 1 hr/week; Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** AMME2200 OR (AMME2261 AND AMME2262) **Assumed knowledge:** Good knowledge of fluid dynamics and thermodynamics **Assessment:** Through semester assessment (55%) Final Exam (45%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This UoS teaches the students the techniques used to propel aircraft. The students will learn to analyse various propulsion systems in use - propellers, gas turbines, etc.

The topics covered include:

Propulsion unit requirements for subsonic and supersonic flight; thrust components, efficiencies, additive drag of intakes. Piston engine components and operation. Propeller theory. Operation, components and cycle analysis of gas turbine engines; turbojets; turbofans; turboprops; ramjets. Components: compressor; fan; burner; turbine; nozzle. Efficiency of components; Off-design considerations. Future directions; minimisation of noise and pollution; scram-jets; hybrid engines.

AERO3560
Flight Mechanics 1

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/semester. **Prerequisites:** AMME2500 **Corequisites:** AMME3500 **Assumed knowledge:** This Unit of Study builds on basic mechanics and aerodynamics material covered in previous Units and focuses it towards the analysis and understanding of aircraft flight mechanics. It is expected that students have satisfactorily completed the following material: ENGG1802 Engineering Mechanics: Forces, moments, equilibrium, momentum, energy, linear and angular motion. AMME2500 Engineering Dynamics 1: Mechanisms, kinematics, frames of reference, mass and inertia, dynamics. If you struggled to pass MECH2500 and/or ENGG1802, you should spend some time revising the material of those Units of Study early in the semester. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to develop an understanding of aircraft longitudinal equilibrium, static stability, dynamic stability and response. Students will develop an understanding of the importance and significance of flight stability, will gain skills in dynamic system analysis and will learn mathematical tools used for prediction of aircraft flight behaviour. Students will gain skills in problem solving in the area of flight vehicle motion, and learn the fundamentals of flight simulation.

At the end of this unit students will be able to understand: aircraft flight conditions and equilibrium; the effects of aerodynamic and propulsive controls on equilibrium conditions; the significance of flight stability and its impact of aircraft operations and pilot workload; the meaning of aerodynamic stability derivatives and their sources; the effects of aerodynamic derivatives on flight stability; the impact of flight stability and trim on all atmospheric flight vehicles. Students will also be able to model aircraft flight characteristics using computational techniques and analyse the aircraft equations of rigid-body motion and to extract stability characteristics.

Unit content will include static longitudinal aircraft stability: origin of symmetric forces and moments; static and manoeuvring longitudinal stability, equilibrium and control of rigid aircraft; aerodynamic load effects of wings, stabilisers, fuselages and power plants; trailing edge aerodynamic controls; trimmed equilibrium condition; static margin; effect on static stability of free and reversible controls.

AERO3465
Aerospace Design 2

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 4 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** AMME2301 and MECH2400 **Assumed knowledge:** AERO1400 and AMME2302. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to develop an understanding of the aerospace industry procedures for design, analysis, and testing of aircraft and aerospace vehicle components. It provides a Design-Build-Test experience by putting into practice, learning outcomes from this and other previously completed UoS, through working on a small structure which is representative of a typical light metal aircraft. Students will be introduced to typical metallic and composite materials and structures for aerospace vehicles. The unit also provides an introduction to fatigue and damaged tolerance analysis of metallic aircraft structures. Experiential learning opportunities are provided to acquire skills and knowledge in structural design, analyses, testing methods, procedures, techniques, and equipment.

On satisfactory completion of this unit students will have gained practical skills relevant to working on typical modern aircraft and aerospace vehicle components. They will learn from methods, techniques, and experiences from the modern aerospace industry. Experiential learning is enhanced through verifying analyses with actual testing of fabricated component, and the experience of a full design-build-test cycle of a typical aerospace structural component. Subject areas covered will include design methods, internal loads calculations, stress analysis, design for manufacture, joints and fasteners, test procedures, fatigue and damage tolerance, composites, and the art of design.

Students in combined degrees are exempt from this unit.

Fourth year

AERO4460
Aerospace Design 3

Credit points: 6 **Session:** Semester 1 **Classes:** Project Work - in class 3 hrs/week; Lecture 2 hrs/week; Project Work - own time 5 hrs/week. **Prerequisites:** AERO3260 AND AERO3261 AND AERO3360 AND AERO3460 **Assumed knowledge:** AERO1400, AERO2703 and AERO3465 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to develop an understanding of the application of design to the modern aerospace industry. Students will gain an overview of how to manage a design team and will also gain skills in carrying out detailed design problems. Course content will include: Design requirements; Sources of information for aircraft design; Configuration design: performance, weight and balance, propulsion; Aerodynamic design: lift, drag and control; Structural design: loads, materials; Philosophies of design and analysis; System design: requirements and specification; System design procedures; systems integration.

ENGG4000
Practical Experience

Session: Semester 1, Semester 2 **Classes:** Practical Experience, **Prerequisites:** 36 Credit Points of Senior Units **Assessment:** Through semester assessment (100%) **Mode of delivery:** Professional practice

Note: Students should have completed three years of their BE program before enrolling in this unit.

The aim of this unit is to give students exposure to work in an engineering organisation and gain some professional experience; to enhance a student's abilities and experience in report writing; to encourage self-evaluation in the context of applying their theoretical knowledge to real industry practise. Students will gain a better appreciation of the role of engineers in the workplace. The assessment will enhance the student's ability to present structured observations and reflections in the mode of a formal written report.

Each student is required to gain exposure to professional engineering practice and environments and to submit a satisfactory written report of his or her work. The report will include the requirement of a detail logbook recording tasks given and timelines set for achieving these. Self-evaluation of a student's personal level of knowledge and its applicability to the workplace is a major component of the reporting. Normally 12 weeks (60 days) of practical work experience is required, though the Faculty may accept alternatives that are judged as equivalent. Students are strongly encouraged to undertake their work experience in the break between Year 3 and 4 and definitely prior to commencing their final semester of study, however any engineering work taken after completing 28 credit points of 3rd year units of study may be accepted for the requirements of this unit. The University Careers and Appointments Service is available to assist students to obtain suitable employment. This unit of study is a core unit of study in all BE programs and must be passed in order to graduate from those programs.

Students should have completed three years of their BEHons program before enrolling in this unit.

Students must enrol in 12cp of Thesis units

AMME4111
Honours Thesis A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research 10 hrs/week. **Prerequisites:** 36 credits of 3rd year units of study. **Prohibitions:** AMME4010, AMME4121, AMME4122 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: Honours Thesis A is only available to students with an HWAM of 65 or over. HWAM is a weighted average based on all 2000, 3000 and 4000 level units completed prior to enrolment in this unit. Prospective students in Honours Thesis A are expected to have consulted with supervisors and selected a topic of interest at the end of third year, guided by the advertised list of suggested thesis topics and supervisors. Availability of topics is limited and students should undertake to speak with prospective supervisors as soon as possible. Students who are unable to secure a supervisor and topic will be allocated a supervisor by the unit coordinator. Alternatively, students may do a thesis with a supervisor in industry or in another university department. In this case, the student must also find a second supervisor within the School of AMME.

The fourth year honours thesis aims to provide students with the opportunity to carry out a defined piece of independent research in a setting and in a manner that fosters the development of engineering research skills. These skills include the capacity to define a research question, showing how it relates to existing knowledge, identifying the tools needed to investigate the question, carrying out the research in a systematic way, analysing the results obtained and presenting the outcomes in a report that is clear, coherent and logically structured. Honours thesis is undertaken across two semesters of enrolment, in two successive Units of Study of 6 credits points each. Honours Thesis A covers first steps of thesis research starting with development of research proposal. Thesis B covers the second of stage writing up and presenting the research results.

Students are asked to write a thesis based on a research project, which is very often related to some aspect of a staff member's research interests. Some projects will be experimental in nature, others may involve computer-based simulation, feasibility studies or the design, construction and testing of equipment. Direction of thesis work may be determined by the supervisor or be of an original nature, but in either case the student is responsible for the execution of the practical work and the general layout and content of the thesis itself. The final thesis must be the student's individual work, although research is sometimes conducted in the framework of a group project shared with others. Students undertaking research on this basis will need to take care in ensuring the individual quality of their own research work and the final thesis submission. The thesis will be judged on the extent and quality of the student's original work and particularly how critical, perceptive and constructive he or she has been in assessing his/her work and that of others. Students will also be required to present the results of their findings to their peers and supervisors as part of a seminar program.

It is not expected that a thesis at this level will represent a significant contribution to new knowledge; nor is it expected that theses will resolve great intellectual problems. The timeframe available for the thesis is simply too short to permit students to tackle complex or difficult problems. Indeed, a key aim of the thesis is to specify a research topic that arouses sufficient intellectual curiosity, and presents an appropriate range and diversity of technical and conceptual challenges, while remaining manageable and allowing achievable outcomes within the time and resources available. It is important that the topic be of sufficient scope and complexity to allow a student to learn their craft and demonstrate their research skills. Equally imperative is that the task not be so demanding as to elude completion.

Normally taken in Semester 1

AMME4112
Honours Thesis B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research 10 hrs/week. **Prerequisites:** 36 credits of 3rd year units of study and WAM 65 or over **Prohibitions:** AMME4010, AMME4122, AMME4121 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: HWAM of 65 or greater required for enrolment. HWAM is the weighted average of all 2000, 3000 and 4000 level units completed prior to enrolment in this unit.

The fourth year honours thesis aims to provide students with the opportunity to carry out a defined piece of independent research or design work in a setting and in a manner that fosters the development of engineering skills in research or design. These skills include the capacity to define a research or design question, showing how it relates to existing knowledge, identifying the tools needed to investigate the question, carrying out the research or design in a systematic way, analysing the results obtained and presenting the outcomes in a report that is clear, coherent and logically structured. Honours thesis is undertaken across two semesters of enrolment, in two successive Units of Study of 6 credits points each. Honours Thesis A covers first steps of thesis research starting with development of research proposal. Thesis B covers the second of stage writing up and presenting the research results.

Students are asked to write a thesis based on a research or major design project, which is very often related to some aspect of a staff member's research interests. Some projects will be experimental in nature, others may involve computer-based simulation, feasibility studies or the design, construction and testing of equipment. Direction of thesis work may be determined by the supervisor or be of an original nature, but in either case the student is responsible for the execution of the practical work and the general layout and content of the thesis itself. The final thesis must be the student's individual work, although research is sometimes conducted in the framework of a group project shared with others. Students undertaking research on this basis will need to take care in ensuring the individual quality of their own research work and the final thesis submission. The thesis will be judged on the extent and quality of the student's original work and particularly how critical, perceptive and constructive he or she has been in assessing his/her work and that of others. Students will also be required to present the results of their findings to their peers and supervisors as part of a seminar program.

It is not expected that a thesis at this level will represent a significant contribution to new knowledge; nor is it expected that theses will resolve great intellectual problems. The time frame available for the thesis is simply too short to permit students to tackle complex or difficult problems. Indeed, a key aim of the thesis is to specify a research or design topic that arouses sufficient intellectual curiosity, and presents an appropriate range and diversity of technical and conceptual challenges, while remaining manageable and allowing achievable outcomes within the time and resources available. It is important that the topic be of sufficient scope and complexity to allow a student to learn their craft and demonstrate their research or design skills. Equally imperative is that the task not be so demanding as to elude completion.

Normally taken in Semester 2

Acceptable alternative units of study

BE/BSc students can enrol in PHYS2011, PHYS2012 or advanced equivalent, as acceptable alternative to AMME2500.Most units of study offered by the Faculty of Science shown in the tables can be replaced by an equivalent advanced level unit, subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing advanced options should seek advice from their department before enrolling.Students undertaking Study Abroad in a particular year of their degree must enrol in the appropriate International Exchange Program units of study as an alternative to a semester's standard units.

Resolutions of the Faculty of Engineering and Information Technologies relating to this table:

BEHons (Aeronautical)

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete 30 credit points of recommended elective units of study for Aeronautical Engineering and 6 credits points of free elective units of study. A minimum of 192 credit points is required to be eligible for the award of the degree of BE (Aeronautical).

BEHons (Aeronautical)/BSc or BCom or BMedSc or BPM

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete at least 12 credit points of recommended elective units of study for Aeronautical Engineering, and 96 credit points of units of study given by the Faculty of Science for the BE/BSc or BE/BMedSc; or the Business School for the BE/BCom or from the core units table for the BPM. A minimum of 240 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies and the faculty in which they are undertaking the combined degree.

BEHons (Aeronautical)/BA

In addition to gaining credit for the units of study set out in this table, candidates are required to complete at least 18 credit points of recommended elective units of study for Aeronautical Engineering, and 84 credit points of units of study given by the Faculty of Arts and Social Sciences for the BE/BA. A minimum of 240 credit points is required to be eligible for the combined degree. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies and the faculty in which they are undertaking the combined degree.

BEHons (Aeronautical)/LLB

In addition to gaining credit for the core units of study set out in this table, candidates are required to complete at least 12 credit points of recommended elective units of study for Aeronautical Engineering and 144 credit points of units of study given by the Faculty of Law for the BE/LLB. A minimum of 288 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies and the Faculty of Law.

Recommended elective units of study

AERO3660
Aerospace Management

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Lecture 2 hrs/week; Working in assignments and Major Project 6 hrs/week. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit has two parts.

The first part aims to develop knowledge and understanding of the current state of aerospace design, manufacturing, and operations in the Australian aviation industry. Students will gain skills in aerospace engineering management. On satisfactory completion of this unit, students will be able to apply risk management skills to a variety of industry situations and use appropriate methodology to manage these situations. Students will also become proficient in the use of Project Management tools and learn how to apply them to industry standard problems. Subject areas covered within the Unit of Study include principles and practice of aviation and airline management; discussion and analysis of airline operations and management in aerospace engineering design.

The second part addresses general management principles as applies particularly to engineering and industrial settings. It aims to provide knowledge of the principles and tools that can assist communication, supervision, project management, team membership, decision making and management of human resources.

At the end of this unit students will be able to understand different management practices and approaches applicable to a broad range of environments. The concepts covered are from the following management areas: Engineers and Management - including ethics , Communication and People in Organisations, Economics, Leadership, Strategic Management, Managerial Decision Analysis, Marketing, Business Planning, Legal Environment of Business, Risk Management, Human Resource Management, Project Management, Quality Assurance and Management, Operations Management, and Financial Management.

AERO4206
Rotary Wing Aircraft

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 1 hr/week; Tutorial 3 hrs/week. **Prerequisites:** AERO3260 **Assumed knowledge:** concepts from 3rd Year Aerodynamics and Flight Mechanics will be applied to Rotary Wing Vehicles in this unit. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to develop an understanding of the theory of flight, design and analysis of helicopters, auto-gyros and other rotary wing aircraft. Students will gain an appreciation of the extra difficulties involved when the vehicle flow is cyclic in nature. At the end of this unit students will be able to: Identify and predict the various flow states of a generic lift producing rotor; Use appropriate methods to determine the forces and torques associated with the rotor; Estimate values for typical stability derivatives for helicopters and be able to construct a simple set of stability analysis equations for the vehicle; become aware of the regulatory and liability requirements relating to all aspects of commercial helicopter operation and maintenance. Course content will include introduction to rotary wing aircraft; vertical flight performance; forward flight performance; blade motion and control; dynamics of rotors; rotor-craft stability; rotor blade design.

AERO4260
Aerodynamics 2

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** AMME2200 **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to introduce students to: elementary and advanced topics in Gasdynamics (High Speed Flows). Course content will include review of Equations of Gasdynamics, One-Dimensional Gas Flow, Isentropic Flows, Normal Shock, Flow in a Converging and Converging-Diverging Nozzle, Steady Two-dimensional Supersonic Flow, Shock waves (Normal and Oblique), Method of Characteristics, Two-dimensional Supersonic Aerofoils, Introduction to Three Dimensional Effects, Unsteady Flows, Moving Shocks, Shock Tube Flow and Transonic Flow and Compressible Boundary Layers, introduction to turbulent flows.

At the end of this unit the student will be able to calculate a high speed flow about an aerofoil and compressible flow through a duct of varying cross-section and will have a good appreciation of Transonic and Hypersonic Flows.

AERO4360
Aerospace Structures 2

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2.5 hrs/week; Laboratory/Tutorial 2 hrs/week. **Prerequisites:** AERO3360 **Assumed knowledge:** AERO3465 **Assessment:** Through semester assessment (55%) Final Exam (45%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to teach fundamentals of modern numerical and analytical techniques for evaluating stresses, strains, deformations and strengths of representative aerospace structures. In particular the focus is on developing an understanding of: Fundamental concepts and formulations of the finite element methods for basic structural analysis; Elements for typical aerospace structures, such as beams/frames, plates/shells, and their applications and limitations; Finite element techniques for various types of problems pertinent to aerospace structures; d)and, developing hands-on experience of using selected commercial finite element analysis program.

At the end of this unit of study the following will have been covered: Introduction to Finite Element Method for modern structural and stress analysis; One-dimensional rod elements; Generalization of FEM for elasticity; Two- and three-dimensional trusses; FEA for beams and frames in 2D and 3D; Two-dimensional problems using constant strain triangular elements; The two-dimensional isoparametric elements; Plates and shells elements and their applications; FEA for axisymmetric shells and pressure vessels, shells of revolution; FEA for axisymmetric solids subjected to axi-symmetric loading; FEA for structural dynamics, eigenvalue analysis, modal response, transient response; Finite element analysis for stress stiffening and buckling of beams, plates and shells; Three-dimensional problems in stress analysis; Extensions to the element library, higher order elements, special elements; Constraints; FEA modeling strategy; FEA for heat conduction; FEA for non-linear material and geometric analysis.

AERO4560
Flight Mechanics 2

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** AERO3560 and AMME3500 **Assumed knowledge:** AMME2500 develops the basic principles of engineering mechanics and system dynamics that underpin this course. AERO3560 Flight Mechanics 1 develops the specifics of aircraft flight dynamics and stability. AMME3500 Systems control covers basic system theory and control system synthesis techniques. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to develop an understanding of the application of flight mechanics principles to modern aircraft systems. Students will gain skills in problem solving in the areas of dynamic aircraft behaviour, aircraft sensitivity to wind gusts, control systems development and aircraft handling analysis.

At the end of this unit students will be able to: understand the nature of an aircraft's response to control inputs and atmospheric disturbances, including the roles of the various modes of motion; analyse an aircraft's response to control inputs in the frequency domain using Laplace Transforms and Transfer Function representations; represent and model wind gust distributions using stochastic methods (Power Spectral Density); analyse an aircraft's response to disturbances (wind gust inputs) by combining Transfer Function representations with gust PSD's; understand the principles of stability augmentation systems and autopilot control systems in aircraft operation, their functions and purposes; understand basic feedback control systems and classical frequency domain loop analysis; understand the characteristics of closed loop system responses; understand the characteristics of PID, Lead, Lag and Lead-Lag compensators, and to be competent in designing suitable compensators using Bode and Root-locus design techniques; design multi-loop control and guidance systems and understand the reasons for their structures.

AERO5200
Advanced Aerodynamics

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** AERO5210 OR AERO9260 OR AERO3260 **Assumed knowledge:** BE in the area of Aerospace Engineering or related Engineering field. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

Objectives/Expected Outcomes:

To develop a specialist knowledge in the fields of computational, non-linear and unsteady and aerodynamics. The develop familiarity with the techniques for predicting airflow/structure interactions for aerospace vehicles.

Syllabus Summary:

(a) Advanced two and three dimensional panel method techniques; calculation of oscillatory flow results; prediction of aerodynamic derivatives. Pressure distributions for complete aircraft configuration. Unsteady subsonic flow analysis of aircraft; calculation of structural modes. Structural response to gusts; aeroelasticity; flutter and divergence. Solution of aerospace flow problems using finite element methods.

(b) Unsteady supersonic one-dimensional flow. Hypersonic flow; real gas effects. Introduction to the use of CFD for transonic flow.

(c) Rarefied gas dynamics. Direct simulation method (DSMC); near-continuum solutions. Simulation techniques for numerical solutions of non-linear continuum flow.

AERO5400
Advanced Aircraft Design Analysis

Credit points: 6 **Session:** Semester 2 **Classes:** Project Work - in class 3 hrs/week; Lecture 2 hrs/week; Meeting 2 hrs/week. **Prerequisites:** AERO3460 OR AERO5410 OR AERO9460 **Prohibitions:** : AERO4491 **Assumed knowledge:** (AERO1400, AERO3260, AERO3261, AERO3360, AERO3465, AERO3560, AERO4460) or equivalent. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This Unit aims to provide familiarity and understanding with practical aircraft design processes expected in industry, including the evaluation and case studies of existing aircraft designs. Students will gain a better understanding of relevant issues particularly related to the design of aircraft with a level of confidence to lead them to develop new designs or modifications, having a good balance between theory and real-world applications. Good familiarity with unique and stringent international aviation regulations and certification processes will be expected with respect to the design of aircraft. Topics coved by the lectures will include aircraft specifications; aircraft selection and evaluation; aircraft configuration design; design considerations for aerodynamics, structures, systems, manufacture, testing, certification, life-cycle-cost, operations; the use of computational aircraft design tools, in particular DARcorp`s Advanced Aircraft Analysis (AAA); and introduction to multidisdiplinary design optimisation methods. Projects will be based on case study analyses and evaluation of aircraft types to operational specifications and requirements.

AERO5500
Flight Mechanics Test and Evaluation Adv

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** AERO5510 OR AERO9560 OR AERO3560 **Assumed knowledge:** BE in the area of Aerospace Engineering or related Engineering field. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to develop an understanding of aircraft flight test, validation and verification, and the development of modern flight control, guidance, and navigation systems. Students will gain skills in analysis, problem solving and systems design in the areas of aircraft dynamic system identification and control.

At the end of this unit students will be able to understand elements of the following: the principles of stability augmentation systems and autopilot control systems in aircraft operation, their functions and purposes; the characteristics of closed loop system responses; advanced feedback control systems and state-space design techniques; the concepts of parameter and state estimation; the design of observers in the state space and the implementation of a Kalman Filter; multi-loop control and guidance systems and the reasons for their structures; flight test principles and procedures and the implementation a flight test programme.

AERO5520
Aircraft Avionics and Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Workgroup 2 hrs/week; Laboratory 2 hrs/week; Site Visit 5 hrs/week; Demonstration 2 hrs/week. **Prerequisites:** AERO5510 or AERO3560 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit of study aims to develop a thorough qualitative understanding of modern avionics and aircraft systems. It deals with the full breadth of cockpit avionics systems and subsystems from flight instrument and display technology to flight management, flight control, navigation and sensor systems.

At the end of this unit students will be able to understand the following: the principles of modern cockpit display technologies and the information they portray; the functions of flight control and navigation systems and their interactions with actuation and other aircraft systems; engine management systems; communication systems; payload sensor systems; the interactions of avionics components with power, hydraulic, bus and communication systems together with their underlying physical principles; the principles of avionics system requirements, specification , design, regulation and certification; fault tolerance and redundancy; software engineering and system integration.

AMME5202
Advanced Computational Fluid Dynamics

Credit points: 6 **Session:** Semester 1 **Classes:** Laboratory 2 hrs/week; Lecture 1 hr/week; Tutorial 1 hr/week. **Assumed knowledge:** Partial differential equations; Finite difference methods;Taylor series; Basic fluid mechanics including pressure, velocity, boundary layers, separated and recirculating flows. Basic computer programming skills. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Objectives: To provide students with the necessary skills to use commercial Computational Fluid Dynamics packages and to carry out research in the area of Computational Fluid Dynamics. Expected outcomes: Students will have a good understanding of the basic theory of Computational Fluid Dynamics, including discretisation, accuracy and stability. They will be capable of writing a simple solver and using a sophisticated commercial CFD package. Syllabus summary: A course of lectures, tutorials and laboratories designed to provide the student with the necessary tools for using a sophisticated commercial CFD package. A set of laboratory tasks will take the student through a series of increasingly complex flow simulations, requiring an understanding of the basic theory of computational fluid dynamics (CFD). The laboratory tasks will be complemented by a series of lectures in which the basic theory is covered, including: governing equations; finite difference methods, accuracy and stability for the advection/diffusion equation; direct and iterative solution techniques; solution of the full Navier-Stokes equations; turbulent flow; Cartesian tensors; turbulence models.

AMME5510
Vibration and Acoustics

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/week. **Assumed knowledge:** (AMME2301 OR AMME9301) AND AMME2200 AND (AMME2500 OR AMME9500) **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This UoS should prepare the student to be able to undertake vibration and acoustic measurement calculations for industry design situations.

The unit aims to introduce a number of new concepts required for analysis of vibrations and acoustics. The response of structure under different dynamic forces, including human and aerodynamic, will be investigated. A number of hands-on experiments will be performed to allow an understanding of the concepts and applicability.

The acoustics component will include: basic acoustics theory, sound generation and propagation, impedance, absorbing materials, industrial noise sources, isolation methods of noise control, enclosures, instrumentation and measurement, frequency analysis, noise regulations and computational acoustics.

Additional Electives

Students can select from other elective units offered within the University that are approved by the Head of the School of Aerospace, Mechanical and Mechatronic Engineering.

ENGG1000
History and Philosophy of Engineering

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Tutorial 1 hr/week; Independent research/study 5 hrs/week; E-Learning 2 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

ENGG1000 is a unique course that aims to provide students with an understanding of the historical development of Engineering with relation to societal expectations of the period. Engineering as a field of study and profession has developed over millennia from simple (yet significant) advances in technology such as the lever and wheel, to modern day examples such as advanced computers, nanomaterials and space flight.

Interaction between human society and Engineers has helped develop and guide the advancement of engineering technology; with society posing problems for Engineers to solve and Engineers developing new technology that changed the course of human history, and helped shape the world we live in.

The general philosophy behind Engineering is that Engineers work to fulfil the needs of society (water, electricity, technological improvements etc.), and as such Engineers are expected to act ethically towards society. The role of Engineers in society will be analysed and discussed from a humanistic perspective, with relation to the current Engineers Australia code of ethics. Other relevant philosophical analyses of Engineering as a skill and profession will also be examined such as, aesthetics, creativity, the epistemology of Engineering and more.

This course will use online resources extensively and help develop research and communication skills of students, whilst providing an overview of the historical significance of Engineers in society, and what it means to be an Engineer.

AMME2000
Engineering Analysis

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** (MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) and ENGG1801. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **Assessment:** Through semester assessment (35%) Final Exam (65%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This course is designed to provide students with the necessary tools for mathematically modelling and solving problems in engineering. Solution methods will be considered for a range of standard engineering problems including; Conduction heat transfer in one and two dimensions, hydrostatics and hydrodynamic balance for internal and external flows, spring/mass systems, vibration and stability problems. The focus will be on real problems and numerical solution methods and will include separation of variables; Fourier series and Fourier transforms; Laplace transforms; scaling and finite differences.

Note

Choice of electives as shown in the above table will depend on subject availability, timetabling and prerequisite conditions.
For a standard enrolment plan for Aeronautical Engineering visit cusp.sydney.edu.au/students/view-degree-page/name/BE(Aero)

Bachelor of Engineering Honours (Aeronautical) (Space)

Course Overview

The space engineering specialisation at the University of Sydney is the only one of its kind in Australia. Space engineering is an exciting and challenging new area of teaching and research concerned with the theory, design, testing, construction and use of engineering components in aerospace.

In the Bachelor of Engineering Honours (Aeronautical) (Space) you will undertake four core units of study providing a foundation in orbital mechanics, aerospace systems design, satellite subsystems, launch technology, and remote sensing. You may also choose to complete optional advanced space engineering projects. As a graduate you will be able to meet the challenges of evolving space industries in fields such as propulsion systems, aeronautical design, communications, and navigation.

Course Requirements

To meet requirements for the Bachelor of Engineering Honours (Aeronautical) (Space), a candidate must successfully complete 192 credit points, comprising:

1. core and elective units of study relating to the specialist stream, as prescribed by the table of units of study for the stream; and
2. any additional free elective units of study as may be necessary to gain credit to complete the award.

For a standard enrolment plan for Aeronautical (Space) Engineering visit cusp.sydney.edu.au/students/view-degree-page/name/BE(Aero)(Space)

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Bachelor of Engineering Honours (Aeronautical) (Space)			
Candidates for the degree of Bachelor of Engineering Honours (Aeronautical) (Space) are required to gain credit for the core units of study set out below. Any additional credit necessary shall be gained by completing additional credit points of elective units of study as recommended by the Faculty, as may be necessary to gain credit for a total of not less than 192 credit points.			
Core units of study			
First year			
AERO1560 **Introduction to Aerospace Engineering**	6	**N** MTRX1701, ENGG1800, MECH1560 *Note: Department permission required for enrolment*	Semester 1
MATH1001 **Differential Calculus**	3	**A** HSC Mathematics Extension 1 **N** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001	Semester 1 Summer Main
MATH1002 **Linear Algebra**	3	**A** HSC Mathematics or MATH1111 **N** MATH1902, MATH1012, MATH1014	Semester 1 Summer Main
ENGG1801 **Engineering Computing**	6		Semester 1 Summer Late
ENGG1803 **Professional Engineering 1**	6	**N** ENGG1061	Semester 1 Semester 2
Normally taken in Semester 1. Students in combined degrees are exempt.			
MATH1003 **Integral Calculus and Modelling**	3	**A** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **N** MATH1013, MATH1903, MATH1907	Semester 2 Summer Main
MATH1005 **Statistics**	3	**A** HSC Mathematics **N** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021	Semester 2 Summer Main Winter Main
ENGG1802 **Engineering Mechanics**	6		Semester 2 Summer Main
AMME1362 **Materials 1**	6	**N** AMME2302, CIVL2110	Semester 2
AERO1400 **Intro to Aircraft Construction & Design**	6	**A** Some basic skills with engineering workshop hand tools is desirable. *Note: Department permission required for enrolment* *Department permission required for enrollment.*	Semester 2
Students in combined degrees are exempt from this unit.			
Second year			
AMME2301 **Mechanics of Solids**	6	**P** ENGG1802, MATH1001, MATH1002, MATH1003	Semester 2
MATH2067 **DEs and Vector Calculus for Engineers**	6	**P** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **N** MATH2901, MATH2961, MATH2005, MATH2965, MATH2001, MATH2905, MATH2061, MATH2065	Semester 1
Students in the combined BEHons/BSc degree program can take both MATH2061 and MATH2065 as an alternative.			
AMME2700 **Instrumentation**	6	**A** ENGG1801. Programming Skills, 1st Year maths skills, familiarity with fundamental Aerospace concepts. **P** AERO1560 OR MECH1560 OR MTRX1701 OR ENGG1800	Semester 1
Students in combined degrees are exempt from this unit.			
AMME2500 **Engineering Dynamics**	6	**P** ENGG1802 and (MATH1001 or MATH1901) and (MATH1002 or MATH1902)	Semester 1
BEHons/BSc students can enrol in PHYS2011, PHYS2012, or advanced equivalent, as acceptable alternative.			
AMME2261 **Fluid Mechanics 1**	6	**A** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **N** AMME2200	Semester 1
AMME2262 **Thermal Engineering 1**	6	**A** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **N** AMME2200	Semester 2
MECH2400 **Mechanical Design 1**	6	**A** ENGG1801 and ENGG1802, HSC Maths and Physics	Semester 2
AERO2705 **Space Engineering 1**	6	**A** First Year Maths and basic MATLAB programming skills. **P** (AERO1560 OR MECH1560 OR MTRX1701 OR ENGG1800) AND MATH1001 AND MATH1002 AND MATH1003	Semester 2

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
Third year			
AERO3260 **Aerodynamics 1**	6	**A** General conservation equations applied to fluid flow; Fundamental elements of potential flow; Vorticity and its effect on ideal flow; Basic mathematical skills required for plotting and graphing data; Linear algebra for solution of simultaneous linear equations; Fourier series; Complex numbers and complex functions. **P** (AMME2200 OR AMME2261) AND (MATH2061 OR MATH2067 OR MATH2961)	Semester 2
AERO3360 **Aerospace Structures 1**	6	**P** AMME2301	Semester 1
AERO3460 **Aerospace Design 1**	6	**P** AMME2301 and MECH2400	Semester 1
AMME3500 **System Dynamics and Control**	6	**P** ((MATH2061 or MATH2961) and (MATH2065 or MATH2965)) or MATH2067	Semester 1
AERO3261 **Propulsion**	6	**A** Good knowledge of fluid dynamics and thermodynamics **P** AMME2200 OR (AMME2261 AND AMME2262)	Semester 2
AERO3560 **Flight Mechanics 1**	6	**A** This Unit of Study builds on basic mechanics and aerodynamics material covered in previous Units and focuses it towards the analysis and understanding of aircraft flight mechanics. It is expected that students have satisfactorily completed the following material: ENGG1802 Engineering Mechanics: Forces, moments, equilibrium, momentum, energy, linear and angular motion. AMME2500 Engineering Dynamics 1: Mechanisms, kinematics, frames of reference, mass and inertia, dynamics. If you struggled to pass MECH2500 and/or ENGG1802, you should spend some time revising the material of those Units of Study early in the semester. **P** AMME2500 **C** AMME3500	Semester 1
AERO3760 **Space Engineering 2**	6	**P** AERO2705	Semester 2
Fourth year			
AERO4701 **Space Engineering 3**	6	**P** AERO3760	Semester 1
ENGG4000 **Practical Experience**		**P** 36 Credit Points of Senior Units *Students should have completed three years of their BE program before enrolling in this unit.*	Semester 1 Semester 2
Students should have completed three years of their Bachelor of Engineering Honours program before enrolling in this unit.			
Students must enrol in 12cp of Thesis units			
AMME4111 **Honours Thesis A**	6	**P** 36 credits of 3rd year units of study. **N** AMME4010, AMME4121, AMME4122 *Note: Department permission required for enrolment* *Honours Thesis A is only available to students with an HWAM of 65 or over. HWAM is a weighted average based on all 2000, 3000 and 4000 level units completed prior to enrolment in this unit. Prospective students in Honours Thesis A are expected to have consulted with supervisors and selected a topic of interest at the end of third year, guided by the advertised list of suggested thesis topics and supervisors. Availability of topics is limited and students should undertake to speak with prospective supervisors as soon as possible. Students who are unable to secure a supervisor and topic will be allocated a supervisor by the unit coordinator. Alternatively, students may do a thesis with a supervisor in industry or in another university department. In this case, the student must also find a second supervisor within the School of AMME.*	Semester 1 Semester 2
Normally taken in Semester 1			
AMME4112 **Honours Thesis B**	6	**P** 36 credits of 3rd year units of study and WAM 65 or over **N** AMME4010, AMME4122, AMME4121 *Note: Department permission required for enrolment* *HWAM of 65 or greater required for enrolment. HWAM is the weighted average of all 2000, 3000 and 4000 level units completed prior to enrolment in this unit.*	Semester 1 Semester 2
Normally taken in Semester 2			

Acceptable alternative units of study

BEHons/BSc students can enrol in PHYS2011, PHYS2012, or advanced equivalent, as acceptable alternative to AMME2500.

Most units of study offered by the Faculty of Science shown in the tables can be replaced by an equivalent advanced level unit, subject to prerequisite conditions (as required by the Faculty of Science) being met.

Students undertaking Study Abroad in a particular year of their degree must enrol in the appropriate AMME International Exchange Program units of study as an alternative to a semester's standard units.

Resolutions of the Faculty of Engineering and Information Technologies relating to this table:

BEHons (Aeronautical)(Space)

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete 30 credit points of recommended elective units of study for Aeronautical (Space) Engineering and 6 credit points of free elective units of study. A minimum of 192 credit points is required to be eligible for the award of BE(Aeronautical)(Space).

BEHons (Aeronautical)(Space)/BSc or BMedSc or BCom or BPM

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete at least 12 credit points of recommended elective units of study for Aeronautical (Space) Engineering and 96 credit points of units of study given by the Faculty of Science for the BE/BSc or BE/BMedSc; or the Business School for the BE/BCom or from the core units table for BPM. A minimum of 240 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies and the faculty in which they are undertaking the combined degree.

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
BEHons (Aeronautical)(Space)/BA			
In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete at least 18 credit points of recommended elective units of study for Aeronautical (Space) Engineering and 84 credit points of units of study given by the Faculty of Arts and Social Sciences for the BE/BA. A minimum of 240 credit points is required to be eligible for the combined degree. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Technologies and the faculty in which they are undertaking the combined degree.			
BEHons (Aeronautical)(Space)/LLB			
In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete at least 12 credit points of recommended elective units of study for Aeronautical (Space) Engineering and 144 credit points of units of study given by the Faculty of Law for the BE/LLB. A minimum of 288 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies and the Faculty of Law.			
Recommended elective units of study			
AERO3660 **Aerospace Management**	6		Semester 2
AERO4260 **Aerodynamics 2**	6	**P** AMME2200	Semester 2
AERO4360 **Aerospace Structures 2**	6	**A** AERO3465 **P** AERO3360	Semester 1
AERO4560 **Flight Mechanics 2**	6	**A** AMME2500 develops the basic principles of engineering mechanics and system dynamics that underpin this course. AERO3560 Flight Mechanics 1 develops the specifics of aircraft flight dynamics and stability. AMME3500 Systems control covers basic system theory and control system synthesis techniques. **P** AERO3560 and AMME3500	Semester 1
AERO5200 **Advanced Aerodynamics**	6	**A** BE in the area of Aerospace Engineering or related Engineering field. **P** AERO5210 OR AERO9260 OR AERO3260 *Note: Department permission required for enrolment*	Semester 1
AERO5400 **Advanced Aircraft Design Analysis**	6	**A** (AERO1400, AERO3260, AERO3261, AERO3360, AERO3465, AERO3560, AERO4460) or equivalent. **P** AERO3460 OR AERO5410 OR AERO9460 **N** : AERO4491	Semester 2
AERO5500 **Flight Mechanics Test and Evaluation Adv**	6	**A** BE in the area of Aerospace Engineering or related Engineering field. **P** AERO5510 OR AERO9560 OR AERO3560	Semester 2
AERO5520 **Aircraft Avionics and Systems** *This unit of study is not available in 2015*	6	**P** AERO5510 or AERO3560 *Note: Department permission required for enrolment*	Semester 2
AERO5700 **Space Engineering (Advanced)**	6	**A** AERO3760	Semester 2
AMME5202 **Advanced Computational Fluid Dynamics**	6	**A** Partial differential equations; Finite difference methods;Taylor series; Basic fluid mechanics including pressure, velocity, boundary layers, separated and recirculating flows. Basic computer programming skills.	Semester 1
AMME5510 **Vibration and Acoustics**	6	**A** (AMME2301 OR AMME9301) AND AMME2200 AND (AMME2500 OR AMME9500) *Note: Department permission required for enrolment*	Semester 2
AMME5520 **Advanced Control and Optimisation**	6	**A** Students have an interest and a strong understanding of feedback control systems, specifically in the area of system modelling and control design in the frequency domain. **P** AMME3500 OR AMME5501 OR AMME9501	Semester 1
Additional Electives			
Students can select the unit below or other elective units offered within the University that are approved by Head of School of Aerospace, Mechanical, and Mechatronics Engineering.			
ENGG1000 **History and Philosophy of Engineering**	6		Semester 1 Semester 2
AMME2000 **Engineering Analysis**	6	**A** (MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) and ENGG1801. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. *Note: Department permission required for enrolment*	Semester 1
Note			
Choice of electives as shown in the above table will depend on subject availability, timetabling and prerequisite conditions.			

For a standard enrolment plan for Aeronautical (Space) Engineering visit cusp.sydney.edu.au/students/view-degree-page/name/BE(Aero)(Space)

Unit of Study Descriptions

Bachelor of Engineering Honours (Aeronautical) (Space)

Candidates for the degree of Bachelor of Engineering Honours (Aeronautical) (Space) are required to gain credit for the core units of study set out below. Any additional credit necessary shall be gained by completing additional credit points of elective units of study as recommended by the Faculty, as may be necessary to gain credit for a total of not less than 192 credit points.

Core units of study

First year

AERO1560
Introduction to Aerospace Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Workshop 3 hrs/week. **Prohibitions:** MTRX1701, ENGG1800, MECH1560 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This Unit introduces students to the role of professional aerospace engineers, along with the development of fundamental engineering knowledge and skills for aerospace vehicle design, analysis performance and operation. Students will learn through experience, to develop professional skills in research, interpretation, communication, and presentation of information relating to aerospace engineering. Expected learning includes: introduction to lateral thinking concepts; glossary of aerospace vehicle components and terminology; an introduction to the multiple disciplines related to aerospace engineering, such as aerodynamics, aircraft and spacecraft performance, mechanics of flight, aerospace structures, materials and propulsion systems; how the various disciplines are integrated into the design and development of flight platform systems; the operating characteristics of modern flight vehicles, their uses and limitations; modern developments and future trends in aerospace; the limitations of the aerospace environment; teamwork; and resource management.

Significantly, professional enhancement is introduced through the development of basic hands-on workshop skills. These practical skills enable students to have a better appreciation of the hardware that they are expected to apply their engineering knowledge to, during their aerospace engineering profession. Experiential learning is facilitated working with machine tools and hand tools in a supervised workshop environment, to develop fundamentals of practical aerospace vehicle component manufacture, construction, servicing and repair.

Workshop Technology: On overview is provided of a range of manufacturing processes, with hands-on experience provided. Workshop Technology practical work is undertaken in: (a) Hand tools; (b) Machining; (c) Welding; and (d) Fibreglassing. Safety requirements: All students are required to provide their own personal protective equipment (PPE) and comply with the safety regulations. Students who fail to do this will not be permitted to enter the workshops. In particular, approved industrial footwear must be worn, and long hair must be protected by a hair net. Safety glasses must be worn at all times.

MATH1001
Differential Calculus

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001 **Assumed knowledge:** HSC Mathematics Extension 1 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1001 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study looks at complex numbers, functions of a single variable, limits and continuity, vector functions and functions of two variables. Differential calculus is extended to functions of two variables. Taylor's theorem as a higher order mean value theorem.

Textbooks
As set out in the Junior Mathematics Handbook.

MATH1002
Linear Algebra

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1902, MATH1012, MATH1014 **Assumed knowledge:** HSC Mathematics or MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1002 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study introduces vectors and vector algebra, linear algebra including solutions of linear systems, matrices, determinants, eigenvalues and eigenvectors.

Textbooks
As set out in the Junior Mathematics Handbook

ENGG1801
Engineering Computing

Credit points: 6 **Session:** Semester 1, Summer Late **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will introduce students to fundamental principles of programming. The language used will be Matlab but the principles taught are readily portable to other languages like C and Java. The unit material will be presented in a manner which will help students to draw a connection between programming constructs and real engineering applications. The unit will use engineering inspired case-studies : especially from Civil, Chemical, Aerospace and Mechanical streams, to motivate new material. There will be a major project which uses programming to solve a real world engineering problem. The extensive Matlab library for visualization will also be introduced. Matlab will cover two-thirds of the unit. The remaining one-third will be devoted to the use of Excel in engineering scenarios. Furthermore, cross integration between Matlab and Excel will also be highlighted.

ENGG1803
Professional Engineering 1

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prohibitions:** ENGG1061 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Professional Engineering 1 is an introductory Unit of Study within the Faculty of Engineering. The semester 1 course is aimed at students from the School of Aerospace, Mechanical and Mechatronic Engineering. It seeks to introduce newly admitted undergraduates to general principles of professional engineering practice, a range of contemporary professional engineering issues, plus outline skills related to academic study within an engineering environment. The subject is structured around a team based design and build project, in which students apply the professional engineering concepts they are learning to an engineering project. Professional engineering topics to be covered include: accessing information, teamwork, creativity, leadership, written and oral communication, project management, problem solving, ethics, liability, work health and safety and environmental issues.

Normally taken in Semester 1. Students in combined degrees are exempt.

MATH1003
Integral Calculus and Modelling

Credit points: 3 **Session:** Semester 2, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1013, MATH1903, MATH1907 **Assumed knowledge:** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1003 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.This unit of study first develops the idea of the definite integral from Riemann sums, leading to the Fundamental Theorem of Calculus. Various techniques of integration are considered, such as integration by parts.The second part is an introduction to the use of first and second order differential equations to model a variety of scientific phenomena.

Textbooks
As set out in the Junior Mathematics Handbook

MATH1005
Statistics

Credit points: 3 **Session:** Semester 2, Summer Main, Winter Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021 **Assumed knowledge:** HSC Mathematics **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1005 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit offers a comprehensive introduction to data analysis, probability, sampling, and inference including t-tests, confidence intervals and chi-squared goodness of fit tests.

Textbooks
As set out in the Junior Mathematics Handbook

ENGG1802
Engineering Mechanics

Credit points: 6 **Session:** Semester 2, Summer Main **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit aims to provide students with an understanding of and competence in solving statics and introductory dynamics problems in engineering. Tutorial sessions will help students to improve their group work and problem solving skills, and gain competency in extracting a simplified version of a problem from a complex situation. Emphasis is placed on the ability to work in 3D as well as 2D, including the 2D and 3D visualization of structures and structural components, and the vectorial 2D and 3D representations of spatial points, forces and moments. Introduction to kinematics and dynamics topics includes position, velocity and acceleration of a point; relative motion, force and acceleration, momentum, collisions and energy methods.

AMME1362
Materials 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/semester. **Prohibitions:** AMME2302, CIVL2110 **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

AMME1362 is an introductory unit in engineering materials. The unit aims to develop students' understanding of the structures, mechanical properties and manufacture of a range of engineering materials as well as how the mechanical properties relate to microstructure and forming and treatment methods. The unit has no prerequisite subject and is therefore intended for those with little or no previous background in engineering materials. However the unit does require students to take a significant degree of independent responsibility for developing their own background knowledge of materials and their properties. The electrical, magnetic, thermal and optical properties of materials are a critical need-to-know area where students are expected to do some independent study.

AERO1400
Intro to Aircraft Construction & Design

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2hrs/week and Workshop 3 hrs/week. **Assumed knowledge:** Some basic skills with engineering workshop hand tools is desirable. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

The study towards BE(Aeronautical) involves learning about the Design, Analysis, Flight, and Operation of Aircraft and other Flight Platforms. This unit facilitates the training towards becoming professional aeronautical engineers through a globally-unique experiential-learning opportunity to provide a strong background familiarity with aircraft hardware. This unit is designed to educate and facilitate the learning of aircraft design, basic aircraft construction techniques, the operation of light aircraft and the registration and regulations relating to light aircraft. In addition to hands-on skills on the construction phase, this unit facilitates learning in motivations for unique aircraft design, aircraft aerodynamics, flight mechanics, structural aspects and other design-related issues. Teamwork plays a very important role in this unit; the ability to work with peers and supervising staff is an invaluable skill sought after by employers of engineers.

Throughout the semester, students will be actively participating in the construction of a light aircraft, and of aircraft structural components. The aircraft is to be constructed under current Australian Civil Aviation Regulations so that students will gain an insight into all aspects of the process. By being a part of the construction team, students will also experience the organisational requirements necessary to successfully complete a complex engineering project. The aircraft construction workshop component is complemented with lectures, homework, research and assignments to further enhance the learning experience on aircraft. The final outcome will be that students gain a good foundation of: aircraft design and analyses methods; innovative methods of construction; techniques for selecting, sizing and stressing components; regulatory requirements for certification; off-design requirements; construction tolerances; and team-work requirements in undertaking complex engineering projects.

Students in combined degrees are exempt from this unit.

Second year

AMME2301
Mechanics of Solids

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** ENGG1802, MATH1001, MATH1002, MATH1003 **Assessment:** Through semester assessment (35%) Final Exam (65%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Equilibrium of deformable structures; basic concept of deformation compatibility; stress and strain in bars, beams and their structures subjected to tension, compression, bending, torsion and combined loading; statically determinate and indeterminate structures; energy methods for bar and beam structures; simple buckling; simple vibration; deformation of simple frames and cell box beams; simple two-dimensional stress and Morh's circle; problem-based applications in aerospace, mechanical and biomedical engineering.

MATH2067
DEs and Vector Calculus for Engineers

Credit points: 6 **Session:** Semester 1 **Classes:** Three 1 hour lectures, one 1 hour tutorial and one 1 hour practice class per week. **Prerequisites:** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **Prohibitions:** MATH2901, MATH2961, MATH2005, MATH2965, MATH2001, MATH2905, MATH2061, MATH2065 **Assessment:** One 2 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH2067 starts by introducing students to solution techniques of ordinary and partial differential equations (ODEs and PDEs) relevant to the engineering disciplines: it provides a basic grounding in these techniques to enable students to build on the concepts in their subsequent engineering classes. The main topics are Fourier series, second order ODEs, including inhomogeneous equations and Laplace transforms, and second order PDEs in rectangular domains (solution by separation of variables).

The unit moves on to topics from vector calculus, including vector-valued functions (parametrised curves and surfaces; vector fields; div, grad and curl; gradient fields and potential functions), line integrals (arc length; work; path-independent integrals and conservative fields; flux across a curve), iterated integrals (double and triple integrals; polar, cylindrical and spherical coordinates; areas, volumes and mass; Green's Theorem), flux integrals (flow through a surface; flux integrals through a surface defined by a function of two variables, though cylinders, spheres and parametrised surfaces), Gauss's Divergence Theorem and Stokes' Theorem.

Students in the combined BEHons/BSc degree program can take both MATH2061 and MATH2065 as an alternative.

AMME2700
Instrumentation

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs. **Prerequisites:** AERO1560 OR MECH1560 OR MTRX1701 OR ENGG1800 **Assumed knowledge:** ENGG1801. Programming Skills, 1st Year maths skills, familiarity with fundamental Aerospace concepts. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to develop in students an understanding of the engineering measurements and instrumentation systems. The students will acquire an ability to make accurate and meaningful measurements. It will cover the general areas of electrical circuits and mechanical/electronic instrumentation for strain, force, pressure, moment, torque, displacement, velocity, acceleration, temperature and so on.

Students in combined degrees are exempt from this unit.

AMME2500
Engineering Dynamics

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs **Prerequisites:** ENGG1802 and (MATH1001 or MATH1901) and (MATH1002 or MATH1902) **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to teach: Dynamics of Rigid Bodies: Analysis of Planar mechanisms; Kinematics of rigid bodies; Kinetics of rigid bodies. Students will also develop their skills in: how to model and analyse dynamic systems and the application of theory to real systems through practical/laboratory sessions.

At the end of this unit students will have developed skills in modelling and analysing planar mechanisms and rigid body dynamic systems.

Course content will include planar mechanisms, linkages, mobility; instant centres of rotation, Kennedy's theorem; velocity and acceleration polygons; kinematics of rigid bodies, frames of reference, velocity and acceleration, rotating frame of reference, relative velocity and acceleration, gyroscopic acceleration; kinetics of rigid bodies, linear momentum and Euler's first law; angular momentum and Euler's second law; centre of mass; moments of inertia, parallel axis and parallel plane theorems, principal axes and principal moments of inertia, rotation about an axis; impulse and momentum; work and energy, kinetic and potential energies; applications to orbital and gyroscopic motion; introduction to Lagrangian methods.

BEHons/BSc students can enrol in PHYS2011, PHYS2012, or advanced equivalent, as acceptable alternative.

AMME2261
Fluid Mechanics 1

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs/semester. **Prohibitions:** AMME2200 **Assumed knowledge:** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit covers the fundamentals of fluid statics and fluid dynamics. At the end of this unit students will have: an understanding of the basic equations governing the statics and dynamics of fluids; the ability to analyze and determine the forces applied by a static fluid; the ability to analyse fluids in motion. The course will cover both inviscid and viscous fluid flow. The course will introduce the relevant parameters for fluid flow in internal engineering systems such as pipes and pumps and external systems such as flow over wings and airfoils. Course content will cover the basic concepts such as viscosity, density, continuum, pressure, force, buoyancy and acceleration; and more detailed methods including continuity, conservation of momentum, streamlines and potential flow theory, Bernoulli equation, Euler equation, Navier-Stokes equation. Experiments will introduce flow measuring devices and flow observation.

AMME2262
Thermal Engineering 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs. **Prohibitions:** AMME2200 **Assumed knowledge:** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to teach the basic laws of thermodynamics and heat transfer. At the end of this unit students will have: an understanding of the basic laws of thermodynamics and heat transfer; The ability to analyze the thermodynamics of a simple open or closed engineering system. The basic knowledge to analyse and design 1D thermal circuits. Course content will include concepts of heat and work, properties of substances, first law of thermodynamics, control mass and control volume analysis, thermal efficiency, entropy, second law of thermodynamics, reversible and irreversible processes, isentropic efficiency, power and refrigeration cycles, heat transfer by conduction, convection and radiation, 1D thermal circuits and transient heat transfer.

MECH2400
Mechanical Design 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 1 hr/week. **Assumed knowledge:** ENGG1801 and ENGG1802, HSC Maths and Physics **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Aim: For students to experience a realistic the design process and to develop good engineering skills.

Course Objectives: To develop an understanding of:

1. the need for and use of standard drawings in the communication and definition of parts and assemblies,
2. Efficient use of a CAD package
3. creativity,
4. the design process from initial idea to finished product
5. Methods used to analyse designs
6. standard components.

AERO2705
Space Engineering 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** (AERO1560 OR MECH1560 OR MTRX1701 OR ENGG1800) AND MATH1001 AND MATH1002 AND MATH1003 **Assumed knowledge:** First Year Maths and basic MATLAB programming skills. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to introduce students to the terminology, technology and current practice in the field of Space Engineering. Course content will include a variety of topics in the area of orbital mechanics, satellite systems and launch requirements. Case studies of current systems will be the focus of this unit.

Third year

AERO3260
Aerodynamics 1

Credit points: 6 **Session:** Semester 2 **Classes:** Laboratory 3 hrs/week; Lecture 3 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** (AMME2200 OR AMME2261) AND (MATH2061 OR MATH2067 OR MATH2961) **Assumed knowledge:** General conservation equations applied to fluid flow; Fundamental elements of potential flow; Vorticity and its effect on ideal flow; Basic mathematical skills required for plotting and graphing data; Linear algebra for solution of simultaneous linear equations; Fourier series; Complex numbers and complex functions. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This UoS should prepare students to be able to undertake aerodynamic performance calculations for industry design situations.

The unit aims to develop a knowledge and appreciation of the complex behaviour of airflow in the case of two dimensional aerofoil sections and three dimensional wings; To encourage hands-on experimentation with wind-tunnel tests to allow an understanding of these concepts and their range of applicability. To understand the limitations of linearised theory and the effects of unsteady flow.

AERO3360
Aerospace Structures 1

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** AMME2301 **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to develop a student's understanding of the theoretical basis of advanced aerospace structural analysis; and introduce students to the solution of real-world aircraft structural problems. This UoS will develop the following attributes: An understanding of the derivation of the fundamental equations of elasticity and their application in certain analytical problems; An understanding of plate theory and the ability to use this to obtain analytical solutions for plate bending and buckling problems; An understanding of energy-method to develop a deeper appreciation for the complexities of designing solution techniques for structural problems; An understanding of the basic principals behind stressed-skin aircraft construction and the practical analysis of typical aircraft components, including the limitations of such techniques.

At the end of this unit students will have an understanding of: 2-D and 3-D elasticity: general equations and solution techniques; Energy methods in structural analysis, including the principles of virtual work and total potential and complimentary energies; Fundamental theory of plates, including in-plane and bending loads as well as buckling and shear instabilities; Solution techniques for plate problems including: Navier solutions for rectangular plates; Combined bending and in-plane loading problems; Energy methods for plate-bending; and Plate buckling for compression and shear loadings; Bending of beams with unsymmetrical cross-sections; Basic principals and theory of stressed-skin structural analysis; Determination of direct stresses and shear flows in arbitrary thin-walled beams under arbitrary loading conditions including: Unsymmetrical sections, Open and closed sections, Single and multi-cell closed sections, Tapered sections, Continuous and idealized sections; The analysis of common aircraft components including fuselages, wings, skin-panels, stringers, ribs, frames and cut-outs; The effects of end constraints and shear-lag on the solutions developed as well as an overall appreciation of the limitations of the solution methods presented.

AERO3460
Aerospace Design 1

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Project Work - in class 2 hrs/week; Project Work - own time 4 hrs/week. **Prerequisites:** AMME2301 and MECH2400 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to introduce students to the theory and practice of aircraft component design. In doing so it will emphasize all the considerations, trade-offs and decisions inherent in this process and thus enable students to gain an understanding of why aircraft structures are designed in the way they are with respect to aircraft operational, certification, manufacturing and cost considerations. At the end of this unit students will be able to understand the design process, especially as it applies to aircraft individual component design; Have a familiarity with some of the standard industry practices for component design; An increasing familiarity with typical aerospace analysis techniques along with the primary failure modes that need to be considered; An understanding of the importance of different failure modes for different components and how these relate to load-conditions; a farmilarity with the operating environment that must be considered when designing components; and understanding of some off the legal and ethical requirements of aircraft design engineers to give a basic understanding of the regulatory framework in which aircraft design is conducted.

AMME3500
System Dynamics and Control

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week. **Prerequisites:** ((MATH2061 or MATH2961) and (MATH2065 or MATH2965)) or MATH2067 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to allow students to develop an understanding of methods for modeling and controlling linear, time-invariant systems. Techniques examined will include the use of differential equations and frequency domain approaches to modeling of systems. This will allow students to examine the response of a system to changing inputs and to examine the influence of external stimuli such as disturbances on system behaviour. Students will also gain an understanding of how the responses of these mechanical systems can be altered to meet desired specifications and why this is important in many engineering problem domains.

The study of control systems engineering is of fundamental importance to most engineering disciplines, including Electrical, Mechanical, Mechatronic and Aerospace Engineering. Control systems are found in a broad range of applications within these disciplines, from aircraft and spacecraft to robots, automobiles, computers and process control systems. The concepts taught in this course introduce students to the mathematical foundations behind the modelling and control of linear, time-invariant dynamic systems. In particular, topics addressed in this course will include:

1. Techniques for modelling mechanical systems and understanding their response to control inputs and disturbances. This will include the use of differential equations and frequency domain methods as well as tools such as Root Locus and Bode plots.

2. Representation of systems in a feedback control system as well as techniques for determining what desired system performance specifications are achievable, practical and important when the system is under control

3. Theoretical and practical techniques that help engineers in designing control systems, and an examination of which technique is best in solving a given problem.

AERO3261
Propulsion

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 1 hr/week; Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** AMME2200 OR (AMME2261

AND AMME2262) **Assumed knowledge:** Good knowledge of fluid dynamics and thermodynamics **Assessment:** Through semester assessment (55%) Final Exam (45%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This UoS teaches the students the techniques used to propel aircraft. The students will learn to analyse various propulsion systems in use - propellers, gas turbines, etc.

The topics covered include:

Propulsion unit requirements for subsonic and supersonic flight; thrust components, efficiencies, additive drag of intakes. Piston engine components and operation. Propeller theory. Operation, components and cycle analysis of gas turbine engines; turbojets; turbofans; turboprops; ramjets. Components: compressor; fan; burner; turbine; nozzle. Efficiency of components; Off-design considerations. Future directions; minimisation of noise and pollution; scram-jets; hybrid engines.

AERO3560
Flight Mechanics 1

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/semester. **Prerequisites:** AMME2500 **Corequisites:** AMME3500 **Assumed knowledge:** This Unit of Study builds on basic mechanics and aerodynamics material covered in previous Units and focuses it towards the analysis and understanding of aircraft flight mechanics. It is expected that students have satisfactorily completed the following material: ENGG1802 Engineering Mechanics: Forces, moments, equilibrium, momentum, energy, linear and angular motion. AMME2500 Engineering Dynamics 1: Mechanisms, kinematics, frames of reference, mass and inertia, dynamics. If you struggled to pass MECH2500 and/or ENGG1802, you should spend some time revising the material of those Units of Study early in the semester. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to develop an understanding of aircraft longitudinal equilibrium, static stability, dynamic stability and response. Students will develop an understanding of the importance and significance of flight stability, will gain skills in dynamic system analysis and will learn mathematical tools used for prediction of aircraft flight behaviour. Students will gain skills in problem solving in the area of flight vehicle motion, and learn the fundamentals of flight simulation.

At the end of this unit students will be able to understand: aircraft flight conditions and equilibrium; the effects of aerodynamic and propulsive controls on equilibrium conditions; the significance of flight stability and its impact of aircraft operations and pilot workload; the meaning of aerodynamic stability derivatives and their sources; the effects of aerodynamic derivatives on flight stability; the impact of flight stability and trim on all atmospheric flight vehicles. Students will also be able to model aircraft flight characteristics using computational techniques and analyse the aircraft equations of rigid-body motion and to extract stability characteristics.

Unit content will include static longitudinal aircraft stability: origin of symmetric forces and moments; static and manoeuvring longitudinal stability, equilibrium and control of rigid aircraft; aerodynamic load effects of wings, stabilisers, fuselages and power plants; trailing edge aerodynamic controls; trimmed equilibrium condition; static margin; effect on static stability of free and reversible controls.

AERO3760
Space Engineering 2

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Practical Experience 2 hrs/week. **Prerequisites:** AERO2705 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to provide students with a learning environment that promotes systems thinking and allows students to develop skills in systems analysis and design. In particular the UoS will focus on Aerospace systems, and students will develop both theoretical and practical skills in the area of systems engineering for this discipline. The primary objective is to develop fundamental systems engineering and systems thinking skills. At the end of this unit students will be able to: define the requirements process and be able to apply it to aerospace systems design.; conduct requirements analysis for an aerospace system and to drill down through requirements breakdown and the use of the V-diagram in this analysis; conduct functional and technical analysis and determine design drivers in a system; manage the use of a log book and its application in engineering design; develop technical skills in the design and development of satellite subsystems; conduct appropriate interaction processes between team members for the successful achievement of goals. Course content will include fundamentals of systems engineering; satellite subsystems; systems design.

Fourth year

AERO4701
Space Engineering 3

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** AERO3760 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This UoS aims to teach students the fundamental principles and methods of designing solutions to optimal estimation and control problems in space engineering applications. Students will apply learned techniques in optimal estimation and control theory to solving a wide range of different problems in engineering such as satellite orbit determination, satellite attitude determination, satellite positioning systems and remote sensing, optimal flight control, space shuttle re-entry and orbit transfers. Students will learn to recognize and appreciate the coupling between the different elements within an estimation and control task, from a systems-theoretic perspective.

ENGG4000
Practical Experience

Session: Semester 1, Semester 2 **Classes:** Practical Experience, **Prerequisites:** 36 Credit Points of Senior Units **Assessment:** Through semester assessment (100%) **Mode of delivery:** Professional practice

Note: Students should have completed three years of their BE program before enrolling in this unit.

The aim of this unit is to give students exposure to work in an engineering organisation and gain some professional experience; to enhance a student's abilities and experience in report writing; to encourage self-evaluation in the context of applying their theoretical knowledge to real industry practise. Students will gain a better appreciation of the role of engineers in the workplace. The assessment will enhance the student's ability to present structured observations and reflections in the mode of a formal written report.

Each student is required to gain exposure to professional engineering practice and environments and to submit a satisfactory written report of his or her work. The report will include the requirement of a detail logbook recording tasks given and timelines set for achieving these. Self-evaluation of a student's personal level of knowledge and its applicability to the workplace is a major component of the reporting. Normally 12 weeks (60 days) of practical work experience is required, though the Faculty may accept alternatives that are judged as equivalent. Students are strongly encouraged to undertake their work experience in the break between Year 3 and 4 and definitely prior to commencing their final semester of study, however any engineering work taken after completing 28 credit points of 3rd year units of study may be accepted for the requirements of this unit. The University Careers and Appointments Service is available to assist students to obtain suitable employment. This unit of study is a core unit of study in all BE programs and must be passed in order to graduate from those programs.

Students should have completed three years of their Bachelor of Engineering Honours program before enrolling in this unit.

Students must enrol in 12cp of Thesis units

AMME4111
Honours Thesis A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research 10 hrs/week. **Prerequisites:** 36 credits of 3rd year units of study. **Prohibitions:** AMME4010, AMME4121, AMME4122 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: Honours Thesis A is only available to students with an HWAM of 65 or over. HWAM is a weighted *average based on all 2000, 3000 and 4000 level units completed prior to enrolment in this unit. Prospective students in Honours Thesis A are expected to have consulted with supervisors and selected a topic of interest at the end of third year, guided by the advertised list of suggested thesis topics and supervisors. Availability of topics is limited and students should undertake to speak with prospective supervisors as soon as possible. Students who are unable to secure a supervisor and topic will be allocated a supervisor by the unit coordinator. Alternatively, students may do a thesis with a supervisor in industry or in another university department. In this case, the student must also find a second supervisor within the School of AMME.*

The fourth year honours thesis aims to provide students with the opportunity to carry out a defined piece of independent research in a setting and in a manner that fosters the development of engineering research skills. These skills include the capacity to define a research question, showing how it relates to existing knowledge, identifying the tools needed to investigate the question, carrying out the research in a systematic way, analysing the results obtained and presenting the outcomes in a report that is clear, coherent and logically structured. Honours thesis is undertaken across two semesters of enrolment, in two successive Units of Study of 6 credits points each. Honours Thesis A covers first steps of thesis research starting with development of research proposal. Thesis B covers the second of stage writing up and presenting the research results.

Students are asked to write a thesis based on a research project, which is very often related to some aspect of a staff member's research interests. Some projects will be experimental in nature, others may involve computer-based simulation, feasibility studies or the design, construction and testing of equipment. Direction of thesis work may be determined by the supervisor or be of an original nature, but in either case the student is responsible for the execution of the practical work and the general layout and content of the thesis itself. The final thesis must be the student's individual work, although research is sometimes conducted in the framework of a group project shared with others. Students undertaking research on this basis will need to take care in ensuring the individual quality of their own research work and the final thesis submission. The thesis will be judged on the extent and quality of the student's original work and particularly how critical, perceptive and constructive he or she has been in assessing his/her work and that of others. Students will also be required to present the results of their findings to their peers and supervisors as part of a seminar program.

It is not expected that a thesis at this level will represent a significant contribution to new knowledge; nor is it expected that theses will resolve great intellectual problems. The timeframe available for the thesis is simply too short to permit students to tackle complex or difficult problems. Indeed, a key aim of the thesis is to specify a research topic that arouses sufficient intellectual curiosity, and presents an appropriate range and diversity of technical and conceptual challenges, while remaining manageable and allowing achievable outcomes within the time and resources available. It is important that the topic be of sufficient scope and complexity to allow a student to learn their craft and demonstrate their research skills. Equally imperative is that the task not be so demanding as to elude completion.

Normally taken in Semester 1

AMME4112
Honours Thesis B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research 10 hrs/week. **Prerequisites:** 36 credits of 3rd year units of study and WAM 65 or over **Prohibitions:** AMME4010, AMME4122, AMME4121 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: HWAM of 65 or greater required for enrolment. HWAM is the weighted average of all 2000, 3000 and 4000 level units completed prior to enrolment in this unit.

The fourth year honours thesis aims to provide students with the opportunity to carry out a defined piece of independent research or design work in a setting and in a manner that fosters the development of engineering skills in research or design. These skills include the capacity to define a research or design question, showing how it relates to existing knowledge, identifying the tools needed to investigate the question, carrying out the research or design in a systematic way, analysing the results obtained and presenting the outcomes in a report that is clear, coherent and logically structured. Honours thesis is undertaken across two semesters of enrolment, in two successive Units of Study of 6 credits points each. Honours Thesis A covers first steps of thesis research starting with development of research proposal. Thesis B covers the second of stage writing up and presenting the research results.

Students are asked to write a thesis based on a research or major design project, which is very often related to some aspect of a staff member's research interests. Some projects will be experimental in nature, others may involve computer-based simulation, feasibility studies or the design, construction and testing of equipment. Direction of thesis work may be determined by the supervisor or be of an original nature, but in either case the student is responsible for the execution of the practical work and the general layout and content of the thesis itself. The final thesis must be the student's individual work, although research is sometimes conducted in the framework of a group project shared with others. Students undertaking research on this basis will need to take care in ensuring the individual quality of their own research work and the final thesis submission. The thesis will be judged on the extent and quality of the student's original work and particularly how critical, perceptive and constructive he or she has been in assessing his/her work and that of others. Students will also be required to present the results of their findings to their peers and supervisors as part of a seminar program.

It is not expected that a thesis at this level will represent a significant contribution to new knowledge; nor is it expected that theses will resolve great intellectual problems. The time frame available for the thesis is simply too short to permit students to tackle complex or difficult problems. Indeed, a key aim of the thesis is to specify a research or design topic that arouses sufficient intellectual curiosity, and presents an appropriate range and diversity of technical and conceptual challenges, while remaining manageable and allowing achievable outcomes within the time and resources available. It is important that the topic be of sufficient scope and complexity to allow a student to learn their craft and demonstrate their research or design skills. Equally imperative is that the task not be so demanding as to elude completion.

Normally taken in Semester 2

Acceptable alternative units of study

BEHons/BSc students can enrol in PHYS2011, PHYS2012, or advanced equivalent, as acceptable alternative to AMME2500. Most units of study offered by the Faculty of Science shown in the tables can be replaced by an equivalent advanced level unit, subject to prerequisite conditions (as required by the Faculty of Science) being met.Students undertaking Study Abroad in a particular year of their degree must enrol in the appropriate AMME International Exchange Program units of study as an alternative to a semester's standard units.

Resolutions of the Faculty of Engineering and Information Technologies relating to this table:

BEHons (Aeronautical)(Space)

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete 30 credit points of recommended elective units of study for Aeronautical (Space) Engineering and 6 credit points of free elective units of study. A minimum of 192 credit points is required to be eligible for the award of BE(Aeronautical)(Space).

BEHons (Aeronautical)(Space)/BSc or BMedSc or BCom or BPM

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete at least 12 credit points of recommended elective units of study for Aeronautical (Space) Engineering and 96 credit points of units of study given by the Faculty of Science for the BE/BSc or BE/BMedSc; or the Business School for the BE/BCom or from the core units table for BPM. A minimum of 240 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies and the faculty in which they are undertaking the combined degree.

BEHons (Aeronautical)(Space)/BA

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete at least 18 credit points of recommended elective units of study for Aeronautical (Space) Engineering and 84 credit points of units of study given by the Faculty of Arts and Social Sciences for the BE/BA. A minimum of 240 credit points is required to be eligible for the combined degree. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Technologies and the faculty in which they are undertaking the combined degree.

BEHons (Aeronautical)(Space)/LLB

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete at least 12 credit points of recommended elective units of study for Aeronautical (Space) Engineering and 144 credit points of units of study given by the Faculty of Law for the BE/LLB. A minimum of 288 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies and the Faculty of Law.

Recommended elective units of study

AERO3660
Aerospace Management

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Lecture 2 hrs/week; Working in assignments and Major Project 6 hrs/week. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit has two parts.

The first part aims to develop knowledge and understanding of the current state of aerospace design, manufacturing, and operations in the Australian aviation industry. Students will gain skills in aerospace engineering management. On satisfactory completion of this unit, students will be able to apply risk management skills to a variety of industry situations and use appropriate methodology to manage these situations. Students will also become proficient in the use of Project Management tools and learn how to apply them to industry standard problems. Subject areas covered within the Unit of Study include principles and practice of aviation and airline management; discussion and analysis of airline operations and management in aerospace engineering design.

The second part addresses general management principles as applies particularly to engineering and industrial settings. It aims to provide knowledge of the principles and tools that can assist communication, supervision, project management, team membership, decision making and management of human resources.

At the end of this unit students will be able to understand different management practices and approaches applicable to a broad range of environments. The concepts covered are from the following management areas: Engineers and Management - including ethics , Communication and People in Organisations, Economics, Leadership, Strategic Management, Managerial Decision Analysis, Marketing, Business Planning, Legal Environment of Business, Risk Management, Human Resource Management, Project Management, Quality Assurance and Management, Operations Management, and Financial Management.

AERO4260
Aerodynamics 2

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** AMME2200 **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to introduce students to: elementary and advanced topics in Gasdynamics (High Speed Flows). Course content will include review of Equations of Gasdynamics, One-Dimensional Gas Flow, Isentropic Flows, Normal Shock, Flow in a Converging and Converging-Diverging Nozzle, Steady Two-dimensional Supersonic Flow, Shock waves (Normal and Oblique), Method of Characteristics, Two-dimensional Supersonic Aerofoils, Introduction to Three Dimensional Effects, Unsteady Flows, Moving Shocks, Shock Tube Flow and Transonic Flow and Compressible Boundary Layers, introduction to turbulent flows.

At the end of this unit the student will be able to calculate a high speed flow about an aerofoil and compressible flow through a duct of varying cross-section and will have a good appreciation of Transonic and Hypersonic Flows.

AERO4360
Aerospace Structures 2

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2.5 hrs/week; Laboratory/Tutorial 2 hrs/week. **Prerequisites:** AERO3360 **Assumed knowledge:** AERO3465 **Assessment:** Through semester assessment (55%) Final Exam (45%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to teach fundamentals of modern numerical and analytical techniques for evaluating stresses, strains, deformations and strengths of representative aerospace structures. In particular the focus is on developing an understanding of: Fundamental concepts and formulations of the finite element methods for basic structural analysis; Elements for typical aerospace structures, such as beams/frames, plates/shells, and their applications and limitations; Finite element techniques for various types of problems pertinent to aerospace structures; d)and, developing hands-on experience of using selected commercial finite element analysis program.

At the end of this unit of study the following will have been covered: Introduction to Finite Element Method for modern structural and stress analysis; One-dimensional rod elements; Generalization of FEM for elasticity; Two- and three-dimensional trusses; FEA for beams and frames in 2D and 3D; Two-dimensional problems using constant strain triangular elements; The two-dimensional isoparametric elements; Plates and shells elements and their applications; FEA for axisymmetric shells and pressure vessels, shells of revolution; FEA for axisymmetric solids subjected to axi-symmetric loading; FEA for structural dynamics, eigenvalue analysis, modal response, transient response; Finite element analysis for stress stiffening and buckling of beams, plates and shells; Three-dimensional problems in stress analysis; Extensions to the element library, higher order elements, special elements; Constraints; FEA modeling strategy; FEA for heat conduction; FEA for non-linear material and geometric analysis.

AERO4560
Flight Mechanics 2

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** AERO3560 and AMME3500 **Assumed knowledge:** AMME2500 develops the basic principles of engineering mechanics and system dynamics that underpin this course. AERO3560 Flight Mechanics 1 develops the specifics of aircraft flight dynamics and stability. AMME3500 Systems control covers basic system theory and control system synthesis techniques. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to develop an understanding of the application of flight mechanics principles to modern aircraft systems. Students will gain skills in problem solving in the areas of dynamic aircraft behaviour, aircraft sensitivity to wind gusts, control systems development and aircraft handling analysis.

At the end of this unit students will be able to: understand the nature of an aircraft's response to control inputs and atmospheric disturbances, including the roles of the various modes of motion; analyse an aircraft's response to control inputs in the frequency domain using Laplace Transforms and Transfer Function representations; represent and model wind gust distributions using stochastic methods (Power Spectral Density); analyse an aircraft's response to disturbances (wind gust inputs) by combining Transfer Function representations with gust PSD's; understand the principles of stability augmentation systems and autopilot control systems in aircraft operation, their functions and purposes; understand basic feedback control systems and classical frequency domain loop analysis; understand the characteristics of closed loop system responses; understand the characteristics of PID, Lead, Lag and Lead-Lag compensators, and to be competent in designing suitable compensators using Bode and Root-locus design techniques; design multi-loop control and guidance systems and understand the reasons for their structures.

AERO5200
Advanced Aerodynamics

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** AERO5210 OR AERO9260 OR AERO3260 **Assumed knowledge:** BE in the area of Aerospace Engineering or related Engineering field. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

Objectives/Expected Outcomes:

To develop a specialist knowledge in the fields of computational, non-linear and unsteady and aerodynamics. The develop familiarity with the techniques for predicting airflow/structure interactions for aerospace vehicles.

Syllabus Summary:

(a) Advanced two and three dimensional panel method techniques; calculation of oscillatory flow results; prediction of aerodynamic derivatives. Pressure distributions for complete aircraft configuration. Unsteady subsonic flow analysis of aircraft; calculation of structural modes. Structural response to gusts; aeroelasticity; flutter and divergence. Solution of aerospace flow problems using finite element methods.

(b) Unsteady supersonic one-dimensional flow. Hypersonic flow; real gas effects. Introduction to the use of CFD for transonic flow.

(c) Rarefied gas dynamics. Direct simulation method (DSMC); near-continuum solutions. Simulation techniques for numerical solutions of non-linear continuum flow.

AERO5400
Advanced Aircraft Design Analysis

Credit points: 6 **Session:** Semester 2 **Classes:** Project Work - in class 3 hrs/week; Lecture 2 hrs/week; Meeting 2 hrs/week. **Prerequisites:** AERO3460 OR AERO5410 OR AERO9460 **Prohibitions:** : AERO4491 **Assumed knowledge:** (AERO1400, AERO3260, AERO3261, AERO3360, AERO3465, AERO3560, AERO4460) or equivalent. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This Unit aims to provide familiarity and understanding with practical aircraft design processes expected in industry, including the evaluation and case studies of existing aircraft designs. Students will gain a better understanding of relevant issues particularly related to the design of aircraft with a level of confidence to lead them to develop new designs or modifications, having a good balance between theory and real-world applications. Good familiarity with unique and stringent international aviation regulations and certification processes will be expected with respect to the design of aircraft. Topics coved by the lectures will include aircraft specifications; aircraft selection and evaluation; aircraft configuration design; design considerations for aerodynamics, structures, systems, manufacture, testing, certification, life-cycle-cost, operations; the use of computational aircraft design tools, in particular DARcorp`s Advanced Aircraft Analysis (AAA); and introduction to multidisdiplinary design optimisation methods. Projects will be based on case study analyses and evaluation of aircraft types to operational specifications and requirements.

AERO5500
Flight Mechanics Test and Evaluation Adv

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** AERO5510 OR AERO9560 OR AERO3560 **Assumed knowledge:** BE in the area of Aerospace Engineering or related Engineering field. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to develop an understanding of aircraft flight test, validation and verification, and the development of modern flight control, guidance, and navigation systems. Students will gain skills in analysis, problem solving and systems design in the areas of aircraft dynamic system identification and control.

At the end of this unit students will be able to understand elements of the following: the principles of stability augmentation systems and autopilot control systems in aircraft operation, their functions and purposes; the characteristics of closed loop system responses; advanced feedback control systems and state-space design techniques; the concepts of parameter and state estimation; the design of observers in the state space and the implementation of a Kalman Filter; multi-loop control and guidance systems and the reasons for their structures; flight test principles and procedures and the implementation a flight test programme.

AERO5520
Aircraft Avionics and Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Workgroup 2 hrs/week; Laboratory 2 hrs/week; Site Visit 5 hrs/week; Demonstration 2 hrs/week. **Prerequisites:** AERO5510 or AERO3560 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit of study aims to develop a thorough qualitative understanding of modern avionics and aircraft systems. It deals with the full breadth of cockpit avionics systems and subsystems from flight instrument and display technology to flight management, flight control, navigation and sensor systems.

At the end of this unit students will be able to understand the following: the principles of modern cockpit display technologies and the information they portray; the functions of flight control and navigation systems and their interactions with actuation and other aircraft systems; engine management systems; communication systems; payload sensor systems; the interactions of avionics components with power, hydraulic, bus and communication systems together with their underlying physical principles; the principles of avionics system requirements, specification , design, regulation and certification; fault tolerance and redundancy; software engineering and system integration.

AERO5700
Space Engineering (Advanced)

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** AERO3760 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Planetary observation using robotics and intelligents systems will grow in importance over the next decade. These systems can take the form of either intelligent spacecraft, robotic air vehicles or planetary rovers. In this subject we will study a wide range of robotic spacecraft systems that are used for planetary observation and focus on their specifications as well as their internal systems. From a practical perspective will be working hands on with the Mars Rover developed at the University of Sydney to study the various intelligent components and how they come together.

AMME5202
Advanced Computational Fluid Dynamics

Credit points: 6 **Session:** Semester 1 **Classes:** Laboratory 2 hrs/week; Lecture 1 hr/week; Tutorial 1 hr/week. **Assumed knowledge:** Partial differential equations; Finite difference methods;Taylor series; Basic fluid mechanics including pressure, velocity, boundary layers, separated and recirculating flows. Basic computer programming skills. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Objectives: To provide students with the necessary skills to use commercial Computational Fluid Dynamics packages and to carry out research in the area of Computational Fluid Dynamics. Expected outcomes: Students will have a good understanding of the basic theory of Computational Fluid Dynamics, including discretisation, accuracy and stability. They will be capable of writing a simple solver and using a sophisticated commercial CFD package. Syllabus summary: A course of lectures, tutorials and laboratories designed to provide the student with the necessary tools for using a sophisticated commercial CFD package. A set of laboratory tasks will take the student through a series of increasingly complex flow simulations, requiring an understanding of the basic theory of computational fluid dynamics (CFD). The laboratory tasks will be complemented by a series of lectures in which the basic theory is covered, including: governing equations; finite difference methods, accuracy and stability for the advection/diffusion equation; direct and iterative solution techniques; solution of the full Navier-Stokes equations; turbulent flow; Cartesian tensors; turbulence models.

AMME5510
Vibration and Acoustics

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/week. **Assumed knowledge:** (AMME2301 OR AMME9301) AND AMME2200 AND (AMME2500 OR AMME9500) **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This UoS should prepare the student to be able to undertake vibration and acoustic measurement calculations for industry design situations.

The unit aims to introduce a number of new concepts required for analysis of vibrations and acoustics. The response of structure under different dynamic forces, including human and aerodynamic, will be investigated. A number of hands-on experiments will be performed to allow an understanding of the concepts and applicability.

The acoustics component will include: basic acoustics theory, sound generation and propagation, impedance, absorbing materials, industrial noise sources, isolation methods of noise control, enclosures, instrumentation and measurement, frequency analysis, noise regulations and computational acoustics.

AMME5520
Advanced Control and Optimisation

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Research 1 hr/week. **Prerequisites:** AMME3500 OR AMME5501 OR AMME9501 **Assumed knowledge:** Students have an interest and a strong understanding of feedback control systems, specifically in the area of system modelling and control design in the frequency domain. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces engineering design via optimization, i.e. finding the "best possible" solution to a particular problem. For example, an autonomous vehicle must find the fastest route between two locations over a road network; a biomedical sensing device must compute the most accurate estimate of important physiological parameters from noise-corrupted measurements; a feedback control system must stabilize and control a multivariable dynamical system (such as an aircraft) in an optimal fashion.

The student will learn how to formulate a design in terms of a "cost function", when it is possible to find the "best" design via minimization of this "cost", and how to do so. The course will introduce widely-used optimization frameworks including linear and quadratic programming (LP and QP), dynamic programming (DP), path planning with Dijkstra's algorithm, A*, and probabilistic roadmaps (PRMs), state estimation via Kalman filters, and control via the linear quadratic regulator (LQR) and Model Predictive Control (MPC). There will be constant emphasis on connections to real-world engineering problems in control, robotics, aerospace, biomedical engineering, and manufacturing.

Additional Electives

Students can select the unit below or other elective units offered within the University that are approved by Head of School of Aerospace, Mechanical, and Mechatronics Engineering.

ENGG1000
History and Philosophy of Engineering

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Tutorial 1 hr/week; Independent research/study 5 hrs/week; E-Learning 2 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

ENGG1000 is a unique course that aims to provide students with an understanding of the historical development of Engineering with relation to societal expectations of the period. Engineering as a field of study and profession has developed over millennia from simple (yet significant) advances in technology such as the lever and wheel, to modern day examples such as advanced computers, nanomaterials and space flight.

Interaction between human society and Engineers has helped develop and guide the advancement of engineering technology; with society posing problems for Engineers to solve and Engineers developing new technology that changed the course of human history, and helped shape the world we live in.

The general philosophy behind Engineering is that Engineers work to fulfil the needs of society (water, electricity, technological improvements etc.), and as such Engineers are expected to act ethically towards society. The role of Engineers in society will be analysed and discussed from a humanistic perspective, with relation to the current Engineers Australia code of ethics. Other relevant philosophical analyses of Engineering as a skill and profession will also be examined such as, aesthetics, creativity, the epistemology of Engineering and more.

This course will use online resources extensively and help develop research and communication skills of students, whilst providing an overview of the historical significance of Engineers in society, and what it means to be an Engineer.

AMME2000
Engineering Analysis

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** (MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) and ENGG1801. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **Assessment:** Through semester assessment (35%) Final Exam (65%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This course is designed to provide students with the necessary tools for mathematically modelling and solving problems in engineering. Solution methods will be considered for a range of standard engineering problems including; Conduction heat transfer in one and two dimensions, hydrostatics and hydrodynamic balance for internal and external flows, spring/mass systems, vibration and stability problems. The focus will be on real problems and numerical solution methods and will include separation of variables; Fourier series and Fourier transforms; Laplace transforms; scaling and finite differences.

Note

Choice of electives as shown in the above table will depend on subject availability, timetabling and prerequisite conditions.

For a standard enrolment plan for Aeronautical (Space) Engineering visit cusp.sydney.edu.au/students/view-degree-page/name/BE(Aero)(Space)

Bachelor of Engineering Honours (Mechanical)

Course Overview

Mechanical engineers design and develop everything you think of as a machine, from supersonic fighter jets to bicycles and toasters. The Bachelor of Engineering Honours (Mechanical) will teach you how to design a mechanical component, a whole machine, a mechanical system and a mechanical process.

You will learn how to analyse mechanical design, using the principles of motion, energy, and force to ensure the safety and reliability of products, and you will understand how efficient systems and processes support the manufacture of products at a competitive cost.

As a mechanical engineering graduate you may specialise in areas such as manufacturing, automotive, transportation or air conditioning. Mechanical engineers work in the automotive, aerospace, chemical, computer, communication, paper, and power generation industries. Increasingly, mechanical engineers are needed in the environmental and biomedical fields; you may pursue a career in the expanding field of nanotechnology. You may also choose to use your degree as preparation for admission to a graduate program in medicine or law at Sydney.

Course Requirements

To meet requirements for the Bachelor of Engineering Honours (Mechanical), a candidate must successfully complete 192 credit points, comprising:

1. core and elective units of study relating to the specialist stream, as prescribed by the table of units of study for the stream; and
2. any additional free elective units of study as may be necessary to gain credit to complete the award.

For a standard enrolment plan for Mechanical Engineering visit cusp.sydney.edu.au/students/view-degree-page/name/BE(Mech)

Unit of Study Table

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
Bachelor of Engineering Honours (Mechanical)			
Candidates for the Bachelor of Engineering Honours (Mechanical) are required to gain credit for the core units of study set out below. Any additional credit necessary shall be gained by completing additional credit points of elective units of study as recommended by the Faculty, as may be necessary to gain credit for a total of not less than 192 credit points.			
Core units of study			
First year			
MECH1560 **Introduction to Mechanical Engineering**	6	**N** MTRX1701, AERO1560, ENGG1800 *Note: Department permission required for enrolment* *Limited Places due to TAFE component. Department Permission required for non-BE(Mech) students.*	Semester 1
MATH1001 **Differential Calculus**	3	**A** HSC Mathematics Extension 1 **N** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001	Semester 1 Summer Main
MATH1002 **Linear Algebra**	3	**A** HSC Mathematics or MATH1111 **N** MATH1902, MATH1012, MATH1014	Semester 1 Summer Main
ENGG1801 **Engineering Computing**	6		Semester 1 Summer Late
ENGG1803 **Professional Engineering 1**	6	**N** ENGG1061	Semester 1 Semester 2
Normally taken in Semester 1, students in combined degrees are exempt from this unit.			
MATH1003 **Integral Calculus and Modelling**	3	**A** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **N** MATH1013, MATH1903, MATH1907	Semester 2 Summer Main
MATH1005 **Statistics**	3	**A** HSC Mathematics **N** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021	Semester 2 Summer Main Winter Main
ENGG1802 **Engineering Mechanics**	6		Semester 2 Summer Main
MECH1400 **Mechanical Construction**	6	**A** Material from MECH1560 (steam engine), HSC studies (Maths, Physics, Chemistry). *Note: Department permission required for enrolment*	Semester 2
Students in combined degrees are exempt from this unit.			
AMME1362 **Materials 1**	6	**N** AMME2302, CIVL2110	Semester 2
Second year			
AMME2500 **Engineering Dynamics**	6	**P** ENGG1802 and (MATH1001 or MATH1901) and (MATH1002 or MATH1902)	Semester 1
MATH2067 **DEs and Vector Calculus for Engineers**	6	**P** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **N** MATH2901, MATH2961, MATH2005, MATH2965, MATH2001, MATH2905, MATH2061, MATH2065	Semester 1
Students in the combined BEHons/BSc degree program can take both MATH2061 and MATH2065 as an alternative.			
AMME2700 **Instrumentation**	6	**A** ENGG1801. Programming Skills, 1st Year maths skills, familiarity with fundamental Aerospace concepts. **P** AERO1560 OR MECH1560 OR MTRX1701 OR ENGG1800	Semester 1
Students in combined degrees are exempt for this unit.			
AMME2301 **Mechanics of Solids**	6	**P** ENGG1802, MATH1001, MATH1002, MATH1003	Semester 2
AMME2261 **Fluid Mechanics 1**	6	**A** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **N** AMME2200	Semester 1
AMME2262 **Thermal Engineering 1**	6	**A** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **N** AMME2200	Semester 2
MECH2400 **Mechanical Design 1**	6	**A** ENGG1801 and ENGG1802, HSC Maths and Physics	Semester 2
MECH2660 **Engineering Management**	6	**A** ENGG1803. It is expected that students will understand the concepts previously presented in ENGG1803 Professional Engineering. It is assumed that the students have an understanding of professional engineering issues, and are experienced in academic writing (both essays and reports), including appropriate referencing techniques, oral presentations and the project management process (particularly in group situations). Such previous knowledge will assist students in the development their awareness of the issues involved with engineering management.	Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Third year			
AMME3060 Engineering Methods	6	**P** AMME2000	Semester 2
AMME3500 System Dynamics and Control	6	**P** ((MATH2061 or MATH2961) and (MATH2065 or MATH2965)) or MATH2067	Semester 1
MECH3260 Thermal Engineering 2	6	**A** Fundamentals of thermodynamics and fluid mechanics are needed to begin this more advanced course **P** AMME2200 OR AMME2262.	Semester 2
MECH3261 Fluid Mechanics 2	6	**P** AMME2200 OR AMME2261.	Semester 1
MECH3361 Mechanics of Solids 2	6	**P** AMME2301 and AMME2302	Semester 2
MECH3362 Materials 2	6	**A** This subject requires you to have two important skills to bring in: (1) A good understanding of basic knowledge and principles of material science and engineering from AMME2302 (MECH2300) Materials I and mechanics of solids for simple structural elements (in tension, bending, torsion) from AMME2301 (AERO2300); (2) Reasonable mathematical skills in calculation of stresses and strains in simple structural elements. **P** AMME2301 and AMME2302	Semester 1
MECH3460 Mechanical Design 2	6	**A** Properties of engineering materials including fatigue failure theories. Statics and dynamics properties of machines. Practical use of Word and Excel including the use of the 'solver' and graphing capabilities built into the spreadsheet. The use of a spreadsheet is mandatory. **P** MECH2400 and AMME2301	Semester 2
MECH3660 Manufacturing Engineering	6	**P** MECH2400 or ENGG1960	Semester 1
Fourth year			
ENGG4000 Practical Experience		**P** 36 Credit Points of Senior Units *Students should have completed three years of their BE program before enrolling in this unit.*	Semester 1 Semester 2
Students should have completed three years of their BEHons program before enrolling in this unit.			
Students must select at least one of the following two units of study			
MECH4601 Professional Engineering 2	6	**A** ENGG1803, ENGG4000 It is recommended that you have undertaken ENGG4000 Practical Experience in a period prior to undertaking this course, or be able to demonstrate equivalent understanding of professional practice as some assessment tasks will draw upon your experiences in professional engineering practice.	Semester 1
MECH4460 Mechanical Design 3	6	**A** ENGG1802, AMME2301, AMME2500, MECH3361 **P** MECH2400 and MECH3460	Semester 1
Students must enrol in 12cp of Thesis units			
AMME4111 Honours Thesis A	6	**P** 36 credits of 3rd year units of study. **N** AMME4010, AMME4121, AMME4122 *Note: Department permission required for enrolment* *Honours Thesis A is only available to students with an HWAM of 65 or over. HWAM is a weighted average based on all 2000, 3000 and 4000 level units completed prior to enrolment in this unit. Prospective students in Honours Thesis A are expected to have consulted with supervisors and selected a topic of interest at the end of third year, guided by the advertised list of suggested thesis topics and supervisors. Availability of topics is limited and students should undertake to speak with prospective supervisors as soon as possible. Students who are unable to secure a supervisor and topic will be allocated a supervisor by the unit coordinator. Alternatively, students may do a thesis with a supervisor in industry or in another university department. In this case, the student must also find a second supervisor within the School of AMME.*	Semester 1 Semester 2
Normally taken in Semester 1			
AMME4112 Honours Thesis B	6	**P** 36 credits of 3rd year units of study and WAM 65 or over **N** AMME4010, AMME4122, AMME4121 *Note: Department permission required for enrolment* *HWAM of 65 or greater required for enrolment. HWAM is the weighted average of all 2000, 3000 and 4000 level units completed prior to enrolment in this unit.*	Semester 1 Semester 2
Normally taken in Semester 2			
Acceptable alternative units of study			
Most units of study offered by the Faculty of Science shown in the tables can be replaced by an equivalent advanced level unit, subject to prerequisite conditions (as required by the Faculty of Science) being met.			
Students undertaking Study Abroad in a particular year of their degree must enrol in the appropriate exchange program units of study as an alternative to a semester's standard units.			
Resolutions of the Faculty of Engineering relating to this table:			
Bachelor of Engineering Honours (Mechanical)			
In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete 24 credit points of recommended elective units of study for Mechanical ENgineering and 6 credit points for free elective units of study. A minimum of 192 credit points is required to be eligible for the award of the degree of BE(Mechanical).			
BEHons (Mechanical)/BSc or BCom or BMedSc or BPM			
In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete 6 credit points of recommended elective units of studyfor Mechanical Engineering and 96 credit points of units of study given by the Faculty of Science for the BE/BSc and BMedSci, or the Business School for the BE/BCom or from the core units table for BPM. A minimum of 240 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and the faculty in which they are undertaking the combined degree.			

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
BEHons (Mechanical)/BA			
In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete at least 12 credit points of recommended units of study for Mechanical ENgineering and 84 credit points of units of study given by the Faculty of Arts and Social Sciences for the BE/BA. A minimum of 240 credit points is required to be eligible for the combined degree. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and the faculty in which they are undertaking the combined degree			
BEHons (Mechanical)/LLB			
In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete at least 6 credit points of recommended units of study for Mechanical Engineering and 144 credit points of units of study given by the Faculty of Law for the BE/LLB. A minimum of 288 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and the faculty in which they are undertaking the combined degree.			
Recommended elective units of study			
AMME5202 **Advanced Computational Fluid Dynamics**	6	**A** Partial differential equations; Finite difference methods;Taylor series; Basic fluid mechanics including pressure, velocity, boundary layers, separated and recirculating flows. Basic computer programming skills.	Semester 1
MECH5275 **Advanced Renewable Energy**	6	**A** The students will require an understanding of the basic principles of fluid mechanics, thermodynamics and heat transfer, and the application of these principles to energy conversion systems. In particular, students should be able to analyse fluid flow in turbomachinery; perform first and second law thermodynamic analysis of energy conversion systems; and perform calculations of radiative, conductive and convective heat transfer. **P** (MECH3260 AND MECH3261) OR (AERO3260 AND AERO3261) OR (MECH5262 AND MECH5261) OR (MECH9260 AND MECH9261) *Note: Department permission required for enrolment*	Semester 2
AMME5101 **Energy and the Environment**	6	**P** 24 credits of 3000-level or above units of study	Semester 1
MECH5255 **Air Conditioning and Refrigeration (Adv)**	6	**A** Students are expected to be familiar with the basic laws of thermodynamics, fluid mechanics and heat transfer. **P** MECH3260 **N** MECH4255	Semester 2
MECH5265 **Advanced Combustion**	6	**A** Students are expected to be familiar with the basic laws of thermodynamics, fluid mechanics and heat transfer. **P** (MECH3260 AND MECH3261) OR MECH5262 OR MECH9260	Semester 2
MECH5310 **Advanced Engineering Materials**	6	**N** MECH4310 *Advanced polymer matrix composites, smart/functional materials, high-strength ferrous and non ferrous alloys, superalloys, high performance polymers, eco-materials, thin film science and technology, advanced joining methods, processing-structure-property relationship, damage tolerance, toughening mechanisms, structure integrity and reliability.*	Semester 1
MECH4460 **Mechanical Design 3**	6	**A** ENGG1802, AMME2301, AMME2500, MECH3361 **P** MECH2400 and MECH3460	Semester 1
AMME5961 **Biomaterials Engineering** *This unit of study is not available in 2015*	6	**A** Recommended 6 credit points of junior biology 6 credit points of junior chemistry 6 credit points of junior materials science 6 credit points of engineering design	Semester 2
AMME5912 **Crash Analysis and Design**	6	**A** Computer Aided Drafting, Basic FEA principles and Solid Mechanics	Semester 1
AMME5902 **Advanced Computer Aided Manufacturing**	6		Semester 2
AMME5510 **Vibration and Acoustics**	6	**A** (AMME2301 OR AMME9301) AND AMME2200 AND (AMME2500 OR AMME9500) *Note: Department permission required for enrolment*	Semester 2
AMME5310 **Engineering Tribology**	6	**A** (AMME2302 OR AMME9302) AND (AMME2301 OR AMME9301) AND (MECH3261 OR MECH9261)	Semester 1
AMME5520 **Advanced Control and Optimisation**	6	**A** Students have an interest and a strong understanding of feedback control systems, specifically in the area of system modelling and control design in the frequency domain. **P** AMME3500 OR AMME5501 OR AMME9501	Semester 1
Additional Electives			
Students can select from the units below or other elective units offered within the University that are approved by the Head of the School of Aerospace, Mechanical and Mechatronic Engineering.			
ENGG1000 **History and Philosophy of Engineering**	6		Semester 1 Semester 2
AMME2000 **Engineering Analysis**	6	**A** (MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) and ENGG1801. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. *Note: Department permission required for enrolment*	Semester 1
Note			
Choice of electives as shown in the above table will depend on subject availability, timetabling and prerequisite conditions.			

For a standard enrolment plan for Mechanical Engineering visit cusp.sydney.edu.au/students/view-degree-page/name/BE(Mech)

Unit of Study Descriptions

Bachelor of Engineering Honours (Mechanical)

Candidates for the Bachelor of Engineering Honours (Mechanical) are required to gain credit for the core units of study set out below. Any additional credit necessary shall be gained by completing additional credit points of elective units of study as recommended by the Faculty, as may be necessary to gain credit for a total of not less than 192 credit points.

Core units of study

First year

MECH1560
Introduction to Mechanical Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 1 hr/week; Tutorial 2 hrs/week; Workshop 3 hrs/week. **Prohibitions:** MTRX1701, AERO1560, ENGG1800 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment. Note: Limited Places due to TAFE component. Department Permission required for non-BE(Mech) students.

Objectives:

a) To develop an understanding of the role of Mechanical Engineers and the core concepts within the discipline.

b) To understand the content of the degree structure and how the subjects are applied.

c) To develop an understanding of a range of machining and manufacturing processes required to make mechanical components.

Introductory Mechanical Engineering (70%): The subject introduces the core mechanical engineering concepts of design and mechanisms, intelligent systems, applied materials and fluid machinery. An overview is provided of the range of roles and the skills and knowledge required of a Mechanical Engineer. Emphasis is placed on the relationship between the subjects in the degree program and how they are applied by practicing engineers.

Workshop Technology (30%): On overview is provided of a range of machining and manufacturing processes, with hand on experience provided. Workshop Technology practical work is undertaken in: (a) Hand tools (b) Machining and (c) Welding. Safety requirements: All students are required to provide their own personal protective equipment (PPE) and comply with the safety regulations. Students who fail to do this will not be permitted to enter the workshops. In particular, approved industrial footwear must be worn, and long hair must be protected by a hair net. Safety glasses must be worn at all times.

MATH1001
Differential Calculus

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001 **Assumed knowledge:** HSC Mathematics Extension 1 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1001 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study looks at complex numbers, functions of a single variable, limits and continuity, vector functions and functions of two variables. Differential calculus is extended to functions of two variables. Taylor's theorem as a higher order mean value theorem.

Textbooks
As set out in the Junior Mathematics Handbook.

MATH1002
Linear Algebra

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1902, MATH1012, MATH1014 **Assumed knowledge:** HSC Mathematics or MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1002 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study introduces vectors and vector algebra, linear algebra including solutions of linear systems, matrices, determinants, eigenvalues and eigenvectors.

Textbooks
As set out in the Junior Mathematics Handbook

ENGG1801
Engineering Computing

Credit points: 6 **Session:** Semester 1, Summer Late **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will introduce students to fundamental principles of programming. The language used will be Matlab but the principles taught are readily portable to other languages like C and Java. The unit material will be presented in a manner which will help students to draw a connection between programming constructs and real engineering applications. The unit will use engineering inspired case-studies : especially from Civil, Chemical, Aerospace and Mechanical streams, to motivate new material. There will be a major project which uses programming to solve a real world engineering problem. The extensive Matlab library for visualization will also be introduced. Matlab will cover two-thirds of the unit. The remaining one-third will be devoted to the use of Excel in engineering scenarios. Furthermore, cross integration between Matlab and Excel will also be highlighted.

ENGG1803
Professional Engineering 1

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prohibitions:** ENGG1061 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Professional Engineering 1 is an introductory Unit of Study within the Faculty of Engineering. The semester 1 course is aimed at students from the School of Aerospace, Mechanical and Mechatronic Engineering. It seeks to introduce newly admitted undergraduates to general principles of professional engineering practice, a range of contemporary professional engineering issues, plus outline skills related to academic study within an engineering environment. The subject is structured around a team based design and build project, in which students apply the professional engineering concepts they are learning to an engineering project. Professional engineering topics to be covered include: accessing information, teamwork, creativity, leadership, written and oral communication, project management, problem solving, ethics, liability, work health and safety and environmental issues.

Normally taken in Semester 1, students in combined degrees are exempt from this unit.

MATH1003
Integral Calculus and Modelling

Credit points: 3 **Session:** Semester 2, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1013, MATH1903, MATH1907 **Assumed knowledge:** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1003 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.This unit of study first develops the idea of the definite integral from Riemann sums, leading to the Fundamental Theorem of Calculus. Various techniques of integration are considered, such as integration by parts.The second part is an introduction to the use of first and second order differential equations to model a variety of scientific phenomena.

Textbooks

As set out in the Junior Mathematics Handbook

MATH1005
Statistics

Credit points: 3 **Session:** Semester 2, Summer Main, Winter Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021 **Assumed knowledge:** HSC Mathematics **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1005 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit offers a comprehensive introduction to data analysis, probability, sampling, and inference including t-tests, confidence intervals and chi-squared goodness of fit tests.

Textbooks

As set out in the Junior Mathematics Handbook

ENGG1802
Engineering Mechanics

Credit points: 6 **Session:** Semester 2, Summer Main **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit aims to provide students with an understanding of and competence in solving statics and introductory dynamics problems in engineering. Tutorial sessions will help students to improve their group work and problem solving skills, and gain competency in extracting a simplified version of a problem from a complex situation. Emphasis is placed on the ability to work in 3D as well as 2D, including the 2D and 3D visualization of structures and structural components, and the vectorial 2D and 3D representations of spatial points, forces and moments. Introduction to kinematics and dynamics topics includes position, velocity and acceleration of a point; relative motion, force and acceleration, momentum, collisions and energy methods.

MECH1400
Mechanical Construction

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 1 hr/week; Laboratory 3 hrs/week. **Assumed knowledge:** Material from MECH1560 (steam engine), HSC studies (Maths, Physics, Chemistry). **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

Learn about selected historical events, research methods, analysis techniques, application of theory and analysis to real machinery, use of machine and hand tools.

This is a project based subject where the students will design, build and test their own designs. Historical developments in the area of the project are researched and applied and research into relevant fields is required to fully understand and analyse the project problem.

The unit ties in with workshop component of MECH1560. Skills developed become relevant in MECH2400 Mechanical Design 1

Students in combined degrees are exempt from this unit.

AMME1362
Materials 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/semester. **Prohibitions:** AMME2302, CIVL2110 **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

AMME1362 is an introductory unit in engineering materials. The unit aims to develop students' understanding of the structures, mechanical properties and manufacture of a range of engineering materials as well as how the mechanical properties relate to microstructure and forming and treatment methods. The unit has no prerequisite subject and is therefore intended for those with little or no previous background in engineering materials. However the unit does require students to take a significant degree of independent responsibility for developing their own background knowledge of materials and their properties. The electrical, magnetic, thermal and optical properties of materials are a critical need-to-know area where students are expected to do some independent study.

Second year

AMME2500
Engineering Dynamics

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs **Prerequisites:** ENGG1802 and (MATH1001 or MATH1901) and (MATH1002 or MATH1902) **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to teach: Dynamics of Rigid Bodies: Analysis of Planar mechanisms; Kinematics of rigid bodies; Kinetics of rigid bodies. Students will also develop their skills in: how to model and analyse dynamic systems and the application of theory to real systems through practical/laboratory sessions.

At the end of this unit students will have developed skills in modelling and analysing planar mechanisms and rigid body dynamic systems.

Course content will include planar mechanisms, linkages, mobility; instant centres of rotation, Kennedy's theorem; velocity and acceleration polygons; kinematics of rigid bodies, frames of reference, velocity and acceleration, rotating frame of reference, relative velocity and acceleration, gyroscopic acceleration; kinetics of rigid bodies, linear momentum and Euler's first law; angular momentum and Euler's second law; centre of mass; moments of inertia, parallel axis and parallel plane theorems, principal axes and principal moments of inertia, rotation about an axis; impulse and momentum; work and energy, kinetic and potential energies; applications to orbital and gyroscopic motion; introduction to Lagrangian methods.

MATH2067
DEs and Vector Calculus for Engineers

Credit points: 6 **Session:** Semester 1 **Classes:** Three 1 hour lectures, one 1 hour tutorial and one 1 hour practice class per week. **Prerequisites:** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **Prohibitions:** MATH2901, MATH2961, MATH2005, MATH2965, MATH2001, MATH2905, MATH2061, MATH2065 **Assessment:** One 2 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH2067 starts by introducing students to solution techniques of ordinary and partial differential equations (ODEs and PDEs) relevant to the engineering disciplines: it provides a basic grounding in these techniques to enable students to build on the concepts in their subsequent engineering classes. The main topics are Fourier series, second order ODEs, including inhomogeneous equations and Laplace transforms, and second order PDEs in rectangular domains (solution by separation of variables).

The unit moves on to topics from vector calculus, including vector-valued functions (parametrised curves and surfaces; vector fields; div, grad and curl; gradient fields and potential functions), line integrals (arc length; work; path-independent integrals and conservative fields; flux across a curve), iterated integrals (double and triple integrals; polar, cylindrical and spherical coordinates; areas, volumes and mass; Green's Theorem), flux integrals (flow through a surface; flux integrals through a surface defined by a function of two variables, though cylinders, spheres and parametrised surfaces), Gauss's Divergence Theorem and Stokes' Theorem.

Students in the combined BEHons/BSc degree program can take both MATH2061 and MATH2065 as an alternative.

AMME2700
Instrumentation

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs. **Prerequisites:** AERO1560 OR MECH1560 OR MTRX1701 OR ENGG1800 **Assumed knowledge:** ENGG1801. Programming Skills, 1st Year maths skills, familiarity with fundamental Aerospace concepts. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to develop in students an understanding of the engineering measurements and instrumentation systems. The students will acquire an ability to make accurate and meaningful measurements. It will cover the general areas of electrical circuits and mechanical/electronic instrumentation for strain, force, pressure, moment, torque, displacement, velocity, acceleration, temperature and so on.

Students in combined degrees are exempt for this unit.

AMME2301
Mechanics of Solids

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** ENGG1802, MATH1001, MATH1002, MATH1003 **Assessment:** Through semester assessment (35%) Final Exam (65%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Equilibrium of deformable structures; basic concept of deformation compatibility; stress and strain in bars, beams and their structures subjected to tension, compression, bending, torsion and combined loading; statically determinate and indeterminate structures; energy methods for bar and beam structures; simple buckling; simple vibration; deformation of simple frames and cell box beams; simple two-dimensional stress and Morh's circle; problem-based applications in aerospace, mechanical and biomedical engineering.

AMME2261
Fluid Mechanics 1

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs/semester. **Prohibitions:** AMME2200 **Assumed knowledge:** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit covers the fundamentals of fluid statics and fluid dynamics. At the end of this unit students will have: an understanding of the basic equations governing the statics and dynamics of fluids; the ability to analyze and determine the forces applied by a static fluid; the ability to analyse fluids in motion. The course will cover both inviscid and viscous fluid flow. The course will introduce the relevant parameters for fluid flow in internal engineering systems such as pipes and pumps and external systems such as flow over wings and airfoils. Course content will cover the basic concepts such as viscosity, density, continuum, pressure, force, buoyancy and acceleration; and more detailed methods including continuity, conservation of momentum, streamlines and potential flow theory, Bernoulli equation, Euler equation, Navier-Stokes equation. Experiments will introduce flow measuring devices and flow observation.

AMME2262
Thermal Engineering 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs. **Prohibitions:** AMME2200 **Assumed knowledge:** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to teach the basic laws of thermodynamics and heat transfer. At the end of this unit students will have: an understanding of the basic laws of thermodynamics and heat transfer; The ability to analyze the thermodynamics of a simple open or closed engineering system. The basic knowledge to analyse and design 1D thermal circuits. Course content will include concepts of heat and work, properties of substances, first law of thermodynamics, control mass and control volume analysis, thermal efficiency, entropy, second law of thermodynamics, reversible and irreversible processes, isentropic efficiency, power and refrigeration cycles, heat transfer by conduction, convection and radiation, 1D thermal circuits and transient heat transfer.

MECH2400
Mechanical Design 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 1 hr/week. **Assumed knowledge:** ENGG1801 and ENGG1802, HSC Maths and Physics **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Aim: For students to experience a realistic the design process and to develop good engineering skills.

Course Objectives: To develop an understanding of:

1. the need for and use of standard drawings in the communication and definition of parts and assemblies,
2. Efficient use of a CAD package
3. creativity,
4. the design process from initial idea to finished product
5. Methods used to analyse designs
6. standard components.

MECH2660
Engineering Management

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hours per week; Tutorial 2 hours per week. **Assumed knowledge:** ENGG1803. It is expected that students will understand the concepts previously presented in ENGG1803 Professional Engineering. It is assumed that the students have an understanding of professional engineering issues, and are experienced in academic writing (both essays and reports), including appropriate referencing techniques, oral presentations and the project management process (particularly in group situations). Such previous knowledge will assist students in the development their awareness of the issues involved with engineering management. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to: develop an understanding of the principles of management as applies particularly to the engineering and industrial settings. It aims to provide knowledge of the principles and tools that can assist communication, supervision, project management, team membership, decision making and risk management. At the end of this unit students will be able to understand different management practices and approaches applicable to a broad range of environments. In the process they will develop greater skills in team work, written expression, and verbal presentation. The concepts covered in this unit are from the following management areas: Engineers and Management - including ethics, Communication and People in Organisations, Economics, Leadership, Managerial Decision Analysis, Marketing, Business Planning, Legal Environment of Business, Risk Management, Human Resource Management, Project Management, Quality Assurance and Management, Operations Management, and Financial Management.

Third year

AMME3060
Engineering Methods

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture: 2 hours per week; Tutorial: 2 hours per week. **Prerequisites:** AMME2000 **Assessment:** Through semester assessment (50%), Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course will address the use of state of the art engineering software packages for the solution of advanced problems in engineering. We will cover the solution of partial differential equations in heat transfer; fluids, both inviscid and viscous, and solids, including plates, shells and membranes. While some analytical methods will be considered, the primary focus of the course will be on the use of numerical solution methods, including finite difference, finite volume and spectral methods. Commercial engineering packages will be introduced with particular attention given to the development of standards for the accuracy and representation of data.

AMME3500
System Dynamics and Control

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week. **Prerequisites:** ((MATH2061 or MATH2961) and (MATH2065 or MATH2965)) or MATH2067 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to allow students to develop an understanding of methods for modeling and controlling linear, time-invariant systems. Techniques examined will include the use of differential equations and frequency domain approaches to modeling of systems. This will allow students to examine the response of a system to changing inputs and to examine the influence of external stimuli such as disturbances on system behaviour. Students will also gain an understanding of how the responses of these mechanical systems can be altered to meet desired specifications and why this is important in many engineering problem domains.

The study of control systems engineering is of fundamental importance to most engineering disciplines, including Electrical, Mechanical, Mechatronic and Aerospace Engineering. Control systems are found in a broad range of applications within these disciplines, from aircraft and spacecraft to robots, automobiles, computers and process control systems. The concepts taught in this course introduce students to the mathematical foundations behind the modelling and control of linear, time-invariant dynamic systems. In particular, topics addressed in this course will include:

1. Techniques for modelling mechanical systems and understanding their response to control inputs and disturbances. This will include the use of differential equations and frequency domain methods as well as tools such as Root Locus and Bode plots.

2. Representation of systems in a feedback control system as well as techniques for determining what desired system performance specifications are achievable, practical and important when the system is under control

3. Theoretical and practical techniques that help engineers in designing control systems, and an examination of which technique is best in solving a given problem.

MECH3260
Thermal Engineering 2

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs/week. **Prerequisites:** AMME2200 OR AMME2262. **Assumed knowledge:** Fundamentals of thermodynamics and fluid mechanics are needed to begin this more advanced course **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to develop an understanding of: the principles of thermodynamic cycles, gas mixtures, combustion and thermochemistry applied to engineering processes, power and refrigeration systems; heat transfer equipment design. To classify heat transfer situations as conduction, convection, radiation, forced or natural convection. To determine the appropriate approach to problems, the type of solution needed, analytical or numerical. To be able to arrive at a solution and predict heat transfer rates and be able to design and size heat transfer equipment.

At the end of this unit students will be able to: apply the principles of thermodynamics and heat transfer to engineering situations; have the ability to tackle and solve a range of complex thermodynamics cycles, air conditioning, combustion, chemical equilibrium, problems involving gas mixtures; have the ability to tackle and solve a range of heat transfer problems including finned heat exchangers, cooling by fluids, quenching, insulation and solar radiation.

Course content will include: Thermodynamics: exergy and entropy, power cycles: spark ignition, Diesel, gas turbine; gas mixtures, humidity, psychrometry, air-conditioning, combustion: stoichiometry, gas analysis, combustion, thermochemistry, adiabatic flame temperature, 2nd Law analysis of reacting systems, equilibrium, exergy, Heat Transfer: conduction, thermal circuits, general conduction equation, cylindrical fins, heat exchangers, numerical solutions, unsteady conduction, convection, analytical, forced convection correlations, natural convection, boiling, radiation spectrum, blackbody, radiation properties and laws, environmental radiation, solar.

MECH3261
Fluid Mechanics 2

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs. **Prerequisites:** AMME2200 OR AMME2261. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to provide students with a detailed understanding of the theory and practice of fluid mechanics in the context of mechanical engineering. Students will gain skills in problem solving in areas of pipe, pump and channel flow; lift and drag on immersed bodies; boundary layer theory and gas dynamics.

At the end of this unit students will have the ability to critically assess and solve problems commonly found in fluid mechanics practice, such as sizing pumps and piping systems, designing channels, and determing the lift and drag characteristics of submerged bodies. Additionally, they will develop a structured and systematic approach to problem solving.

MECH3361
Mechanics of Solids 2

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 6 hrs. **Prerequisites:** AMME2301 and AMME2302 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The UoS aims to: teach the fundamentals of analysing stress and deformation in a solid under complex loading associated with the elemental structures/components in aerospace, mechanical and biomedical engineering; develop the following attributes: understand the fundamental principles of solid mechanics and basic methods for stress and deformation analysis of a solid structure/element in the above mentioned engineering areas; gain the ability to analyse problems in terms of strength and deformation in relation to the design, manufacturing and maintenance of machines, structures, devices and elements in the above mentioned engineering areas.

At the end of this unit students will have a good understanding of the following: applicability of the theories and why so; how and why to do stress analysis; why we need equations of motion/equilibrium; how and why to do strain analysis; why we need compatibility equations; why Hooke`s law, why plasticity and how to do elastic and plastic analysis; how and why to do mechanics modelling; how to describe boundary conditions for complex engineering problems; why and how to solve a mechanics model based on a practical problem; why and how to use energy methods for stress and deformation analysis; why and how to do stress concentration analysis and its relation to fracture and service life of a component/structure; how and why to do fundamental plastic deformation analysis; how and why the finite element method is introduced and used for stress and deformation analysis.

The students are expected to develop the ability of solving engineering problems by comprehensively using the skills attained above. The students will get familiar with finite element analysis as a research and analysis tool for various real-life problems.

MECH3362
Materials 2

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory, Independent Study **Prerequisites:** AMME2301 and AMME2302 **Assumed knowledge:** This subject requires you to have two important skills to bring in: (1) A good understanding of basic knowledge and principles of material science and engineering from AMME2302 (MECH2300) Materials I and mechanics of solids for simple structural elements (in tension, bending, torsion) from AMME2301 (AERO2300); (2) Reasonable mathematical skills in calculation of stresses and strains in simple structural elements. **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims for students to understand the relationship between properties of materials and their microstructures and to improve mechanical design based on knowledge of mechanics and properties of materials.

At the end of this unit students should have the capability to select proper materials for simple engineering design.

Course content will include: short-term and long-term mechanical properties; introductory fracture and fatigue mechanics, dislocations; polymers and polymer composite materials; ceramics and glasses; structure-property relationships; selection of materials in mechanical design.

MECH3460
Mechanical Design 2

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** MECH2400 and AMME2301 **Assumed knowledge:** Properties of engineering materials including fatigue failure theories. Statics and dynamics properties of machines. Practical use of Word and Excel including the use of the 'solver' and graphing capabilities built into the spreadsheet. The use of a spreadsheet is mandatory. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to apply some newly acquired skills to begin to understand how stress and strain are distributed in the more common categories of machine parts. Reducing the loads in standard parts to just the most significant, leads to a range of relatively simple analyses. By using different degrees of simplification and a proportional amount of effort, the examination of components can provide results of corresponding accuracy. To lead the student to utilize and be aware of modern computer methods, to be aware of past methods and be prepared of future developments. Not all the analysis of mechanical components are covered in the course but the ones that are deal with exemplify principles that can be applied to novel items that our graduates may encounter in their professional life.

At the end of this unit students will be able to: apply fatigue life prediction in general to any component; design a bolted joint to carry tensile and or shear loads: use a numerical solver to arrive at the optimal dimensions of a component, given its loads and sufficient boundary conditions; design shafts to carry specified steady and alternating bending moments and torques; design and construct a space frame, such as that for a dune buggy, to meet requirements of strength and rigidity; be able to arrive at the principle parameters of a pair of matched spur gears, and to be able to extend this to helical gears.

Course content will include: stress and strain in engineering materials; yield and ultimate fail conditions in malleable and brittle materials; spatial, 3D frameworks; deflections due to forces, moments and torques.

MECH3660
Manufacturing Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Laboratory, Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** MECH2400 or ENGG1960 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit aims to teach the fundamentals of manufacturing processes and systems in mechanical, mechatronic and biomedical engineering, including traditional and advanced manufacturing technologies.

This unit aims to develop the following attributes: to understand the fundamental principles of manufacturing technologies for the above mentioned engineering areas; to gain the ability to select existing manufacturing processes and systems for direct engineering applications; to develop ability to create innovative new manufacturing technologies for advanced industrial applications; to develop ability to invent new manufacturing systems

At the end of this unit students will have a good understanding of the following: merits and advantages of individual manufacturing processes and systems; principles of developing new technologies; comprehensive applications and strategic selection of manufacturing processes and systems.

Course content will include:

Manufacturing Processes: Common processes and their science (machining, casting, powder metallurgy, metal working, welding); merits and limitations; CNC and CAM;

Manufacturing Systems: Economics in manufacturing; flexible manufacturing; group technology; materials selection and requirements planning; quality control; introduction to new technology; introduction to e-manufacturing; human factors; plant layout.

Fourth year

ENGG4000
Practical Experience

Session: Semester 1, Semester 2 **Classes:** Practical Experience, **Prerequisites:** 36 Credit Points of Senior Units **Assessment:** Through semester assessment (100%) **Mode of delivery:** Professional practice

Note: Students should have completed three years of their BE program before enrolling in this unit.

The aim of this unit is to give students exposure to work in an engineering organisation and gain some professional experience; to enhance a student's abilities and experience in report writing; to encourage self-evaluation in the context of applying their theoretical knowledge to real industry practise. Students will gain a better appreciation of the role of engineers in the workplace.The assessment will enhance the student's ability to present structured observations and reflections in the mode of a formal written report.

Each student is required to gain exposure to professional engineering practice and environments and to submit a satisfactory written report of his or her work. The report will include the requirement of a detail logbook recording tasks given and timelines set for achieving these. Self-evaluation of a student's personal level of knowledge and its applicability to the workplace is a major component of the reporting. Normally 12 weeks (60 days) of practical work experience is required, though the Faculty may accept alternatives that are judged as equivalent. Students are strongly encouraged to undertake their work experience in the break between Year 3 and 4 and definitely prior to commencing their final semester of study, however any engineering work taken after completing 28 credit points of 3rd year units of study may be accepted for the requirements of this unit. The University Careers and Appointments Service is available to assist students to obtain suitable employment. This unit of study is a core unit of study in all BE programs and must be passed in order to graduate from those programs.

Students should have completed three years of their BEHons program before enrolling in this unit.

Students must select at least one of the following two units of study

MECH4601
Professional Engineering 2

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** ENGG1803, ENGG4000 It is recommended that you have undertaken ENGG4000 Practical Experience in a period prior to undertaking this course, or be able to demonstrate equivalent understanding of professional practice as some assessment tasks will draw upon your experiences in professional engineering practice. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to create an awareness of issues surrounding the management of projects; impart knowledge resulting in a more global approach to the practice of engineering and engineering management; and provide a vehicle for improving communication skills (both written and oral). The course also aims, when taken together with other courses offered by the School, to substantially meet the requirement of the Institution of Engineers, Australia, for undergraduate training in management theory and Professional Engineering skills. On completion of this unit students should be able to: plan small projects and contribute effectively to planning of larger projects; work effectively in small teams; understand their role and expected conduct in the management of engineering projects; perform well in that role from the outset, with performance limited only by experience; prepare an interesting and relevant presentation on aspects of their work for their peers or senior managers; recognise the range of expertise they may need to call on in their role as an engineer working on a project (e.g. in safety and environmental fields); understand what the experts are saying, and be able to contribute effectively to that discussion.

MECH4460
Mechanical Design 3

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** MECH2400 and MECH3460 **Assumed knowledge:** ENGG1802, AMME2301, AMME2500, MECH3361 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit teaches the student how to recognise where and how their theoretical skills can be applied to the practical situations that they may encounter in this field of design. The unit utilises assumed theoretical knowledge and skills to elucidate the stresses and strains that exit in the different categories of machine parts. It sets out to make the students familiar with the simplifications that are applied to arrive at the analytic expressions commonly used to analyse the individual categories parts. These simplifications usually begin by assuming that only particular types of loads are carried by each category. The resulting analyses provide approximations to the actual stresses and it is possible to have different degrees of simplifications, requiring more or less work, giving better or worse approximations. Should a particular part be used to carry loads that were not allowed for in the traditional method then some more appropriate method must be found or developed. An important aspect is to make the student practiced in a range of modern concepts, techniques and tools, and to be made aware of their strengths and limitations.

Options may be provided in the choice of design assignments. Biomedical engineering and vehicle design problems may be provided as options to more general machine design problems.

Students must enrol in 12cp of Thesis units

AMME4111
Honours Thesis A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research 10 hrs/week. **Prerequisites:** 36 credits of 3rd year units of study. **Prohibitions:** AMME4010, AMME4121, AMME4122 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: Honours Thesis A is only available to students with an HWAM of 65 or over. HWAM is a weighted average based on all 2000, 3000 and 4000 level units completed prior to enrolment in this unit. Prospective students in Honours Thesis A are expected to have consulted with supervisors and selected a topic of interest at the end of third year, guided by the advertised list of suggested thesis topics and supervisors. Availability of topics is limited and students should undertake to speak with prospective supervisors as soon as possible. Students who are unable to secure a supervisor and topic will be allocated a supervisor by the unit coordinator. Alternatively, students may do a thesis with a supervisor in industry or in another university department. In this case, the student must also find a second supervisor within the School of AMME.

The fourth year honours thesis aims to provide students with the opportunity to carry out a defined piece of independent research in a setting and in a manner that fosters the development of engineering research skills. These skills include the capacity to define a research question, showing how it relates to existing knowledge, identifying the tools needed to investigate the question, carrying out the research in a systematic way, analysing the results obtained and presenting the outcomes in a report that is clear, coherent and logically structured. Honours thesis is undertaken across two semesters of enrolment, in two successive Units of Study of 6 credits points each. Honours Thesis A covers first steps of thesis research starting with development of research proposal. Thesis B covers the second of stage writing up and presenting the research results.

Students are asked to write a thesis based on a research project, which is very often related to some aspect of a staff member's research interests. Some projects will be experimental in nature, others may involve computer-based simulation, feasibility studies or the design, construction and testing of equipment. Direction of thesis work may be determined by the supervisor or be of an original nature, but in either case the student is responsible for the execution of the practical work and the general layout and content of the thesis itself. The final thesis must be the student's individual work, although research is sometimes conducted in the framework of a group project shared with others. Students undertaking research on this basis will need to take care in ensuring the individual quality of their own research work and the final thesis submission. The thesis will be judged on the extent and quality of the student's original work and particularly how critical, perceptive and constructive he or she has been in assessing his/her work and that of others. Students will also be required to present the results of their findings to their peers and supervisors as part of a seminar program.

It is not expected that a thesis at this level will represent a significant contribution to new knowledge; nor is it expected that theses will resolve great intellectual problems. The timeframe available for the thesis is simply too short to permit students to tackle complex or difficult problems. Indeed, a key aim of the thesis is to specify a research topic that arouses sufficient intellectual curiosity, and presents an appropriate range and diversity of technical and conceptual challenges, while remaining manageable and allowing achievable outcomes within the time and resources available. It is important that the topic be of sufficient scope and complexity to allow a student to learn their craft and demonstrate their research skills. Equally imperative is that the task not be so demanding as to elude completion.

Normally taken in Semester 1

AMME4112
Honours Thesis B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research 10 hrs/week. **Prerequisites:** 36 credits of 3rd year units of study and WAM 65 or over **Prohibitions:** AMME4010, AMME4122, AMME4121 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: HWAM of 65 or greater required for enrolment. HWAM is the weighted average of all 2000, 3000 and 4000 level units completed prior to enrolment in this unit.

The fourth year honours thesis aims to provide students with the opportunity to carry out a defined piece of independent research or design work in a setting and in a manner that fosters the development of engineering skills in research or design. These skills include the capacity to define a research or design question, showing how it relates to existing knowledge, identifying the tools needed to investigate the question, carrying out the research or design in a systematic way, analysing the results obtained and presenting the outcomes in a report that is clear, coherent and logically structured. Honours thesis is undertaken across two semesters of enrolment, in two successive Units of Study of 6 credits points each. Honours Thesis A covers first steps of thesis research starting with development of research proposal. Thesis B covers the second of stage writing up and presenting the research results.

Students are asked to write a thesis based on a research or major design project, which is very often related to some aspect of a staff member's research interests. Some projects will be experimental in nature, others may involve computer-based simulation, feasibility studies or the design, construction and testing of equipment. Direction of thesis work may be determined by the supervisor or be of an original nature, but in either case the student is responsible for the execution of the practical work and the general layout and content of the thesis itself. The final thesis must be the student's individual work, although research is sometimes conducted in the framework of a group project shared with others. Students undertaking research on this basis will need to take care in ensuring the individual quality of their own research work and the final thesis submission. The thesis will be judged on the extent and quality of the student's original work and particularly how critical, perceptive and constructive he or she has been in assessing his/her work and that of others. Students will also be required to present the results of their findings to their peers and supervisors as part of a seminar program.

It is not expected that a thesis at this level will represent a significant contribution to new knowledge; nor is it expected that theses will resolve great intellectual problems. The time frame available for the thesis is simply too short to permit students to tackle complex or difficult problems. Indeed, a key aim of the thesis is to specify a research or design topic that arouses sufficient intellectual curiosity, and presents an appropriate range and diversity of technical and conceptual challenges, while remaining manageable and allowing achievable outcomes within the time and resources available. It is important that the topic be of sufficient scope and complexity to allow a student to learn their craft and demonstrate their research or design skills. Equally imperative is that the task not be so demanding as to elude completion.

Normally taken in Semester 2

Acceptable alternative units of study

Most units of study offered by the Faculty of Science shown in the tables can be replaced by an equivalent advanced level unit, subject to prerequisite conditions (as required by the Faculty of Science) being met.Students undertaking Study Abroad in a particular year of their degree must enrol in the appropriate exchange program units of study as an alternative to a semester's standard units.

Resolutions of the Faculty of Engineering relating to this table:

Bachelor of Engineering Honours (Mechanical)

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete 24 credit points of recommended elective units of study for Mechanical ENgineering and 6 credit points for free elective units of study. A minimum of 192 credit points is required to be eligible for the award of the degree of BE(Mechanical).

BEHons (Mechanical)/BSc or BCom or BMedSc or BPM

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete 6 credit points of recommended elective units of studyfor Mechanical Engineering and 96 credit points of units of study given by the Faculty of Science for the BE/BSc and BMedSci, or the Business School for the BE/BCom or from the core units table for BPM. A minimum of 240 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and the faculty in which they are undertaking the combined degree.

BEHons (Mechanical)/BA

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete at least 12 credit points of recommended units of study for Mechanical ENgineering and 84 credit points of units of study given by the Faculty of Arts and Social Sciences for the BE/BA. A minimum of 240 credit points is required to be eligible for the combined degree. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and the faculty in which they are undertaking the combined degree

BEHons (Mechanical)/LLB

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete at least 6 credit points of recommended units of study for Mechanical Engineering and 144 credit points of units of study given by the Faculty of Law for the BE/LLB. A minimum of 288 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and the faculty in which they are undertaking the combined degree.

Recommended elective units of study

AMME5202
Advanced Computational Fluid Dynamics

Credit points: 6 **Session:** Semester 1 **Classes:** Laboratory 2 hrs/week; Lecture 1 hr/week; Tutorial 1 hr/week. **Assumed knowledge:** Partial differential equations; Finite difference methods;Taylor series; Basic fluid mechanics including pressure, velocity, boundary layers, separated and recirculating flows. Basic computer programming skills. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Objectives: To provide students with the necessary skills to use commercial Computational Fluid Dynamics packages and to carry out research in the area of Computational Fluid Dynamics. Expected outcomes: Students will have a good understanding of the basic theory of Computational Fluid Dynamics, including discretisation, accuracy and stability. They will be capable of writing a simple solver and using a sophisticated commercial CFD package. Syllabus summary: A course of lectures, tutorials and laboratories designed to provide the student with the necessary tools for using a sophisticated commercial CFD package. A set of laboratory tasks will take the student through a series of increasingly complex flow simulations, requiring an understanding of the basic theory of computational fluid dynamics (CFD). The laboratory tasks will be complemented by a series of lectures in which the basic theory is covered, including: governing equations; finite difference methods, accuracy and stability for the advection/diffusion equation; direct and iterative solution techniques; solution of the full Navier-Stokes equations; turbulent flow; Cartesian tensors; turbulence models.

MECH5275
Advanced Renewable Energy

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** (MECH3260 AND MECH3261) OR (AERO3260 AND AERO3261) OR (MECH5262 AND MECH5261) OR (MECH9260 AND MECH9261) **Assumed knowledge:** The students will require an understanding of the basic principles of fluid mechanics, thermodynamics and heat transfer, and the application of these principles to energy conversion systems. In particular, students should be able to analyse fluid flow in turbomachinery; perform first and second law thermodynamic analysis of energy conversion systems; and perform calculations of radiative, conductive and convective heat transfer. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit aims to develop understanding of the engineering design and analysis of different devices and technologies for generating power from renewable sources including: solar, wind, wave, tidal, ocean thermal, geothermal, hydro-electric, and biofuels; to understand the environmental, operational and economic issues associated with each of these technologies. At the end of this unit students will be able to perform in depth technical analysis of different types of renewable energy generation devices using the principles of fluid mechanics, thermodynamics and heat transfer. Students will be able to describe the environmental, economic and operational issues associated with these devices.

AMME5101
Energy and the Environment

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Project Work - own time 2 hrs/week. **Prerequisites:** 24 credits of

3000-level or above units of study **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit is suitable for any engineering discipline student who is interested in developing an understanding of analysis and design in energy, power generation, environment and relevant economic issues. The aim is to acquaint students with the methods engineers use to design and evaluate the thermal processes used for the production of electricity. It also assesses and deals with the environmental consequences of power generation. At the end of this unit students will be able to carry out preliminary design and economic impact analyses for electrical power generation systems.

A series of topics will be covered in relation to energy and electricity and relevant issues. The course contents will include:

1. Economic analysis of energy systems;
2. Environmental impact of power generation;
3. Principles of thermodynamics;
4. First law analysis of power cycles;
5. Design and simulation of power generation cycles;
6. Second law efficiency and availability;
7. Energy efficiency;
8. CO2 capture and sequestration;
9. Design of various components of thermal power plants.

MECH5255
Air Conditioning and Refrigeration (Adv)

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Prerequisites:** MECH3260 **Prohibitions:** MECH4255 **Assumed knowledge:** Students are expected to be familiar with the basic laws of thermodynamics, fluid mechanics and heat transfer. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study develops an advanced knowledge of air conditioning systems and refrigeration applications. At the completion of this unit students will be able to determine thermal loads on structures and design an air conditioning or refrigeration system with attention to comfort, control, air distribution and energy consumption. Course content will include: applied psychrometrics, air conditioning systems, design principles, comfort in the built environment. cooling load calculations, heating load calculations, introduction and use of computer-based load estimation packages software, air distribution, fans, ducts, air conditioning controls, advanced refrigeration cycles, evaporators, condensers, cooling towers, compressors, pumps, throttling devices, piping, refrigerants, control, refrigeration equipment, simulation of refrigeration systems, food refrigeration and industrial applications; Use of CFD packages as tools to simulate flows in building and to optimise air conditioning design, energy estimation methods and software, energy evaluation and management in the built environment. Use of experimental air conditioning systems to test for thermal balances and compare with simulations.

MECH5265
Advanced Combustion

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Prerequisites:** (MECH3260 AND MECH3261) OR MECH5262 OR MECH9260 **Assumed knowledge:** Students are expected to be familiar with the basic laws of thermodynamics, fluid mechanics and heat transfer. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This UoS aims to teach the basic principles of combustion highlighting the role of chemical kinetics, fluid mechanics, and molecular transport in determining the structure of flames. Students will become familiar with laminar and turbulent combustion of gaseous and liquid fuels including the formation of pollutants. They will also be briefly introduced to various applications such as internal combustion engines, gas turbines, furnaces and fires.

This UoS will cover equilibrium compositions, flammability limits, simple chemically reacting systems, detailed chemical kinetics, and the basic theory underlying laminar and turbulent combustion for both premixed and non-premixed cases. There will be an introduction to droplet combustion, the concept of mixture fraction for non-premixed flames, combustion in engines and gas turbines as well as the formation of pollutants. Fire ignition, growth and spread will also be covered with respect to safety in buildings including the hazards related to the formation of smoke and toxic products.

MECH5310
Advanced Engineering Materials

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week; Laboratory 3 hrs. **Prohibitions:** MECH4310 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Advanced polymer matrix composites, smart/functional materials, high-strength ferrous and non ferrous alloys, superalloys, high performance polymers, eco-materials, thin film science and technology, advanced joining methods, processing-structure-property relationship, damage tolerance, toughening mechanisms, structure integrity and reliability.

To understand (a) how to define the relationship between properties and microstructures of advanced engineering materials, (b) how to improve mechanical design with the knowledge of mechanics and properties of materials, and (c) how to conduct failure diagnosis of engineering materials.

MECH4460
Mechanical Design 3

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** MECH2400 and MECH3460 **Assumed knowledge:** ENGG1802, AMME2301, AMME2500, MECH3361 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit teaches the student how to recognise where and how their theoretical skills can be applied to the practical situations that they may encounter in this field of design. The unit utilises assumed theoretical knowledge and skills to elucidate the stresses and strains that exit in the different categories of machine parts. It sets out to make the students familiar with the simplifications that are applied to arrive at the analytic expressions commonly used to analyse the individual categories parts. These simplifications usually begin by assuming that only particular types of loads are carried by each category. The resulting analyses provide approximations to the actual stresses and it is possible to have different degrees of simplifications, requiring more or less work, giving better or worse approximations. Should a particular part be used to carry loads that were not allowed for in the traditional method then some more appropriate method must be found or developed. An important aspect is to make the student practiced in a range of modern concepts, techniques and tools, and to be made aware of their strengths and limitations.

Options may be provided in the choice of design assignments. Biomedical engineering and vehicle design problems may be provided as options to more general machine design problems.

AMME5961
Biomaterials Engineering

Credit points: 6 **Session:** Semester 2 **Classes:** : Lectures: 3 hours per week **Assumed knowledge:** Recommended 6 credit points of junior biology 6 credit points of junior chemistry 6 credit points of junior materials science 6 credit points of engineering design **Assessment:** Through semester assessment (60%), Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

To gain a basic understanding of the major areas of interest in the biomaterials field, learn to apply basic engineering principles to biomedical systems, and understand the challenges and difficulties of biomedical systems. To participate in a project-based-learning approach to the topic of design with Biomaterials.

AMME5912
Crash Analysis and Design

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Project Work - own time, **Assumed knowledge:** Computer Aided Drafting, Basic FEA principles and Solid Mechanics **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The objective of the course is to give students skills in the area of highly non-linear finite element analysis. Major topics covered include CAD, Implicit / explicit codes, Wire frame geometry, Elemental Theory, Materials, Pre-processing using ETA-PreSys, Contact, LS-Dyna, using NCAC FEM models, Modeling fasteners, Material covered in lectures is reinforced through independent research, assignments, quizzes and a major capstone project. The capstone project involves the development of an approved crash scenario.

AMME5902
Advanced Computer Aided Manufacturing

Credit points: 6 **Session:** Semester 2 **Classes:** Project Work - in class, Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory, Seminar, **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The aim of this course is to enhance the student`s manufacturing engineering skills in the CAD/CAM area. The course focuses on CNC milling as a manufacturing automation process applied to a project. The management, planning and marketing of a typical engineering project are also discussed.

Objectives:Through integrated project-based learning and hands-on-machine training, you will learn

oHow to successfully complete a CAD/CAM and CNC mill based project.

oManufacturing management and system skills, such as product planning, manufacturing sequence, time and cost;

oThe science in designing and selecting a manufacturing method.

oHow to effectively present your ideas and outcomes using oral and report based methods.

It is expected that through your hard work in the semester, you will find

oEnhanced learning by real-world problems.

oImproved comprehensive skill in manufacturing design.

AMME5510
Vibration and Acoustics

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/week. **Assumed knowledge:** (AMME2301 OR AMME9301) AND AMME2200 AND (AMME2500 OR AMME9500) **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This UoS should prepare the student to be able to undertake vibration and acoustic measurement calculations for industry design situations.

The unit aims to introduce a number of new concepts required for analysis of vibrations and acoustics. The response of structure under different dynamic forces, including human and aerodynamic, will be investigated. A number of hands-on experiments will be performed to allow an understanding of the concepts and applicability.

The acoustics component will include: basic acoustics theory, sound generation and propagation, impedance, absorbing materials, industrial noise sources, isolation methods of noise control, enclosures, instrumentation and measurement, frequency analysis, noise regulations and computational acoustics.

AMME5310
Engineering Tribology

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs; Tutorial 3 hrs/week; Seminar 3 hrs/week. **Assumed knowledge:** (AMME2302 OR AMME9302) AND (AMME2301 OR AMME9301) AND (MECH3261 OR MECH9261) **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The aim is to teach students in the undergraduate and postgraduate levels basic concepts about friction, lubrication and wear applicable to design and operation of mechanical systems used in engineering, industrial, and modern applications. Examples of these systems are lubrication of internal combustion engines, gearboxes, artificial hip/knee joints, and micro/nano electromechanical systems.

AMME5520
Advanced Control and Optimisation

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Research 1 hr/week. **Prerequisites:** AMME3500 OR AMME5501 OR AMME9501 **Assumed knowledge:** Students have an interest and a strong understanding of feedback control systems, specifically in the area of system modelling and control design in the frequency domain. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces engineering design via optimization, i.e. finding the "best possible" solution to a particular problem. For example, an autonomous vehicle must find the fastest route between two locations over a road network; a biomedical sensing device must compute the most accurate estimate of important physiological parameters from noise-corrupted measurements; a feedback control system must stabilize and control a multivariable dynamical system (such as an aircraft) in an optimal fashion.

The student will learn how to formulate a design in terms of a "cost function", when it is possible to find the "best" design via minimization of this "cost", and how to do so. The course will introduce widely-used optimization frameworks including linear and quadratic programming (LP and QP), dynamic programming (DP), path planning with Dijkstra's algorithm, A*, and probabilistic roadmaps (PRMs), state estimation via Kalman filters, and control via the linear quadratic regulator (LQR) and Model Predictive Control (MPC). There will be constant emphasis on connections to real-world engineering problems in control, robotics, aerospace, biomedical engineering, and manufacturing.

Additional Electives

Students can select from the units below or other elective units offered within the University that are approved by the Head of the School of Aerospace, Mechanical and Mechatronic Engineering.

ENGG1000
History and Philosophy of Engineering

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Tutorial 1 hr/week; Independent research/study 5 hrs/week; E-Learning 2 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

ENGG1000 is a unique course that aims to provide students with an understanding of the historical development of Engineering with relation to societal expectations of the period. Engineering as a field of study and profession has developed over millennia from simple (yet significant) advances in technology such as the lever and wheel, to modern day examples such as advanced computers, nanomaterials and space flight.

Interaction between human society and Engineers has helped develop and guide the advancement of engineering technology; with society posing problems for Engineers to solve and Engineers developing new technology that changed the course of human history, and helped shape the world we live in.

The general philosophy behind Engineering is that Engineers work to fulfil the needs of society (water, electricity, technological improvements etc.), and as such Engineers are expected to act ethically towards society. The role of Engineers in society will be analysed and discussed from a humanistic perspective, with relation to the current Engineers Australia code of ethics. Other relevant philosophical analyses of Engineering as a skill and profession will also be examined such as, aesthetics, creativity, the epistemology of Engineering and more.

This course will use online resources extensively and help develop research and communication skills of students, whilst providing an overview of the historical significance of Engineers in society, and what it means to be an Engineer.

AMME2000
Engineering Analysis

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** (MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) and ENGG1801. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **Assessment:** Through semester assessment (35%) Final Exam (65%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This course is designed to provide students with the necessary tools for mathematically modelling and solving problems in engineering. Solution methods will be considered for a range of standard engineering problems including; Conduction heat transfer in one and two dimensions, hydrostatics and hydrodynamic balance for internal and external flows, spring/mass systems, vibration and stability problems. The focus will be on real problems and numerical solution methods and will include separation of variables; Fourier series and Fourier transforms; Laplace transforms; scaling and finite differences.

Note

Choice of electives as shown in the above table will depend on subject availability, timetabling and prerequisite conditions.
For a standard enrolment plan for Mechanical Engineering visit cusp.sydney.edu.au/students/view-degree-page/name/BE(Mech)

Bachelor of Engineering Honours (Mechanical) (Space)

Course Overview

The space engineering specialisation at the University of Sydney is the only one of its kind in Australia. Space engineering is an exciting and challenging new area of teaching and research concerned with the theory, design, testing, construction and use of engineering components in aerospace.

In the Bachelor of Engineering Honours (Mechanical) (Space) you will undertake four core units of study providing a foundation in orbital mechanics, aerospace systems design, satellite subsystems, launch technology, and remote sensing. You may also choose to complete optional advanced space engineering projects. As a graduate you will be able to meet the challenges of evolving space industries in fields such as propulsion systems, aeronautical design, communications, and navigation.

Course Requirements

To meet requirements for the Bachelor of Engineering Honours (Mechanical) (Space), a candidate must successfully complete 192 credit points, comprising:

1. core and elective units of study relating to the specialist stream, as prescribed by the table of units of study for the stream; and
2. any additional free elective units of study as may be necessary to gain credit to complete the award.

For a standard enrolment plan for Mechanical (Space) Engineering visit http://cusp.sydney.edu.au/students/view-degree-page/name/BE(Mech)(Space)

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Bachelor of Engineering Honours (Mechanical) (Space)			
Candidates for the Bachelor of Engineering Honours (Mechanical) (Space) are required to gain credit for the core units of study set out below. Any additional credit necessary shall be gained by completing additional credit points of elective units of study as recommended by the Faculty, as may be necessary to gain credit for a total of not less than 192 credit points.			
Core units of study			
First Year			
MECH1560 **Introduction to Mechanical Engineering**	6	**N** MTRX1701, AERO1560, ENGG1800 *Note: Department permission required for enrolment* *Limited Places due to TAFE component. Department Permission required for non-BE(Mech) students.*	Semester 1
MATH1001 **Differential Calculus**	3	**A** HSC Mathematics Extension 1 **N** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001	Semester 1 Summer Main
MATH1002 **Linear Algebra**	3	**A** HSC Mathematics or MATH1111 **N** MATH1902, MATH1012, MATH1014	Semester 1 Summer Main
ENGG1801 **Engineering Computing**	6		Semester 1 Summer Late
ENGG1803 **Professional Engineering 1**	6	**N** ENGG1061	Semester 1 Semester 2
Normally taken in Semester 2, students in combined degrees are exempt.			
MATH1003 **Integral Calculus and Modelling**	3	**A** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **N** MATH1013, MATH1903, MATH1907	Semester 2 Summer Main
MATH1005 **Statistics**	3	**A** HSC Mathematics **N** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021	Semester 2 Summer Main Winter Main
ENGG1802 **Engineering Mechanics**	6		Semester 2 Summer Main
MECH1400 **Mechanical Construction**	6	**A** Material from MECH1560 (steam engine), HSC studies (Maths, Physics, Chemistry). *Note: Department permission required for enrolment*	Semester 2
Students in combined degrees are exempt.			
AMME1362 **Materials 1**	6	**N** AMME2302, CIVL2110	Semester 2
Second Year			
MATH2067 **DEs and Vector Calculus for Engineers**	6	**P** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **N** MATH2901, MATH2961, MATH2005, MATH2965, MATH2001, MATH2905, MATH2061, MATH2065	Semester 1
Students in the combined BEHons/BSc degree program can take both MATH2061 and MATH2065 as an alternative.			
AMME2700 **Instrumentation**	6	**A** ENGG1801. Programming Skills, 1st Year maths skills, familiarity with fundamental Aerospace concepts. **P** AERO1560 OR MECH1560 OR MTRX1701 OR ENGG1800	Semester 1
Students in combined degrees are exempt from this unit.			
AMME2500 **Engineering Dynamics**	6	**P** ENGG1802 and (MATH1001 or MATH1901) and (MATH1002 or MATH1902)	Semester 1
BEHons/BSc students can enrol in PHYS2011, PHYS2012 as acceptable alternatives or advanced equivalent.			
AMME2301 **Mechanics of Solids**	6	**P** ENGG1802, MATH1001, MATH1002, MATH1003	Semester 2
AERO2705 **Space Engineering 1**	6	**A** First Year Maths and basic MATLAB programming skills. **P** (AERO1560 OR MECH1560 OR MTRX1701 OR ENGG1800) AND MATH1001 AND MATH1002 AND MATH1003	Semester 2
MECH2400 **Mechanical Design 1**	6	**A** ENGG1801 and ENGG1802, HSC Maths and Physics	Semester 2
AMME2261 **Fluid Mechanics 1**	6	**A** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **N** AMME2200	Semester 1
AMME2262 **Thermal Engineering 1**	6	**A** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **N** AMME2200	Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Third Year			
AMME3500 **System Dynamics and Control**	6	**P** ((MATH2061 or MATH2961) and (MATH2065 or MATH2965)) or MATH2067	Semester 1
MECH2660 **Engineering Management**	6	**A** ENGG1803. It is expected that students will understand the concepts previously presented in ENGG1803 Professional Engineering. It is assumed that the students have an understanding of professional engineering issues, and are experienced in academic writing (both essays and reports), including appropriate referencing techniques, oral presentations and the project management process (particularly in group situations). Such previous knowledge will assist students in the development their awareness of the issues involved with engineering management.	Semester 2
Students in combined degrees are exempt from the above unit.			
AERO3760 **Space Engineering 2**	6	**P** AERO2705	Semester 2
MECH3660 **Manufacturing Engineering**	6	**P** MECH2400 or ENGG1960	Semester 1
MECH3260 **Thermal Engineering 2**	6	**A** Fundamentals of thermodynamics and fluid mechanics are needed to begin this more advanced course **P** AMME2200 OR AMME2262.	Semester 2
MECH3261 **Fluid Mechanics 2**	6	**P** AMME2200 OR AMME2261.	Semester 1
MECH3362 **Materials 2**	6	**A** This subject requires you to have two important skills to bring in: (1) A good understanding of basic knowledge and principles of material science and engineering from AMME2302 (MECH2300) Materials I and mechanics of solids for simple structural elements (in tension, bending, torsion) from AMME2301 (AERO2300); (2) Reasonable mathematical skills in calculation of stresses and strains in simple structural elements. **P** AMME2301 and AMME2302	Semester 1
Fourth Year			
MECH4601 **Professional Engineering 2**	6	**A** ENGG1803, ENGG4000 It is recommended that you have undertaken ENGG4000 Practical Experience in a period prior to undertaking this course, or be able to demonstrate equivalent understanding of professional practice as some assessment tasks will draw upon your experiences in professional engineering practice.	Semester 1
AERO4701 **Space Engineering 3**	6	**P** AERO3760	Semester 1
ENGG4000 **Practical Experience**		**P** 36 Credit Points of Senior Units *Students should have completed three years of their BE program before enrolling in this unit.*	Semester 1 Semester 2
Students should have completed three years of their BEHons program before enrolling in this unit.			
Students must enrol in 12cp of Thesis units.			
AMME4111 **Honours Thesis A**	6	**P** 36 credits of 3rd year units of study. **N** AMME4010, AMME4121, AMME4122 *Note: Department permission required for enrolment* *Honours Thesis A is only available to students with an HWAM of 65 or over. HWAM is a weighted average based on all 2000, 3000 and 4000 level units completed prior to enrolment in this unit. Prospective students in Honours Thesis A are expected to have consulted with supervisors and selected a topic of interest at the end of third year, guided by the advertised list of suggested thesis topics and supervisors. Availability of topics is limited and students should undertake to speak with prospective supervisors as soon as possible. Students who are unable to secure a supervisor and topic will be allocated a supervisor by the unit coordinator. Alternatively, students may do a thesis with a supervisor in industry or in another university department. In this case, the student must also find a second supervisor within the School of AMME.*	Semester 1 Semester 2
Normally taken in Semester 1			
AMME4112 **Honours Thesis B**	6	**P** 36 credits of 3rd year units of study and WAM 65 or over **N** AMME4010, AMME4122, AMME4121 *Note: Department permission required for enrolment* *HWAM of 65 or greater required for enrolment. HWAM is the weighted average of all 2000, 3000 and 4000 level units completed prior to enrolment in this unit.*	Semester 1 Semester 2
Normally taken in Semester 2.			

Acceptable alternative units of study

Most units of study offered by the Faculty of Science shown in the tables can be replaced by an equivalent advanced level unit, subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing advanced options should seek advice from their department before enrolling.

Students undertaking Study Abroad in a particular year of their degree must enrol in the appropriate International Exchange Program units of study as an alternative to a semester's standard units.

Resolutions of the Faculty of Engineering relating to this table:

Bachelor of Engineering Honours (Mechanical) (Space)

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete 24 credit points of recommended elective units of study for Mechanical (Space) Engineering and 6 credit points of free elective units of study. A minimum of 192 credit points is required to be eligible for the award of BE(Mechanical)(Space).

BEHons(Mechanical)(Space)/BSc or BCom or BMedSci or BPM

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete 96 credit points of units of study given by the Faculty of Science for the BE/BSc and BMedSci, or the Business School for the BE/BCom or from the core units table for BPM. A minimum of 240 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and the faculty in which they are undertaking the combined degree.

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
BEHons(Mechanical)(Space)/BA			
In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete at least 6 credit points of recommended elective units of study for Mechanical (Space) Engineering and 84 credit points of units of study given by the Faculty of Arts and Social Sciences for the BE/BA. A minimum of 240 credit points is required to be eligible for the combined degree. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and the faculty in which they are undertaking the combined degree.			
BEHons(Mechanical)(Space)/LLB			
In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete 144 credit points of units of study given by the Faculty of Law for the BE/LLB. A minimum of 288 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and IT and the Faculty of Law.			
Recommended elective units of study			
AMME5202 **Advanced Computational Fluid Dynamics**	6	**A** Partial differential equations; Finite difference methods;Taylor series; Basic fluid mechanics including pressure, velocity, boundary layers, separated and recirculating flows. Basic computer programming skills.	Semester 1
MECH5275 **Advanced Renewable Energy**	6	**A** The students will require an understanding of the basic principles of fluid mechanics, thermodynamics and heat transfer, and the application of these principles to energy conversion systems. In particular, students should be able to analyse fluid flow in turbomachinery; perform first and second law thermodynamic analysis of energy conversion systems; and perform calculations of radiative, conductive and convective heat transfer. **P** (MECH3260 AND MECH3261) OR (AERO3260 AND AERO3261) OR (MECH5262 AND MECH5261) OR (MECH9260 AND MECH9261) *Note: Department permission required for enrolment*	Semester 2
AMME5101 **Energy and the Environment**	6	**P** 24 credits of 3000-level or above units of study	Semester 1
MECH5255 **Air Conditioning and Refrigeration (Adv)**	6	**A** Students are expected to be familiar with the basic laws of thermodynamics, fluid mechanics and heat transfer. **P** MECH3260 **N** MECH4255	Semester 2
MECH5265 **Advanced Combustion**	6	**A** Students are expected to be familiar with the basic laws of thermodynamics, fluid mechanics and heat transfer. **P** (MECH3260 AND MECH3261) OR MECH5262 OR MECH9260	Semester 2
MECH5310 **Advanced Engineering Materials**	6	**N** MECH4310 *Advanced polymer matrix composites, smart/functional materials, high-strength ferrous and non ferrous alloys, superalloys, high performance polymers, eco-materials, thin film science and technology, advanced joining methods, processing-structure-property relationship, damage tolerance, toughening mechanisms, structure integrity and reliability.*	Semester 1
AERO5700 **Space Engineering (Advanced)**	6	**A** AERO3760	Semester 2
AMME5961 **Biomaterials Engineering** *This unit of study is not available in 2015*	6	**A** Recommended 6 credit points of junior biology 6 credit points of junior chemistry 6 credit points of junior materials science 6 credit points of engineering design	Semester 2
AMME5912 **Crash Analysis and Design**	6	**A** Computer Aided Drafting, Basic FEA principles and Solid Mechanics	Semester 1
AMME5902 **Advanced Computer Aided Manufacturing**	6		Semester 2
AMME5510 **Vibration and Acoustics**	6	**A** (AMME2301 OR AMME9301) AND AMME2200 AND (AMME2500 OR AMME9500) *Note: Department permission required for enrolment*	Semester 2
AMME5310 **Engineering Tribology**	6	**A** (AMME2302 OR AMME9302) AND (AMME2301 OR AMME9301) AND (MECH3261 OR MECH9261)	Semester 1
AMME5520 **Advanced Control and Optimisation**	6	**A** Students have an interest and a strong understanding of feedback control systems, specifically in the area of system modelling and control design in the frequency domain. **P** AMME3500 OR AMME5501 OR AMME9501	Semester 1
Additional Electives			
Students can select from the units below or other elective units offered within the University that are approved by the Head of the School of Aerospace, Mechanical and Mechatronic Engineering.			
ENGG1000 **History and Philosophy of Engineering**	6		Semester 1 Semester 2
AMME2000 **Engineering Analysis**	6	**A** (MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) and ENGG1801. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. *Note: Department permission required for enrolment*	Semester 1
Note			
Choice of electives as shown in the above table will depend on subject availability, timetabling and prerequisite conditions.			

For a standard enrolment plan for Mechanical (Space) Engineering visit http://cusp.sydney.edu.au/students/view-degree-page/name/BE(Mech)(Space)

Unit of Study Descriptions

Bachelor of Engineering Honours (Mechanical) (Space)

Candidates for the Bachelor of Engineering Honours (Mechanical) (Space) are required to gain credit for the core units of study set out below. Any additional credit necessary shall be gained by completing additional credit points of elective units of study as recommended by the Faculty, as may be necessary to gain credit for a total of not less than 192 credit points.

Core units of study

First Year

MECH1560
Introduction to Mechanical Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 1 hr/week; Tutorial 2 hrs/week; Workshop 3 hrs/week. **Prohibitions:** MTRX1701, AERO1560, ENGG1800 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment. Note: Limited Places due to TAFE component. Department Permission required for non-BE(Mech) students.

Objectives:

a) To develop an understanding of the role of Mechanical Engineers and the core concepts within the discipline.

b) To understand the content of the degree structure and how the subjects are applied.

c) To develop an understanding of a range of machining and manufacturing processes required to make mechanical components.

Introductory Mechanical Engineering (70%): The subject introduces the core mechanical engineering concepts of design and mechanisms, intelligent systems, applied materials and fluid machinery. An overview is provided of the range of roles and the skills and knowledge required of a Mechanical Engineer. Emphasis is placed on the relationship between the subjects in the degree program and how they are applied by practicing engineers.

Workshop Technology (30%): On overview is provided of a range of machining and manufacturing processes, with hand on experience provided. Workshop Technology practical work is undertaken in: (a) Hand tools (b) Machining and (c) Welding. Safety requirements: All students are required to provide their own personal protective equipment (PPE) and comply with the safety regulations. Students who fail to do this will not be permitted to enter the workshops. In particular, approved industrial footwear must be worn, and long hair must be protected by a hair net. Safety glasses must be worn at all times.

MATH1001
Differential Calculus

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001 **Assumed knowledge:** HSC Mathematics Extension 1 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1001 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study looks at complex numbers, functions of a single variable, limits and continuity, vector functions and functions of two variables. Differential calculus is extended to functions of two variables. Taylor's theorem as a higher order mean value theorem.

Textbooks

As set out in the Junior Mathematics Handbook.

MATH1002
Linear Algebra

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1902, MATH1012, MATH1014 **Assumed knowledge:** HSC Mathematics or MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1002 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study introduces vectors and vector algebra, linear algebra including solutions of linear systems, matrices, determinants, eigenvalues and eigenvectors.

Textbooks

As set out in the Junior Mathematics Handbook

ENGG1801
Engineering Computing

Credit points: 6 **Session:** Semester 1, Summer Late **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will introduce students to fundamental principles of programming. The language used will be Matlab but the principles taught are readily portable to other languages like C and Java. The unit material will be presented in a manner which will help students to draw a connection between programming constructs and real engineering applications. The unit will use engineering inspired case-studies : especially from Civil, Chemical, Aerospace and Mechanical streams, to motivate new material. There will be a major project which uses programming to solve a real world engineering problem. The extensive Matlab library for visualization will also be introduced. Matlab will cover two-thirds of the unit. The remaining one-third will be devoted to the use of Excel in engineering scenarios. Furthermore, cross integration between Matlab and Excel will also be highlighted.

ENGG1803
Professional Engineering 1

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prohibitions:** ENGG1061 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Professional Engineering 1 is an introductory Unit of Study within the Faculty of Engineering. The semester 1 course is aimed at students from the School of Aerospace, Mechanical and Mechatronic Engineering. It seeks to introduce newly admitted undergraduates to general principles of professional engineering practice, a range of contemporary professional engineering issues, plus outline skills related to academic study within an engineering environment. The subject is structured around a team based design and build project, in which students apply the professional engineering concepts they are learning to an engineering project. Professional engineering topics to be covered include: accessing information, teamwork, creativity, leadership, written and oral communication, project management, problem solving, ethics, liability, work health and safety and environmental issues.

Normally taken in Semester 2, students in combined degrees are exempt.

MATH1003
Integral Calculus and Modelling

Credit points: 3 **Session:** Semester 2, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1013, MATH1903, MATH1907 **Assumed knowledge:** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1003 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.This unit of study first develops the idea of the definite integral from Riemann sums, leading to the Fundamental Theorem of Calculus. Various techniques of integration are considered, such as integration by parts.The second part is an introduction to the use of first and second order differential equations to model a variety of scientific phenomena.

Textbooks

As set out in the Junior Mathematics Handbook

MATH1005
Statistics

Credit points: 3 **Session:** Semester 2, Summer Main, Winter Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021 **Assumed knowledge:** HSC Mathematics **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1005 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit offers a comprehensive introduction to data analysis, probability, sampling, and inference including t-tests, confidence intervals and chi-squared goodness of fit tests.

Textbooks

As set out in the Junior Mathematics Handbook

ENGG1802
Engineering Mechanics

Credit points: 6 **Session:** Semester 2, Summer Main **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit aims to provide students with an understanding of and competence in solving statics and introductory dynamics problems in engineering. Tutorial sessions will help students to improve their group work and problem solving skills, and gain competency in extracting a simplified version of a problem from a complex situation. Emphasis is placed on the ability to work in 3D as well as 2D, including the 2D and 3D visualization of structures and structural components, and the vectorial 2D and 3D representations of spatial points, forces and moments. Introduction to kinematics and dynamics topics includes position, velocity and acceleration of a point; relative motion, force and acceleration, momentum, collisions and energy methods.

MECH1400
Mechanical Construction

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 1 hr/week; Laboratory 3 hrs/week. **Assumed knowledge:** Material from MECH1560 (steam engine), HSC studies (Maths, Physics, Chemistry). **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

Learn about selected historical events, research methods, analysis techniques, application of theory and analysis to real machinery, use of machine and hand tools.

This is a project based subject where the students will design, build and test their own designs. Historical developments in the area of the project are researched and applied and research into relevant fields is required to fully understand and analyse the project problem.

The unit ties in with workshop component of MECH1560. Skills developed become relevant in MECH2400 Mechanical Design 1

Students in combined degrees are exempt.

AMME1362
Materials 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/semester. **Prohibitions:** AMME2302, CIVL2110 **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

AMME1362 is an introductory unit in engineering materials. The unit aims to develop students' understanding of the structures, mechanical properties and manufacture of a range of engineering materials as well as how the mechanical properties relate to microstructure and forming and treatment methods. The unit has no prerequisite subject and is therefore intended for those with little or no previous background in engineering materials. However the unit does require students to take a significant degree of independent responsibility for developing their own background knowledge of materials and their properties. The electrical, magnetic, thermal and optical properties of materials are a critical need-to-know area where students are expected to do some independent study.

Second Year

MATH2067
DEs and Vector Calculus for Engineers

Credit points: 6 **Session:** Semester 1 **Classes:** Three 1 hour lectures, one 1 hour tutorial and one 1 hour practice class per week. **Prerequisites:** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **Prohibitions:** MATH2901, MATH2961, MATH2005, MATH2965, MATH2001, MATH2905, MATH2061, MATH2065 **Assessment:** One 2 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH2067 starts by introducing students to solution techniques of ordinary and partial differential equations (ODEs and PDEs) relevant to the engineering disciplines: it provides a basic grounding in these techniques to enable students to build on the concepts in their subsequent engineering classes. The main topics are Fourier series, second order ODEs, including inhomogeneous equations and Laplace transforms, and second order PDEs in rectangular domains (solution by separation of variables).

The unit moves on to topics from vector calculus, including vector-valued functions (parametrised curves and surfaces; vector fields; div, grad and curl; gradient fields and potential functions), line integrals (arc length; work; path-independent integrals and conservative fields; flux across a curve), iterated integrals (double and triple integrals; polar, cylindrical and spherical coordinates; areas, volumes and mass; Green's Theorem), flux integrals (flow through a surface; flux integrals through a surface defined by a function of two variables, though cylinders, spheres and parametrised surfaces), Gauss's Divergence Theorem and Stokes' Theorem.

Students in the combined BEHons/BSc degree program can take both MATH2061 and MATH2065 as an alternative.

AMME2700
Instrumentation

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs. **Prerequisites:** AERO1560 OR MECH1560 OR MTRX1701 OR ENGG1800 **Assumed knowledge:** ENGG1801. Programming Skills, 1st Year maths skills, familiarity with fundamental Aerospace concepts. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to develop in students an understanding of the engineering measurements and instrumentation systems. The students will acquire an ability to make accurate and meaningful measurements. It will cover the general areas of electrical circuits and mechanical/electronic instrumentation for strain, force, pressure, moment, torque, displacement, velocity, acceleration, temperature and so on.

Students in combined degrees are exempt from this unit.

AMME2500
Engineering Dynamics

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs **Prerequisites:** ENGG1802 and (MATH1001 or MATH1901) and (MATH1002 or MATH1902) **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to teach: Dynamics of Rigid Bodies: Analysis of Planar mechanisms; Kinematics of rigid bodies; Kinetics of rigid bodies. Students will also develop their skills in: how to model and analyse dynamic systems and the application of theory to real systems through practical/laboratory sessions.

At the end of this unit students will have developed skills in modelling and analysing planar mechanisms and rigid body dynamic systems.

Course content will include planar mechanisms, linkages, mobility; instant centres of rotation, Kennedy's theorem; velocity and acceleration polygons; kinematics of rigid bodies, frames of reference, velocity and acceleration, rotating frame of reference, relative velocity and acceleration, gyroscopic acceleration; kinetics of rigid bodies, linear momentum and Euler's first law; angular momentum and Euler's second law; centre of mass; moments of inertia, parallel axis and parallel plane theorems, principal axes and principal moments of inertia, rotation about an axis; impulse and momentum; work and energy, kinetic and potential energies; applications to orbital and gyroscopic motion; introduction to Lagrangian methods.

BEHons/BSc students can enrol in PHYS2011, PHYS2012 as acceptable alternatives or advanced equivalent.

AMME2301
Mechanics of Solids

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** ENGG1802, MATH1001, MATH1002, MATH1003 **Assessment:** Through semester assessment (35%) Final Exam (65%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Equilibrium of deformable structures; basic concept of deformation compatibility; stress and strain in bars, beams and their structures subjected to tension, compression, bending, torsion and combined loading; statically determinate and indeterminate structures; energy methods for bar and beam structures; simple buckling; simple vibration; deformation of simple frames and cell box beams; simple two-dimensional stress and Morh's circle; problem-based applications in aerospace, mechanical and biomedical engineering.

AERO2705
Space Engineering 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** (AERO1560 OR MECH1560 OR MTRX1701 OR ENGG1800) AND MATH1001 AND MATH1002 AND MATH1003 **Assumed knowledge:** First Year Maths and basic MATLAB programming skills. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to introduce students to the terminology, technology and current practice in the field of Space Engineering. Course content will include a variety of topics in the area of orbital mechanics, satellite systems and launch requirements. Case studies of current systems will be the focus of this unit.

MECH2400
Mechanical Design 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 1 hr/week. **Assumed knowledge:** ENGG1801 and ENGG1802, HSC Maths and Physics **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Aim: For students to experience a realistic the design process and to develop good engineering skills.

Course Objectives: To develop an understanding of:

1. the need for and use of standard drawings in the communication and definition of parts and assemblies,
2. Efficient use of a CAD package
3. creativity,
4. the design process from initial idea to finished product
5. Methods used to analyse designs
6. standard components.

AMME2261
Fluid Mechanics 1

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs/semester. **Prohibitions:** AMME2200 **Assumed knowledge:** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit covers the fundamentals of fluid statics and fluid dynamics. At the end of this unit students will have: an understanding of the basic equations governing the statics and dynamics of fluids; the ability to analyze and determine the forces applied by a static fluid; the ability to analyse fluids in motion. The course will cover both inviscid and viscous fluid flow. The course will introduce the relevant parameters for fluid flow in internal engineering systems such as pipes and pumps and external systems such as flow over wings and airfoils. Course content will cover the basic concepts such as viscosity, density, continuum, pressure, force, buoyancy and acceleration; and more detailed methods including continuity, conservation of momentum, streamlines and potential flow theory, Bernoulli equation, Euler equation, Navier-Stokes equation. Experiments will introduce flow measuring devices and flow observation.

AMME2262
Thermal Engineering 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs. **Prohibitions:** AMME2200 **Assumed knowledge:** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to teach the basic laws of thermodynamics and heat transfer. At the end of this unit students will have: an understanding of the basic laws of thermodynamics and heat transfer; The ability to analyze the thermodynamics of a simple open or closed engineering system. The basic knowledge to analyse and design 1D thermal circuits. Course content will include concepts of heat and work, properties of substances, first law of thermodynamics, control mass and control volume analysis, thermal efficiency, entropy, second law of thermodynamics, reversible and irreversible processes, isentropic efficiency, power and refrigeration cycles, heat transfer by conduction, convection and radiation, 1D thermal circuits and transient heat transfer.

Third Year

AMME3500
System Dynamics and Control

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week. **Prerequisites:** ((MATH2061 or MATH2961) and (MATH2065 or MATH2965)) or MATH2067 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to allow students to develop an understanding of methods for modeling and controlling linear, time-invariant systems. Techniques examined will include the use of differential equations and frequency domain approaches to modeling of systems. This will allow students to examine the response of a system to changing inputs and to examine the influence of external stimuli such as disturbances on system behaviour. Students will also gain an understanding of how the responses of these mechanical systems can be altered to meet desired specifications and why this is important in many engineering problem domains.

The study of control systems engineering is of fundamental importance to most engineering disciplines, including Electrical, Mechanical, Mechatronic and Aerospace Engineering. Control systems are found in a broad range of applications within these disciplines, from aircraft and spacecraft to robots, automobiles, computers and process control systems. The concepts taught in this course introduce students to the mathematical foundations behind the modelling and control of linear, time-invariant dynamic systems. In particular, topics addressed in this course will include:

1. Techniques for modelling mechanical systems and understanding their response to control inputs and disturbances. This will include the use of differential equations and frequency domain methods as well as tools such as Root Locus and Bode plots.

2. Representation of systems in a feedback control system as well as techniques for determining what desired system performance specifications are achievable, practical and important when the system is under control

3. Theoretical and practical techniques that help engineers in designing control systems, and an examination of which technique is best in solving a given problem.

MECH2660
Engineering Management

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hours per week; Tutorial 2 hours per week. **Assumed knowledge:** ENGG1803. It is expected that students will understand the concepts previously presented in ENGG1803 Professional Engineering. It is assumed that the students have an understanding of professional engineering issues, and are experienced in academic writing (both essays and reports), including appropriate referencing techniques, oral presentations and the project management process (particularly in group situations). Such previous knowledge will assist students in the development their awareness of the issues involved with engineering management. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to: develop an understanding of the principles of management as applies particularly to the engineering and industrial settings. It aims to provide knowledge of the principles and tools that can assist communication, supervision, project management, team membership, decision making and risk management. At the end of this unit students will be able to understand different management practices and approaches applicable to a broad range of environments. In the process they will develop greater skills in team work, written expression, and verbal presentation. The concepts covered in this unit are from the following management areas: Engineers and Management - including ethics, Communication and People in Organisations, Economics, Leadership, Managerial Decision Analysis, Marketing, Business Planning, Legal Environment of Business, Risk Management, Human Resource Management, Project Management, Quality Assurance and Management, Operations Management, and Financial Management.

Students in combined degrees are exempt from the above unit.

AERO3760
Space Engineering 2

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Practical Experience 2 hrs/week. **Prerequisites:** AERO2705 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to provide students with a learning environment that promotes systems thinking and allows students to develop skills in systems analysis and design. In particular the UoS will focus on Aerospace systems, and students will develop both theoretical and practical skills in the area of systems engineering for this discipline. The primary objective is to develop fundamental systems engineering and systems thinking skills. At the end of this unit students will be able to: define the requirements process and be able to apply it to aerospace systems design.; conduct requirements analysis for an aerospace system and to drill down through requirements breakdown and the use of the V-diagram in this analysis; conduct functional and technical analysis and determine design drivers in a system; manage the use of a log book and its application in engineering design; develop technical skills in the design and development of satellite subsystems; conduct appropriate interaction processes between team members for the successful achievement of goals. Course content will include fundamentals of systems engineering; satellite subsystems; systems design.

MECH3660
Manufacturing Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Laboratory, Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** MECH2400 or ENGG1960 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit aims to teach the fundamentals of manufacturing processes and systems in mechanical, mechatronic and biomedical engineering, including traditional and advanced manufacturing technologies.

This unit aims to develop the following attributes: to understand the fundamental principles of manufacturing technologies for the above mentioned engineering areas; to gain the ability to select existing manufacturing processes and systems for direct engineering applications; to develop ability to create innovative new manufacturing technologies for advanced industrial applications; to develop ability to invent new manufacturing systems

At the end of this unit students will have a good understanding of the following: merits and advantages of individual manufacturing processes and systems; principles of developing new technologies; comprehensive applications and strategic selection of manufacturing processes and systems.

Course content will include:

Manufacturing Processes: Common processes and their science (machining, casting, powder metallurgy, metal working, welding); merits and limitations; CNC and CAM;

Manufacturing Systems: Economics in manufacturing; flexible manufacturing; group technology; materials selection and requirements planning; quality control; introduction to new technology; introduction to e-manufacturing; human factors; plant layout.

MECH3260
Thermal Engineering 2

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs/week. **Prerequisites:** AMME2200 OR AMME2262. **Assumed knowledge:** Fundamentals of thermodynamics and fluid mechanics are needed to begin this more advanced course **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to develop an understanding of: the principles of thermodynamic cycles, gas mixtures, combustion and thermochemistry applied to engineering processes, power and refrigeration systems; heat transfer equipment design. To classify heat transfer situations as conduction, convection, radiation, forced or natural convection. To determine the appropriate approach to problems, the type of solution needed, analytical or numerical. To be able to arrive at a solution and predict heat transfer rates and be able to design and size heat transfer equipment.

At the end of this unit students will be able to: apply the principles of thermodynamics and heat transfer to engineering situations; have the ability to tackle and solve a range of complex thermodynamics cycles, air conditioning, combustion, chemical equilibrium, problems involving gas mixtures; have the ability to tackle and solve a range of heat transfer problems including finned heat exchangers, cooling by fluids, quenching, insulation and solar radiation.

Course content will include: Thermodynamics: exergy and entropy, power cycles: spark ignition, Diesel, gas turbine; gas mixtures, humidity, psychrometry, air-conditioning, combustion: stoichiometry, gas analysis, combustion, thermochemistry, adiabatic flame temperature, 2nd Law analysis of reacting systems, equilibrium, exergy, Heat Transfer: conduction, thermal circuits, general conduction equation, cylindrical fins, heat exchangers, numerical solutions, unsteady conduction, convection, analytical, forced convection correlations, natural convection, boiling, radiation spectrum, blackbody, radiation properties and laws, environmental radiation, solar.

MECH3261
Fluid Mechanics 2

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs. **Prerequisites:** AMME2200 OR AMME2261. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to provide students with a detailed understanding of the theory and practice of fluid mechanics in the context of mechanical engineering. Students will gain skills in problem solving in areas of pipe, pump and channel flow; lift and drag on immersed bodies; boundary layer theory and gas dynamics.

At the end of this unit students will have the ability to critically assess and solve problems commonly found in fluid mechanics practice, such as sizing pumps and piping systems, designing channels, and determing the lift and drag characteristics of submerged bodies. Additionally, they will develop a structured and systematic approach to problem solving.

MECH3362
Materials 2

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory, Independent Study **Prerequisites:** AMME2301 and AMME2302 **Assumed knowledge:** This subject requires you to have two important skills to bring in: (1) A good understanding of basic knowledge and principles of material science and engineering from AMME2302 (MECH2300) Materials I and mechanics of solids for simple structural elements (in tension, bending, torsion) from AMME2301 (AERO2300); (2) Reasonable mathematical skills in calculation of stresses and strains in simple structural elements. **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims for students to understand the relationship between properties of materials and their microstructures and to improve mechanical design based on knowledge of mechanics and properties of materials.

At the end of this unit students should have the capability to select proper materials for simple engineering design.

Course content will include: short-term and long-term mechanical properties; introductory fracture and fatigue mechanics, dislocations; polymers and polymer composite materials; ceramics and glasses; structure-property relationships; selection of materials in mechanical design.

Fourth Year

MECH4601
Professional Engineering 2

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** ENGG1803, ENGG4000 It is recommended that you have undertaken ENGG4000 Practical Experience in a period prior to undertaking this course, or be able to demonstrate equivalent understanding of professional practice as some assessment tasks will draw upon your experiences in professional engineering practice. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to create an awareness of issues surrounding the management of projects; impart knowledge resulting in a more global approach to the practice of engineering and engineering management; and provide a vehicle for improving communication skills (both written and oral). The course also aims, when taken together with other courses offered by the School, to substantially meet the requirement of the Institution of Engineers, Australia, for undergraduate training in management theory and Professional Engineering skills. On completion of this unit students should be able to: plan small projects and contribute effectively to planning of larger projects; work effectively in small teams; understand their role and expected conduct in the management of engineering projects; perform well in that role from the outset, with performance limited only by experience; prepare an interesting and relevant presentation on aspects of their work for their peers or senior managers; recognise the range of expertise they may need to call on in their role as an engineer working on a project (e.g. in safety and environmental fields); understand what the experts are saying, and be able to contribute effectively to that discussion.

AERO4701
Space Engineering 3

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** AERO3760 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This UoS aims to teach students the fundamental principles and methods of designing solutions to optimal estimation and control problems in space engineering applications. Students will apply learned techniques in optimal estimation and control theory to solving a wide range of different problems in engineering such as satellite orbit determination, satellite attitude determination, satellite positioning systems and remote sensing, optimal flight control, space shuttle re-entry and orbit transfers. Students will learn to recognize and appreciate the coupling between the different elements within an estimation and control task, from a systems-theoretic perspective.

ENGG4000
Practical Experience

Session: Semester 1, Semester 2 **Classes:** Practical Experience, **Prerequisites:** 36 Credit Points of Senior Units **Assessment:** Through semester assessment (100%) **Mode of delivery:** Professional practice

Note: Students should have completed three years of their BE program before enrolling in this unit.

The aim of this unit is to give students exposure to work in an engineering organisation and gain some professional experience; to enhance a student's abilities and experience in report writing; to encourage self-evaluation in the context of applying their theoretical knowledge to real industry practise. Students will gain a better appreciation of the role of engineers in the workplace. The assessment will enhance the student's ability to present structured observations and reflections in the mode of a formal written report.

Each student is required to gain exposure to professional engineering practice and environments and to submit a satisfactory written report of his or her work. The report will include the requirement of a detail logbook recording tasks given and timelines set for achieving these. Self-evaluation of a student's personal level of knowledge and its applicability to the workplace is a major component of the reporting. Normally 12 weeks (60 days) of practical work experience is required, though the Faculty may accept alternatives that are judged as equivalent. Students are strongly encouraged to undertake their work experience in the break between Year 3 and 4 and definitely prior to commencing their final semester of study, however any engineering work taken after completing 28 credit points of 3rd year units of study may be accepted for the requirements of this unit. The University Careers and Appointments Service is available to assist students to obtain suitable employment. This unit of study is a core unit of study in all BE programs and must be passed in order to graduate from those programs.

Students should have completed three years of their BEHons program before enrolling in this unit.

Students must enrol in 12cp of Thesis units.

AMME4111
Honours Thesis A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research 10 hrs/week. **Prerequisites:** 36 credits of 3rd year units of study. **Prohibitions:** AMME4010, AMME4121, AMME4122 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: Honours Thesis A is only available to students with an HWAM of 65 or over. HWAM is a weighted average based on all 2000, 3000 and 4000 level units completed prior to enrolment in this unit. Prospective students in Honours Thesis A are expected to have consulted with supervisors and selected a topic of interest at the end of third year, guided by the advertised list of suggested thesis topics and supervisors. Availability of topics is limited and students should undertake to speak with prospective supervisors as soon as possible. Students who are unable to secure a supervisor and topic will be allocated a supervisor by the unit coordinator. Alternatively, students may do a thesis with a supervisor in *industry or in another university department. In this case, the student must also find a second supervisor within the School of AMME.*

The fourth year honours thesis aims to provide students with the opportunity to carry out a defined piece of independent research in a setting and in a manner that fosters the development of engineering research skills. These skills include the capacity to define a research question, showing how it relates to existing knowledge, identifying the tools needed to investigate the question, carrying out the research in a systematic way, analysing the results obtained and presenting the outcomes in a report that is clear, coherent and logically structured. Honours thesis is undertaken across two semesters of enrolment, in two successive Units of Study of 6 credits points each. Honours Thesis A covers first steps of thesis research starting with development of research proposal. Thesis B covers the second of stage writing up and presenting the research results.

Students are asked to write a thesis based on a research project, which is very often related to some aspect of a staff member's research interests. Some projects will be experimental in nature, others may involve computer-based simulation, feasibility studies or the design, construction and testing of equipment. Direction of thesis work may be determined by the supervisor or be of an original nature, but in either case the student is responsible for the execution of the practical work and the general layout and content of the thesis itself. The final thesis must be the student's individual work, although research is sometimes conducted in the framework of a group project shared with others. Students undertaking research on this basis will need to take care in ensuring the individual quality of their own research work and the final thesis submission. The thesis will be judged on the extent and quality of the student's original work and particularly how critical, perceptive and constructive he or she has been in assessing his/her work and that of others. Students will also be required to present the results of their findings to their peers and supervisors as part of a seminar program.

It is not expected that a thesis at this level will represent a significant contribution to new knowledge; nor is it expected that theses will resolve great intellectual problems. The timeframe available for the thesis is simply too short to permit students to tackle complex or difficult problems. Indeed, a key aim of the thesis is to specify a research topic that arouses sufficient intellectual curiosity, and presents an appropriate range and diversity of technical and conceptual challenges, while remaining manageable and allowing achievable outcomes within the time and resources available. It is important that the topic be of sufficient scope and complexity to allow a student to learn their craft and demonstrate their research skills. Equally imperative is that the task not be so demanding as to elude completion.

Normally taken in Semester 1

AMME4112
Honours Thesis B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research 10 hrs/week. **Prerequisites:** 36 credits of 3rd year units of study and WAM 65 or over **Prohibitions:** AMME4010, AMME4122, AMME4121 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: HWAM of 65 or greater required for enrolment. HWAM is the weighted average of all 2000, 3000 and 4000 level units completed prior to enrolment in this unit.

The fourth year honours thesis aims to provide students with the opportunity to carry out a defined piece of independent research or design work in a setting and in a manner that fosters the development of engineering skills in research or design. These skills include the capacity to define a research or design question, showing how it relates to existing knowledge, identifying the tools needed to investigate the question, carrying out the research or design in a systematic way, analysing the results obtained and presenting the outcomes in a report that is clear, coherent and logically structured. Honours thesis is undertaken across two semesters of enrolment, in two successive Units of Study of 6 credits points each. Honours Thesis A covers first steps of thesis research starting with development of research proposal. Thesis B covers the second of stage writing up and presenting the research results.

Students are asked to write a thesis based on a research or major design project, which is very often related to some aspect of a staff member's research interests. Some projects will be experimental in nature, others may involve computer-based simulation, feasibility studies or the design, construction and testing of equipment. Direction of thesis work may be determined by the supervisor or be of an original nature, but in either case the student is responsible for the execution of the practical work and the general layout and content of the thesis itself. The final thesis must be the student's individual work, although research is sometimes conducted in the framework of a group project shared with others. Students undertaking research on this basis will need to take care in ensuring the individual quality of their own research work and the final thesis submission. The thesis will be judged on the extent and quality of the student's original work and particularly how critical, perceptive and constructive he or she has been in assessing his/her work and that of others. Students will also be required to present the results of their findings to their peers and supervisors as part of a seminar program.

It is not expected that a thesis at this level will represent a significant contribution to new knowledge; nor is it expected that theses will resolve great intellectual problems. The time frame available for the thesis is simply too short to permit students to tackle complex or difficult problems. Indeed, a key aim of the thesis is to specify a research or design topic that arouses sufficient intellectual curiosity, and presents an appropriate range and diversity of technical and conceptual challenges, while remaining manageable and allowing achievable outcomes within the time and resources available. It is important that the topic be of sufficient scope and complexity to allow a student to learn their craft and demonstrate their research or design skills. Equally imperative is that the task not be so demanding as to elude completion.

Normally taken in Semester 2.

Acceptable alternative units of study

Most units of study offered by the Faculty of Science shown in the tables can be replaced by an equivalent advanced level unit, subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing advanced options should seek advice from their department before enrolling.Students undertaking Study Abroad in a particular year of their degree must enrol in the appropriate International Exchange Program units of study as an alternative to a semester's standard units.

Resolutions of the Faculty of Engineering relating to this table:

Bachelor of Engineering Honours (Mechanical) (Space)

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete 24 credit points of recommended elective units of study for Mechanical (Space) Engineering and 6 credit points of free elective units of study. A minimum of 192 credit points is required to be eligible for the award of BE(Mechanical)(Space).

BEHons(Mechanical)(Space)/BSc or BCom or BMedSci or BPM

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete 96 credit points of units of study given by the Faculty of Science for the BE/BSc and BMedSci, or the Business School for the BE/BCom or from the core units table for BPM. A minimum of 240 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and the faculty in which they are undertaking the combined degree.

BEHons(Mechanical)(Space)/BA

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete at least 6 credit points of recommended elective units of study for Mechanical (Space) Engineering and 84 credit points of units of study given by the Faculty of Arts and Social Sciences for the BE/BA. A minimum of 240 credit points is required to be eligible for the combined degree. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and the faculty in which they are undertaking the combined degree.

BEHons(Mechanical)(Space)/LLB

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete 144 credit points of units of study given by the Faculty of Law for the BE/LLB. A minimum of 288 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and IT and the Faculty of Law.

Recommended elective units of study

AMME5202
Advanced Computational Fluid Dynamics

Credit points: 6 **Session:** Semester 1 **Classes:** Laboratory 2 hrs/week; Lecture 1 hr/week; Tutorial 1 hr/week. **Assumed knowledge:** Partial differential equations; Finite difference methods;Taylor series; Basic fluid mechanics including pressure, velocity, boundary layers, separated and recirculating flows. Basic computer programming skills. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Objectives: To provide students with the necessary skills to use commercial Computational Fluid Dynamics packages and to carry out research in the area of Computational Fluid Dynamics. Expected outcomes: Students will have a good understanding of the basic theory of Computational Fluid Dynamics, including discretisation, accuracy and stability. They will be capable of writing a simple solver and using a sophisticated commercial CFD package. Syllabus summary: A course of lectures, tutorials and laboratories designed to provide the student with the necessary tools for using a sophisticated commercial CFD package. A set of laboratory tasks will take the student through a series of increasingly complex flow simulations, requiring an understanding of the basic theory of computational fluid dynamics (CFD). The laboratory tasks will be complemented by a series of lectures in which the basic theory is covered, including: governing equations; finite difference methods, accuracy and stability for the advection/diffusion equation; direct and iterative solution techniques; solution of the full Navier-Stokes equations; turbulent flow; Cartesian tensors; turbulence models.

MECH5275
Advanced Renewable Energy

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** (MECH3260 AND MECH3261) OR (AERO3260 AND AERO3261) OR (MECH5262 AND MECH5261) OR (MECH9260 AND MECH9261) **Assumed knowledge:** The students will require an understanding of the basic principles of fluid mechanics, thermodynamics and heat transfer, and the application of these principles to energy conversion systems. In particular, students should be able to analyse fluid flow in turbomachinery; perform first and second law thermodynamic analysis of energy conversion systems; and perform calculations of radiative, conductive and convective heat transfer. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit aims to develop understanding of the engineering design and analysis of different devices and technologies for generating power from renewable sources including: solar, wind, wave, tidal, ocean thermal, geothermal, hydro-electric, and biofuels; to understand the environmental, operational and economic issues associated with each of these technologies. At the end of this unit students will be able to perform in depth technical analysis of different types of renewable energy generation devices using the principles of fluid mechanics, thermodynamics and heat transfer. Students will be able to describe the environmental, economic and operational issues associated with these devices.

AMME5101
Energy and the Environment

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Project Work - own time 2 hrs/week. **Prerequisites:** 24 credits of 3000-level or above units of study **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit is suitable for any engineering discipline student who is interested in developing an understanding of analysis and design in energy, power generation, environment and relevant economic issues. The aim is to acquaint students with the methods engineers use to design and evaluate the thermal processes used for the production of electricity. It also assesses and deals with the environmental consequences of power generation. At the end of this unit students will be able to carry out preliminary design and economic impact analyses for electrical power generation systems.

A series of topics will be covered in relation to energy and electricity and relevant issues. The course contents will include:

1. Economic analysis of energy systems;
2. Environmental impact of power generation;
3. Principles of thermodynamics;
4. First law analysis of power cycles;
5. Design and simulation of power generation cycles;
6. Second law efficiency and availability;
7. Energy efficiency;
8. CO2 capture and sequestration;
9. Design of various components of thermal power plants.

MECH5255
Air Conditioning and Refrigeration (Adv)

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Prerequisites:** MECH3260 **Prohibitions:** MECH4255 **Assumed knowledge:** Students are expected to be familiar with the basic laws of thermodynamics, fluid mechanics and heat transfer. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study develops an advanced knowledge of air conditioning systems and refrigeration applications. At the completion of this unit students will be able to determine thermal loads on structures and design an air conditioning or refrigeration system with attention to comfort, control, air distribution and energy consumption. Course content will include: applied psychrometrics, air conditioning systems, design principles, comfort in the built environment. cooling load calculations, heating load calculations, introduction and use of computer-based load estimation packages software, air distribution, fans, ducts, air conditioning controls, advanced refrigeration cycles, evaporators, condensers, cooling towers, compressors, pumps, throttling devices, piping, refrigerants, control, refrigeration equipment, simulation of refrigeration systems, food refrigeration and industrial applications; Use of CFD packages as tools to simulate flows in building and to optimise air conditioning design, energy estimation methods and software, energy evaluation and management in the built environment. Use of experimental air conditioning systems to test for thermal balances and compare with simulations.

MECH5265
Advanced Combustion

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Prerequisites:** (MECH3260 AND MECH3261) OR MECH5262 OR MECH9260 **Assumed knowledge:** Students are expected to be familiar with the basic laws of thermodynamics, fluid mechanics and heat transfer. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This UoS aims to teach the basic principles of combustion highlighting the role of chemical kinetics, fluid mechanics, and molecular transport in determining the structure of flames. Students will become familiar with laminar and turbulent combustion of gaseous and liquid fuels including the formation of pollutants. They will also be briefly introduced to various applications such as internal combustion engines, gas turbines, furnaces and fires.

This UoS will cover equilibrium compositions, flammability limits, simple chemically reacting systems, detailed chemical kinetics, and the basic theory underlying laminar and turbulent combustion for both premixed and non-premixed cases. There will be an introduction to droplet combustion, the concept of mixture fraction for non-premixed flames, combustion in engines and gas turbines as well as the formation of pollutants. Fire ignition, growth and spread will also be covered with respect to safety in buildings including the hazards related to the formation of smoke and toxic products.

MECH5310
Advanced Engineering Materials

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week; Laboratory 3 hrs. **Prohibitions:** MECH4310 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Advanced polymer matrix composites, smart/functional materials, high-strength ferrous and non ferrous alloys, superalloys, high performance polymers, eco-materials, thin film science and technology, advanced joining methods, processing-structure-property relationship, damage tolerance, toughening mechanisms, structure integrity and reliability.

To understand (a) how to define the relationship between properties and microstructures of advanced engineering materials, (b) how to improve mechanical design with the knowledge of mechanics and properties of materials, and (c) how to conduct failure diagnosis of engineering materials.

AERO5700
Space Engineering (Advanced)

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** AERO3760 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Planetary observation using robotics and intelligents systems will grow in importance over the next decade. These systems can take the form of either intelligent spacecraft, robotic air vehicles or planetary rovers. In this subject we will study a wide range of robotic spacecraft systems that are used for planetary observation and focus on their specifications as well as their internal systems. From a practical perspective will be working hands on with the Mars Rover developed at the University of Sydney to study the various intelligent components and how they come together.

AMME5961
Biomaterials Engineering

Credit points: 6 **Session:** Semester 2 **Classes:** : Lectures: 3 hours per week **Assumed knowledge:** Recommended 6 credit points of junior biology 6 credit points of junior chemistry 6 credit points of junior materials science 6 credit points of engineering design **Assessment:** Through semester assessment (60%), Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

To gain a basic understanding of the major areas of interest in the biomaterials field, learn to apply basic engineering principles to biomedical systems, and understand the challenges and difficulties of biomedical systems. To participate in a project-based-learning approach to the topic of design with Biomaterials.

AMME5912
Crash Analysis and Design

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Project Work - own time, **Assumed knowledge:** Computer Aided Drafting, Basic FEA principles and Solid Mechanics **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The objective of the course is to give students skills in the area of highly non-linear finite element analysis. Major topics covered include CAD, Implicit / explicit codes, Wire frame geometry, Elemental Theory, Materials, Pre-processing using ETA-PreSys, Contact, LS-Dyna, using NCAC FEM models, Modeling fasteners, Material covered in lectures is reinforced through independent research, assignments, quizzes and a major capstone project. The capstone project involves the development of an approved crash scenario.

AMME5902
Advanced Computer Aided Manufacturing

Credit points: 6 **Session:** Semester 2 **Classes:** Project Work - in class, Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory, Seminar, **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The aim of this course is to enhance the student`s manufacturing engineering skills in the CAD/CAM area. The course focuses on CNC milling as a manufacturing automation process applied to a project. The management, planning and marketing of a typical engineering project are also discussed.

Objectives:Through integrated project-based learning and hands-on-machine training, you will learn

oHow to successfully complete a CAD/CAM and CNC mill based project.

oManufacturing management and system skills, such as product planning, manufacturing sequence, time and cost;

oThe science in designing and selecting a manufacturing method.

oHow to effectively present your ideas and outcomes using oral and report based methods.

It is expected that through your hard work in the semester, you will find

oEnhanced learning by real-world problems.

oImproved comprehensive skill in manufacturing design.

AMME5510
Vibration and Acoustics

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/week. **Assumed knowledge:** (AMME2301 OR AMME9301) AND AMME2200 AND (AMME2500 OR AMME9500) **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This UoS should prepare the student to be able to undertake vibration and acoustic measurement calculations for industry design situations.

The unit aims to introduce a number of new concepts required for analysis of vibrations and acoustics. The response of structure under different dynamic forces, including human and aerodynamic, will be investigated. A number of hands-on experiments will be performed to allow an understanding of the concepts and applicability.

The acoustics component will include: basic acoustics theory, sound generation and propagation, impedance, absorbing materials, industrial noise sources, isolation methods of noise control, enclosures, instrumentation and measurement, frequency analysis, noise regulations and computational acoustics.

AMME5310
Engineering Tribology

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs; Tutorial 3 hrs/week; Seminar 3 hrs/week. **Assumed knowledge:** (AMME2302 OR AMME9302) AND (AMME2301 OR AMME9301) AND (MECH3261 OR MECH9261) **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The aim is to teach students in the undergraduate and postgraduate levels basic concepts about friction, lubrication and wear applicable to design and operation of mechanical systems used in engineering, industrial, and modern applications. Examples of these systems are lubrication of internal combustion engines, gearboxes, artificial hip/knee joints, and micro/nano electromechanical systems.

AMME5520
Advanced Control and Optimisation

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Research 1 hr/week. **Prerequisites:** AMME3500 OR AMME5501 OR AMME9501 **Assumed knowledge:** Students have an interest and a strong understanding of feedback control systems, specifically in the area of system modelling and control design in the frequency domain. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces engineering design via optimization, i.e. finding the "best possible" solution to a particular problem. For example, an autonomous vehicle must find the fastest route between two locations over a road network; a biomedical sensing device must compute the most accurate estimate of important physiological parameters from noise-corrupted measurements; a feedback control system must stabilize and control a multivariable dynamical system (such as an aircraft) in an optimal fashion.

The student will learn how to formulate a design in terms of a "cost function", when it is possible to find the "best" design via minimization of this "cost", and how to do so. The course will introduce widely-used optimization frameworks including linear and quadratic programming (LP and QP), dynamic programming (DP), path planning with Dijkstra's algorithm, A*, and probabilistic roadmaps (PRMs), state estimation via Kalman filters, and control via the linear quadratic regulator (LQR) and Model Predictive Control (MPC). There will be constant emphasis on connections to real-world engineering problems in control, robotics, aerospace, biomedical engineering, and manufacturing.

Additional Electives

Students can select from the units below or other elective units offered within the University that are approved by the Head of the School of Aerospace, Mechanical and Mechatronic Engineering.

ENGG1000
History and Philosophy of Engineering

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Tutorial 1 hr/week; Independent research/study 5 hrs/week; E-Learning 2 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

ENGG1000 is a unique course that aims to provide students with an understanding of the historical development of Engineering with relation to societal expectations of the period. Engineering as a field of study and profession has developed over millennia from simple (yet significant) advances in technology such as the lever and wheel, to modern day examples such as advanced computers, nanomaterials and space flight.

Interaction between human society and Engineers has helped develop and guide the advancement of engineering technology; with society posing problems for Engineers to solve and Engineers developing new technology that changed the course of human history, and helped shape the world we live in.

The general philosophy behind Engineering is that Engineers work to fulfil the needs of society (water, electricity, technological improvements etc.), and as such Engineers are expected to act ethically towards society. The role of Engineers in society will be analysed and discussed from a humanistic perspective, with relation to the current Engineers Australia code of ethics. Other relevant philosophical analyses of Engineering as a skill and profession will also be examined such as, aesthetics, creativity, the epistemology of Engineering and more.

This course will use online resources extensively and help develop research and communication skills of students, whilst providing an overview of the historical significance of Engineers in society, and what it means to be an Engineer.

AMME2000
Engineering Analysis

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** (MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) and ENGG1801. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **Assessment:** Through semester assessment (35%) Final Exam (65%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This course is designed to provide students with the necessary tools for mathematically modelling and solving problems in engineering. Solution methods will be considered for a range of standard engineering problems including; Conduction heat transfer in one and two dimensions, hydrostatics and hydrodynamic balance for internal and external flows, spring/mass systems, vibration and stability problems. The focus will be on real problems and numerical solution methods and will include separation of variables; Fourier series and Fourier transforms; Laplace transforms; scaling and finite differences.

Note

Choice of electives as shown in the above table will depend on subject availability, timetabling and prerequisite conditions.

For a standard enrolment plan for Mechanical (Space) Engineering visit http://cusp.sydney.edu.au/students/view-degree-page/name/BE(Mech)(Space)

Bachelor of Engineering Honours (Mechatronic)

Course Overview

Mechatronics combines mechanical, electronic, and software engineering to create computer controlled machines and consumer products. It is the technology that underpins robotics and autonomous systems, automated manufacturing, and intelligent microprocessor-based products.

The Bachelor of Engineering Honours (Mechatronic) places strong emphasis on the development of skills in digital electronics, microprocessors, computer control, and software design in a mechanical engineering environment. Management and communications are an integral part of this course.

Mechatronic engineers are involved in the application of electronics, computer systems and control theory to automate mechanical systems, as well as in the design and development of electro-mechanical systems. They are also involved in designing automated vehicle navigation systems using GPS, designing process control systems for chemical production industries, designing and implementing computer controlled machine monitoring systems, designing micromachines, project management, inventing new products and processes or acting as aid workers to provide engineering services to developing nations.

Course Requirements

To meet requirements for the Bachelor of Engineering Honours (Mechatronic), a candidate must successfully complete 192 credit points, comprising:

1. core and elective units of study relating to the specialist stream, as prescribed by the table of units of study for the stream; and
2. any additional free elective units of study as may be necessary to gain credit to complete the award.

For a standard enrolment plan for Mechatronic Engineering visit http://cusp.sydney.edu.au/students/view-degree-page/name/BE(Mtrx)

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Bachelor of Engineering Honours (Mechatronic)			
Candidates for the Bachelor of Engineering Honours (Mechatronic) are required to gain credit for the core units of study set out below. Any additional credit necessary shall be gained by completing additional credit points of elective units of study as recommended by the Faculty, as may be necessary to gain credit for a total of not less than 192 credit points.			
Core units of study			
First year			
MATH1001 **Differential Calculus**	3	**A** HSC Mathematics Extension 1 **N** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001	Semester 1 Summer Main
MATH1002 **Linear Algebra**	3	**A** HSC Mathematics or MATH1111 **N** MATH1902, MATH1012, MATH1014	Semester 1 Summer Main
MTRX1701 **Mechatronic Engineering Introductory**	6	**N** AERO1560, MECH1560, ENGG1800 *Note: Department permission required for enrolment*	Semester 1
MTRX1702 **Mechatronics 1**	6	**A** MTRX1701 **N** COSC1002, COSC1902, ELEC1101, ELEC2602	Semester 2
MATH1003 **Integral Calculus and Modelling**	3	**A** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **N** MATH1013, MATH1903, MATH1907	Semester 2 Summer Main
MATH1005 **Statistics**	3	**A** HSC Mathematics **N** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021	Semester 2 Summer Main Winter Main
ENGG1802 **Engineering Mechanics**	6		Semester 2 Summer Main
ELEC1103 **Fundamentals of Elec and Electronic Eng**	6	**A** Basic knowledge of differentiation & integration, and HSC Physics	Semester 1
ENGG1801 **Engineering Computing** INFO1103 is an acceptable alternative.	6		Semester 1 Summer Late
AMME1362 **Materials 1**	6	**N** AMME2302, CIVL2110	Semester 2
Second year			
MATH2067 **DEs and Vector Calculus for Engineers** Students in the combined BEHons/BSc degree program can take both MATH2061 and MATH2065 as an alternative.	6	**P** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **N** MATH2901, MATH2961, MATH2005, MATH2965, MATH2001, MATH2905, MATH2061, MATH2065	Semester 1
AMME2500 **Engineering Dynamics**	6	**P** ENGG1802 and (MATH1001 or MATH1901) and (MATH1002 or MATH1902)	Semester 1
AMME2301 **Mechanics of Solids**	6	**P** ENGG1802, MATH1001, MATH1002, MATH1003	Semester 2
ELEC2104 **Electronic Devices and Circuits**	6	**A** Knowledge: ELEC1103. Ohm's Law and Kirchoff's Laws; action of Current and Voltage sources; network analysis and the superposition theorem; Thevenin and Norton equivalent circuits; inductors and capacitors, transient response of RL, RC and RLC circuits; the ability to use power supplies, oscilloscopes, function generators, meters, etc.	Semester 2
MECH2400 **Mechanical Design 1**	6	**A** ENGG1801 and ENGG1802, HSC Maths and Physics	Semester 2
AMME2261 **Fluid Mechanics 1** Combined degree students are exempt from this unit.	6	**A** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **N** AMME2200	Semester 1
MECH2660 **Engineering Management** Combined degree students are exempt from this unit.	6	**A** ENGG1803. It is expected that students will understand the concepts previously presented in ENGG1803 Professional Engineering. It is assumed that the students have an understanding of professional engineering issues, and are experienced in academic writing (both essays and reports), including appropriate referencing techniques, oral presentations and the project management process (particularly in group situations). Such previous knowledge will assist students in the development their awareness of the issues involved with engineering management.	Semester 2
MTRX2700 **Mechatronics 2**	6	**A** MTRX1701. Students are assumed to know how to program using the 'C' programming language. Additionally, students should understand the basic concepts behind simple digital logic circuits. **P** MTRX1702 **N** ELEC2601, ELEC3607	Semester 1

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
Third year			
ELEC3404 **Electronic Circuit Design**	6	**A** A background in basic electronics and circuit theory is assumed.	Semester 1
ELEC3204 **Power Electronics and Applications**	6	**A** 1. Differential equations, linear algebra, complex variables, analysis of linear circuits. 2. Fourier theory applied to periodic and non-periodic signals. 3. Software such as MATLAB to perform signal analysis and filter design. 4. Familiarity with the use of basic laboratory equipment such as oscilloscope, function generator, power supply, etc. 5. Basic electric circuit theory and analysis **P** ELEC2104	Semester 1
Combined degree students are exempt from this unit.			
AMME3500 **System Dynamics and Control**	6	**P** ((MATH2061 or MATH2961) and (MATH2065 or MATH2965)) or MATH2067	Semester 1
AMME2262 **Thermal Engineering 1**	6	**A** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **N** AMME2200	Semester 2
Combined degree students are exempt from this unit.			
MECH3460 **Mechanical Design 2**	6	**A** Properties of engineering materials including fatigue failure theories. Statics and dynamics properties of machines. Practical use of Word and Excel including the use of the 'solver' and graphing capabilities built into the spreadsheet. The use of a spreadsheet is mandatory. **P** MECH2400 and AMME2301	Semester 2
MECH3660 **Manufacturing Engineering**	6	**P** MECH2400 or ENGG1960	Semester 1
MTRX3700 **Mechatronics 3**	6	**A** Completion of a first course in microprocessor systems, including assembly and C language programming, interfacing, introductory digital and analogue electronics. **P** MTRX2700 **N** MECH4710	Semester 2
Required Core Unit of Study in Semester 2: MECH2660 Engineering Management. This unit of study will be available commencing in 2015. Students in combined degrees will be exempt from this unit.			
Fourth year			
MECH4601 **Professional Engineering 2**	6	**A** ENGG1803, ENGG4000 It is recommended that you have undertaken ENGG4000 Practical Experience in a period prior to undertaking this course, or be able to demonstrate equivalent understanding of professional practice as some assessment tasks will draw upon your experiences in professional engineering practice.	Semester 1
ENGG4000 **Practical Experience**		**P** 36 Credit Points of Senior Units *Students should have completed three years of their BE program before enrolling in this unit.*	Semester 1 Semester 2
Students must enrol in 12cp of Thesis units.			
AMME4111 **Honours Thesis A**	6	**P** 36 credits of 3rd year units of study. **N** AMME4010, AMME4121, AMME4122 *Note: Department permission required for enrolment* *Honours Thesis A is only available to students with an HWAM of 65 or over. HWAM is a weighted average based on all 2000, 3000 and 4000 level units completed prior to enrolment in this unit. Prospective students in Honours Thesis A are expected to have consulted with supervisors and selected a topic of interest at the end of third year, guided by the advertised list of suggested thesis topics and supervisors. Availability of topics is limited and students should undertake to speak with prospective supervisors as soon as possible. Students who are unable to secure a supervisor and topic will be allocated a supervisor by the unit coordinator. Alternatively, students may do a thesis with a supervisor in industry or in another university department. In this case, the student must also find a second supervisor within the School of AMME.*	Semester 1 Semester 2
Normally taken in Semester 1.			
AMME4112 **Honours Thesis B**	6	**P** 36 credits of 3rd year units of study and WAM 65 or over **N** AMME4010, AMME4122, AMME4121 *Note: Department permission required for enrolment* *HWAM of 65 or greater required for enrolment. HWAM is the weighted average of all 2000, 3000 and 4000 level units completed prior to enrolment in this unit.*	Semester 1 Semester 2
Normally taken in Semester 2			

Acceptable alternative units of study

Most units of study offered by the Faculty of Science shown in the tables can be replaced by an equivalent advanced level unit, subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing advanced options should seek advice from their department before enrolling.

Students undertaking Study Abroad in a particular year of their degree must enrol in the appropriate AMME International Exchange Program units of study as an alternative to a semester's standard units.

Resolutions of the Faculty of Engineering and Information Technologies relating to this table:

Bachelor of Engineering Honours (Mechatronic)

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete 30 credit points of recommended elective units of study for Mechatronic Engineering and 6 credit points of free elective units of study. A minimum of 192 credit points is required to be eligible for the award of the degree.

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
BEHons(Mechatronic)/BSc or BCom or BMedSci or BPM			
In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete at least 12 credit points of recommended elective units of study for Mechatronic Engineering and 96 credit points of units of study given by the Faculty of Science for the BE/BSc and BMedSci, or the Business Schoole for the BE/BCom or from the core unit table for BPM. A minimum of 240 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies the faculty in which they are undertaking the combined degree.			
BEHons(Mechatronic)/BA			
In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete at least 18 credit points of recommended elective units of study for Mechatronic Engineering and 84 credit points of units of study given by the Faculty of Arts and Social Sciences for the BE/BA. A minimum of 240 credit points is required to be eligible for the combined degree. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies the faculty in which they are undertaking the combined degree.			
BEHons(Mechatronic)/LLB			
In addition to gaining credit for the ore units of study set out in the above table, candidates are required to complete at least 12 credit points of recommended elective units of study for Mechatronic Engineering and at least 144 credit points of units of study given by the Faculty of Law for the BE/LLB. A minimum of 288 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies the faculty in which they are undertaking the combined degree.			
Recommended elective units of study			
AMME4710 **Computer Vision and Image Processing**	6	**A** Mandatory prerequisite MECH4720 Sensors and Signals or MECH4730 Computers in Real-Time Control and Instrumentation *Current Lectures: Dr. Thierry Peynot, tpeynot@acfr.usyd.edu.au, Dr. Shrihari Vasudevan, s.vasudevan@acfr.usyd.edu.au*	Semester 2
AMME4790 **Introduction to Biomechatronics**	6	**A** 1. A good practical knowledge and an interest in mechanical and electronic engineering; 2. Adequate maths and applied maths skills; 3. Background knowledge of physics, chemistry and biology; 4. Some programming capability, MATLAB, C, C++; 5. The ability to use, and experience of, common software tools used by engineers including CAD and EDA packages. **P** MTRX3700 or MECH3921 *AMME4790 is the last in a series of practical Mechatronic and Electrical courses taken over three years. It takes these engineering concepts, along with the associated mathematical, electronic and mechanical theory and applies this knowledge to a series of practical, albeit specialized biomechatronic applications that will be encountered by Mechatronic Engineers who enter this broad field on graduation.*	Semester 2
AMME5510 **Vibration and Acoustics**	6	**A** (AMME2301 OR AMME9301) AND AMME2200 AND (AMME2500 OR AMME9500) *Note: Department permission required for enrolment*	Semester 2
AMME5520 **Advanced Control and Optimisation**	6	**A** Students have an interest and a strong understanding of feedback control systems, specifically in the area of system modelling and control design in the frequency domain. **P** AMME3500 OR AMME5501 OR AMME9501	Semester 1
MECH5416 **Advanced Design and Analysis**	6	**A** ENGG1802 - Eng Mechanics, balance of forces and moments; AMME2301 - Mechanics of Solids, 2 and 3 dimensional stress and strain; AMME2500 - Engineering Dynamics - dynamic forces and moments; MECH2400 - Mechanical Design 1, approach to design problems and report writing, and preparation of engineering drawing; MECH3460 - Mechanical design 2, means of applying fatigue analysis to a wide range of machine components	Semester 1
MECH5720 **Sensors and Signals**	6	**A** Strong MATLAB skills **N** MECH4720	Semester 2
MTRX5700 **Experimental Robotics**	6	**A** Knowledge of statics and dynamics, rotation matrices, programming and some electronic and mechanical design experience is assumed. **P** (AMME3500 OR AMME9501) AND MTRX3700	Semester 1
Additional Electives			
Students can select from the units below or other elective units offered within the University that are approved by the Head of the School of Aerospace, Mechanical and Mechatronic Engineering.			
ENGG1000 **History and Philosophy of Engineering**	6		Semester 1 Semester 2
AMME2000 **Engineering Analysis**	6	**A** (MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) and ENGG1801. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. *Note: Department permission required for enrolment*	Semester 1
Note			
Choice of electives as shown in the above table will depend on subject availability, timetabling and prerequisite conditions.			

For a standard enrolment plan for Mechatronic Engineering visit http://cusp.sydney.edu.au/students/view-degree-page/name/BE(Mtrx)

Unit of Study Descriptions

Bachelor of Engineering Honours (Mechatronic)

Candidates for the Bachelor of Engineering Honours (Mechatronic) are required to gain credit for the core units of study set out below. Any additional credit necessary shall be gained by completing additional credit points of elective units of study as recommended by the Faculty, as may be necessary to gain credit for a total of not less than 192 credit points.

Core units of study

First year

MATH1001
Differential Calculus

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001 **Assumed knowledge:** HSC Mathematics Extension 1 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1001 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study looks at complex numbers, functions of a single variable, limits and continuity, vector functions and functions of two variables. Differential calculus is extended to functions of two variables. Taylor's theorem as a higher order mean value theorem.

Textbooks
As set out in the Junior Mathematics Handbook.

MATH1002
Linear Algebra

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1902, MATH1012, MATH1014 **Assumed knowledge:** HSC Mathematics or MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1002 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study introduces vectors and vector algebra, linear algebra including solutions of linear systems, matrices, determinants, eigenvalues and eigenvectors.

Textbooks
As set out in the Junior Mathematics Handbook

MTRX1701
Mechatronic Engineering Introductory

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 1 hr/week; Tutorial/Laboratory 2 hrs/week; Workshop 3 hrs/week. **Prohibitions:** AERO1560, MECH1560, ENGG1800 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit of study aims to introduce students to the fundamental principles that underlie the study of mechatronic engineering. It lays the foundation for later studies, including advanced mechatronic engineering, computing, control and system design courses. The subject also provides students with the opportunity to develop an understanding of a range of machining and manufacturing processes required to make mechanical components.

Introduction to Mechatronic Engineering (70%): (a) Introduction to mechatronics and to the structure of the BE in Mechatronic Engineering. (b) Systems Modelling and Control - Fundamental concepts which underlie the modelling and control of dynamic systems. (c) Design Process - The process of design synthesis as an important part of engineering. (d) Actuators - Components that exert effort to accomplish a given task. (e) Sensors - Components that take measurements of the environment. (f) Computers - Hardware and software components that, when combined, allow a system to be controlled. (g) Advanced Topics - Case studies relating to the application of mechatronic engineering principles.

Workshop Technology (30%): An overview of a range of machining and manufacturing processes, with hands-on experience provided. Workshop Technology practical work is undertaken in: (a) Hand tools (b) Machining and (c) Soldering. Safety requirements: All students are required to provide their own personal protective equipment (PPE) and comply with safety regulations. Students who fail to do this will not be permitted to enter the workshops. In particular, approved industrial footwear must be worn, and long hair must be protected by a hair net. Safety glasses must be worn at all times.

MTRX1702
Mechatronics 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 1 hr/week; Digital Systems Laboratory/Tutorial 2 hrs/week; Tutorial 2 hrs/week. **Prohibitions:** COSC1002, COSC1902, ELEC1101, ELEC2602 **Assumed knowledge:** MTRX1701 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to provide an introduction to the analysis and design of digital logic circuits and to provide a foundation for the study of systems and embedded programming for the degree in Mechatronic Engineering.

Introductory Digital Systems (3 CR): Number systems and codes; Logic gates and Boolean algebra, universal (NAND) logic gates; Digital arithmetic: operations and circuits, Two`s complement addition and subtraction, overflow; Combinational logic circuits; Flip-flops and related devices; Counters and registers, shift register applications; sequential circuits, designs of synchronous, cascadable counters (BCD and binary). Integrated circuit logic families and interfacing; practical issues including, fan out, pull-up/down, grounds, power supplies and decoupling; timing issues, race conditions. Tri-state signals and buses; MSI logic circuits, multiplexers, demultiplexers, decoders, magnitude comparators; Introduction to programmable logic devices. The unit of study will include a practical component where students design and implement logic circuits. Purchase of a basic laboratory tool kit as described in classes will be required.

Introductory Software Engineering (3 CR): This unit of study provides an introduction to software design, implementation, debugging and testing in the context of C programming language. Problem definition and decomposition; the design process; designing for testing and defensive coding methods; modular code structure and abstract data types; best practice in programming. Preprocessor, tokens, storage classes and types. Arithmetic, relational and bit manipulation operators. Constructs for control flow: if, switch, for, do and while. Arrays. Pointers and character strings. Dynamic memory. Functions and parameter passing. Derived storage classes: structures and unions. File I/O.

MATH1003
Integral Calculus and Modelling

Credit points: 3 **Session:** Semester 2, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1013, MATH1903, MATH1907 **Assumed knowledge:** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1003 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.This unit of study first develops the idea of the definite integral from Riemann sums, leading to the Fundamental Theorem of Calculus. Various techniques of integration are considered, such as integration by parts.The second part is an introduction to the use of first and second order differential equations to model a variety of scientific phenomena.

Textbooks
As set out in the Junior Mathematics Handbook

MATH1005
Statistics

Credit points: 3 **Session:** Semester 2, Summer Main, Winter Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021 **Assumed knowledge:** HSC Mathematics **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1005 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit offers a comprehensive introduction to data analysis, probability, sampling, and inference including t-tests, confidence intervals and chi-squared goodness of fit tests.

Textbooks
As set out in the Junior Mathematics Handbook

ENGG1802
Engineering Mechanics

Credit points: 6 **Session:** Semester 2, Summer Main **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit aims to provide students with an understanding of and competence in solving statics and introductory dynamics problems in engineering. Tutorial sessions will help students to improve their group work and problem solving skills, and gain competency in extracting a simplified version of a problem from a complex situation. Emphasis is placed on the ability to work in 3D as well as 2D, including the 2D and 3D visualization of structures and structural components, and the vectorial 2D and 3D representations of spatial points, forces and moments. Introduction to kinematics and dynamics topics includes position, velocity and acceleration of a point; relative motion, force and acceleration, momentum, collisions and energy methods.

ELEC1103
Fundamentals of Elec and Electronic Eng

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Basic knowledge of differentiation & integration, and HSC Physics **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to develop knowledge of the fundamental concepts and building blocks of electrical and electronics circuits. This is a foundation unit in circuit theory. Circuit theory is the electrical engineer's fundamental tool.

The concepts learnt in this unit will be made use of heavily in many units of study (in later years) in the areas of electronics, instrumentation, electrical machines, power systems, communication systems, and signal processing.

Topics: a) Basic electrical and electronic circuit concepts: Circuits, circuit elements, circuit laws, node and mesh analysis, circuit theorems, energy storage, capacitors and inductors, circuits with switches, transient response, sine waves and complex analysis, phasors, impedance, ac power.; b) Project management, teamwork, ethics; c) Safety issues

ENGG1801
Engineering Computing

Credit points: 6 **Session:** Semester 1, Summer Late **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will introduce students to fundamental principles of programming. The language used will be Matlab but the principles taught are readily portable to other languages like C and Java. The unit material will be presented in a manner which will help students to draw a connection between programming constructs and real engineering applications. The unit will use engineering inspired case-studies : especially from Civil, Chemical, Aerospace and Mechanical streams, to motivate new material. There will be a major project which uses programming to solve a real world engineering problem. The extensive Matlab library for visualization will also be introduced. Matlab will cover two-thirds of the unit. The remaining one-third will be devoted to the use of Excel in engineering scenarios. Furthermore, cross integration between Matlab and Excel will also be highlighted.

INFO1103 is an acceptable alternative.

AMME1362
Materials 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/semester. **Prohibitions:** AMME2302, CIVL2110 **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

AMME1362 is an introductory unit in engineering materials. The unit aims to develop students' understanding of the structures, mechanical properties and manufacture of a range of engineering materials as well as how the mechanical properties relate to microstructure and forming and treatment methods. The unit has no prerequisite subject and is therefore intended for those with little or no previous background in engineering materials. However the unit does require students to take a significant degree of independent responsibility for developing their own background knowledge of materials and their properties. The electrical, magnetic, thermal and optical properties of materials are a critical need-to-know area where students are expected to do some independent study.

Second year

MATH2067
DEs and Vector Calculus for Engineers

Credit points: 6 **Session:** Semester 1 **Classes:** Three 1 hour lectures, one 1 hour tutorial and one 1 hour practice class per week. **Prerequisites:** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **Prohibitions:** MATH2901, MATH2961, MATH2005, MATH2965, MATH2001, MATH2905, MATH2061, MATH2065 **Assessment:** One 2 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH2067 starts by introducing students to solution techniques of ordinary and partial differential equations (ODEs and PDEs) relevant to the engineering disciplines: it provides a basic grounding in these techniques to enable students to build on the concepts in their subsequent engineering classes. The main topics are Fourier series, second order ODEs, including inhomogeneous equations and Laplace transforms, and second order PDEs in rectangular domains (solution by separation of variables).

The unit moves on to topics from vector calculus, including vector-valued functions (parametrised curves and surfaces; vector fields; div, grad and curl; gradient fields and potential functions), line integrals (arc length; work; path-independent integrals and conservative fields; flux across a curve), iterated integrals (double and triple integrals; polar, cylindrical and spherical coordinates; areas, volumes and mass; Green's Theorem), flux integrals (flow through a surface; flux integrals through a surface defined by a function of two variables, though cylinders, spheres and parametrised surfaces), Gauss's Divergence Theorem and Stokes' Theorem.

Students in the combined BEHons/BSc degree program can take both MATH2061 and MATH2065 as an alternative.

AMME2500
Engineering Dynamics

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs **Prerequisites:** ENGG1802 and (MATH1001 or MATH1901) and (MATH1002 or MATH1902) **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to teach: Dynamics of Rigid Bodies: Analysis of Planar mechanisms; Kinematics of rigid bodies; Kinetics of rigid bodies. Students will also develop their skills in: how to model and analyse dynamic systems and the application of theory to real systems through practical/laboratory sessions.

At the end of this unit students will have developed skills in modelling and analysing planar mechanisms and rigid body dynamic systems.

Course content will include planar mechanisms, linkages, mobility; instant centres of rotation, Kennedy's theorem; velocity and acceleration polygons; kinematics of rigid bodies, frames of reference, velocity and acceleration, rotating frame of reference, relative velocity and acceleration, gyroscopic acceleration; kinetics of rigid bodies, linear momentum and Euler's first law; angular momentum and Euler's second law; centre of mass; moments of inertia, parallel axis and parallel plane theorems, principal axes and principal moments of inertia, rotation about an axis; impulse and momentum; work and energy, kinetic and potential energies; applications to orbital and gyroscopic motion; introduction to Lagrangian methods.

AMME2301
Mechanics of Solids

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** ENGG1802, MATH1001, MATH1002, MATH1003 **Assessment:** Through semester assessment (35%) Final Exam (65%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Equilibrium of deformable structures; basic concept of deformation compatibility; stress and strain in bars, beams and their structures subjected to tension, compression, bending, torsion and combined loading; statically determinate and indeterminate structures; energy methods for bar and beam structures; simple buckling; simple vibration; deformation of simple frames and cell box beams; simple two-dimensional stress and Morh's circle; problem-based applications in aerospace, mechanical and biomedical engineering.

ELEC2104
Electronic Devices and Circuits

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/fortnight; Laboratory 3 hrs/fortnight **Assumed knowledge:** Knowledge: ELEC1103. Ohm's Law and Kirchoff's Laws; action of Current and Voltage sources; network analysis and the superposition theorem; Thevenin and Norton equivalent circuits; inductors and capacitors, transient response of RL, RC and RLC circuits; the ability to use power supplies, oscilloscopes, function generators, meters, etc. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Modern Electronics has come to be known as microelectronics which refers to the Integrated Circuits (ICs) containing millions of discrete devices. This course introduces some of the basic electronic devices like diodes and different types of transistors. It also aims to introduce students the analysis and design techniques of circuits involving these discrete devices as well as the integrated circuits.

Completion of this course is essential to specialize in Electrical, Telecommunication or Computer Engineering stream. The knowledge of ELEC1103 is assumed.

MECH2400
Mechanical Design 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 1 hr/week. **Assumed knowledge:** ENGG1801 and ENGG1802, HSC Maths and Physics **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Aim: For students to experience a realistic the design process and to develop good engineering skills.

Course Objectives: To develop an understanding of:

1. the need for and use of standard drawings in the communication and definition of parts and assemblies,
2. Efficient use of a CAD package
3. creativity,
4. the design process from initial idea to finished product
5. Methods used to analyse designs
6. standard components.

AMME2261
Fluid Mechanics 1

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs/semester. **Prohibitions:** AMME2200 **Assumed knowledge:** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit covers the fundamentals of fluid statics and fluid dynamics. At the end of this unit students will have: an understanding of the basic equations governing the statics and dynamics of fluids; the ability to analyze and determine the forces applied by a static fluid; the ability to analyse fluids in motion. The course will cover both inviscid and viscous fluid flow. The course will introduce the relevant parameters for fluid flow in internal engineering systems such as pipes and pumps and external systems such as flow over wings and airfoils. Course content will cover the basic concepts such as viscosity, density, continuum, pressure, force, buoyancy and acceleration; and more detailed methods including continuity, conservation of momentum, streamlines and potential flow theory, Bernoulli equation, Euler equation, Navier-Stokes equation. Experiments will introduce flow measuring devices and flow observation.

Combined degree students are exempt from this unit.

MECH2660
Engineering Management

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hours per week; Tutorial 2 hours per week. **Assumed knowledge:** ENGG1803. It is expected that students will understand the concepts previously presented in ENGG1803 Professional Engineering. It is assumed that the students have an understanding of professional engineering issues, and are experienced in academic writing (both essays and reports), including appropriate referencing techniques, oral presentations and the project management process (particularly in group situations). Such previous knowledge will assist students in the development their awareness of the issues involved with engineering management. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to: develop an understanding of the principles of management as applies particularly to the engineering and industrial settings. It aims to provide knowledge of the principles and tools that can assist communication, supervision, project management, team membership, decision making and risk management. At the end of this unit students will be able to understand different management practices and approaches applicable to a broad range of environments. In the process they will develop greater skills in team work, written expression, and verbal presentation. The concepts covered in this unit are from the following management areas: Engineers and Management - including ethics, Communication and People in Organisations, Economics, Leadership, Managerial Decision Analysis, Marketing, Business Planning, Legal Environment of Business, Risk Management, Human Resource Management, Project Management, Quality Assurance and Management, Operations Management, and Financial Management.

Combined degree students are exempt from this unit.

MTRX2700
Mechatronics 2

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2.5 hrs/week; Laboratory 3 hrs/week. **Prerequisites:** MTRX1702 **Prohibitions:** ELEC2601, ELEC3607 **Assumed knowledge:** MTRX1701. Students are assumed to know how to program using the 'C' programming language. Additionally, students should understand the basic concepts behind simple digital logic circuits. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The aim of the unit is to introduce students to microprocessor and microcomputer systems, emphasizing assembly language programming and building on the digital logic foundations from first year. In particular, the following subjects are addressed:

Introduction to microprocessors, stored-program computer architecture, instruction codes and addressing modes, instruction execution cycle; Memory devices. Computer architecture and assembly language programming. Microprocessor and microcontroller systems, memory and IO interfacing, interrupts and interrupt handling. Serial and parallel communications. System design, documentation, implementation, debugging and testing.

MTRX2700 is the introductory course in the basics of real Mechatronic systems. This course builds on knowledge obtained in the courses ENGG1801, MTRX1701, ELEC1103 and MTRX1702. This course extends this knowledge by introducing students to their first practical applications in Mechatronic Engineering. By passing this subject, the student will have obtained the necessary skills to undertake Mechatronics 3 (MTRX3700).

Third year

ELEC3404
Electronic Circuit Design

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/fortnight; Laboratory 3 hrs/fortnight. **Assumed knowledge:** A background in basic electronics and circuit theory is assumed. **Assessment:** Through semester assessment (70%) Final Exam (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to teach students analysis and design techniques for electronic systems such as signal amplifiers, differential amplifiers and power amplifiers. Completion of this unit will allow progression to advanced studies or to work in electronics and telecommunication engineering.

Topics covered are as follows. The BJT and MOSFET as an amplifier. Biasing in amplifier circuits. Small signal operation and models. Single stage amplifiers. Internal capacitances and high frequency models. The frequency response of the common-emitter amplifier. Current sources and current mirrors. Differential amplifiers. Output stages and power amplifiers:class A, class B and class AB.

ELEC3204
Power Electronics and Applications

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs/week; Project Work - own time 2 hrs/week. **Prerequisites:** ELEC2104 **Assumed knowledge:** 1. Differential equations, linear algebra, complex variables, analysis of linear circuits. 2. Fourier theory applied to periodic and non-periodic signals. 3. Software such as MATLAB to perform signal analysis and filter design. 4. Familiarity with the use of basic laboratory equipment such as oscilloscope, function generator, power supply, etc. 5. Basic electric circuit theory and analysis **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to teach the fundamentals of advanced energy conversion systems based on power electronics. It provides description of the operation principles and control of these blocks. Through analysis and design methodologies, it delivers an in depth understanding of modern enabling technologies associated with energy conversion. Through laboratory hands-on experience on actual industrial systems, such electrical motor drives, robotic arms, and power supplies, it enhances the link between the theory and the "real" engineering world. The unit clarifies unambiguously the role these imperative technologies play in every human activity; from mobile telephone chargers to energy electricity grids; from electric vehicles and industrial automation to wind energy conversion to name just few.

The following topics are covered:

Introduction to power electronic converters and systems; applications of power electronic converters; power semiconductor devices; uncontrolled rectifiers: single- and three-phase; non-isolated dc-dc converters: buck, boost and buck-boost; isolated dc-dc converters; inverters: single- and three-phase; uninterruptible power supplies; battery chargers and renewable energy systems; electric and hybrid electric vehicles technologies, design of converters and systems.

Combined degree students are exempt from this unit.

AMME3500
System Dynamics and Control

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week. **Prerequisites:** ((MATH2061 or MATH2961) and (MATH2065 or MATH2965)) or MATH2067 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to allow students to develop an understanding of methods for modeling and controlling linear, time-invariant systems. Techniques examined will include the use of differential equations and frequency domain approaches to modeling of systems. This will allow students to examine the response of a system to changing inputs and to examine the influence of external stimuli such as disturbances on system behaviour. Students will also gain an understanding of how the responses of these mechanical systems can be altered to meet desired specifications and why this is important in many engineering problem domains.

The study of control systems engineering is of fundamental importance to most engineering disciplines, including Electrical, Mechanical, Mechatronic and Aerospace Engineering. Control systems are found in a broad range of applications within these disciplines, from aircraft and spacecraft to robots, automobiles, computers and process control systems. The concepts taught in this course introduce students to the mathematical foundations behind the modelling and control of linear, time-invariant dynamic systems. In particular, topics addressed in this course will include:

1. Techniques for modelling mechanical systems and understanding their response to control inputs and disturbances. This will include the use of differential equations and frequency domain methods as well as tools such as Root Locus and Bode plots.

2. Representation of systems in a feedback control system as well as techniques for determining what desired system performance specifications are achievable, practical and important when the system is under control

3. Theoretical and practical techniques that help engineers in designing control systems, and an examination of which technique is best in solving a given problem.

AMME2262
Thermal Engineering 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs. **Prohibitions:** AMME2200 **Assumed knowledge:** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to teach the basic laws of thermodynamics and heat transfer. At the end of this unit students will have: an understanding of the basic laws of thermodynamics and heat transfer; The ability to analyze the thermodynamics of a simple open or closed engineering system. The basic knowledge to analyse and design 1D thermal circuits. Course content will include concepts of heat and work, properties of substances, first law of thermodynamics, control mass and control volume analysis, thermal efficiency, entropy, second law of thermodynamics, reversible and irreversible processes, isentropic efficiency, power and refrigeration cycles, heat transfer by conduction, convection and radiation, 1D thermal circuits and transient heat transfer.

Combined degree students are exempt from this unit.

MECH3460
Mechanical Design 2

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** MECH2400 and AMME2301 **Assumed knowledge:** Properties of engineering materials including fatigue failure theories. Statics and dynamics properties of machines. Practical use of Word and Excel including the use of the 'solver' and graphing capabilities built into the spreadsheet. The use of a spreadsheet is mandatory. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to apply some newly acquired skills to begin to understand how stress and strain are distributed in the more common categories of machine parts. Reducing the loads in standard parts to just the most significant, leads to a range of relatively simple analyses. By using different degrees of simplification and a proportional amount of effort, the examination of components can provide results of corresponding accuracy. To lead the student to utilize and be aware of modern computer methods, to be aware of past methods and be prepared of future developments. Not all the analysis of mechanical components are covered in the course but the ones that are deal with exemplify principles that can be applied to novel items that our graduates may encounter in their professional life.

At the end of this unit students will be able to: apply fatigue life prediction in general to any component; design a bolted joint to carry tensile and or shear loads: use a numerical solver to arrive at the optimal dimensions of a component, given its loads and sufficient boundary conditions; design shafts to carry specified steady and alternating bending moments and torques; design and construct a space frame, such as that for a dune buggy, to meet requirements of strength and rigidity; be able to arrive at the principle parameters of a pair of matched spur gears, and to be able to extend this to helical gears.

Course content will include: stress and strain in engineering materials; yield and ultimate fail conditions in malleable and brittle materials; spatial, 3D frameworks; deflections due to forces, moments and torques.

MECH3660
Manufacturing Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Laboratory, Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** MECH2400 or ENGG1960 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit aims to teach the fundamentals of manufacturing processes and systems in mechanical, mechatronic and biomedical engineering, including traditional and advanced manufacturing technologies.

This unit aims to develop the following attributes: to understand the fundamental principles of manufacturing technologies for the above mentioned engineering areas; to gain the ability to select existing manufacturing processes and systems for direct engineering applications; to develop ability to create innovative new manufacturing technologies for advanced industrial applications; to develop ability to invent new manufacturing systems

At the end of this unit students will have a good understanding of the following: merits and advantages of individual manufacturing processes and systems; principles of developing new technologies; comprehensive applications and strategic selection of manufacturing processes and systems.

Course content will include:

Manufacturing Processes: Common processes and their science (machining, casting, powder metallurgy, metal working, welding); merits and limitations; CNC and CAM;

Manufacturing Systems: Economics in manufacturing; flexible manufacturing; group technology; materials selection and requirements planning; quality control; introduction to new technology; introduction to e-manufacturing; human factors; plant layout.

MTRX3700
Mechatronics 3

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2.5 hrs/week; Laboratory 3 hrs/week. **Prerequisites:** MTRX2700 **Prohibitions:** MECH4710 **Assumed knowledge:** Completion of a first course in microprocessor systems, including assembly and C language programming, interfacing, introductory digital and analogue electronics. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to provide experience, confidence and competence in the design and implementation of microprocessor-based products and instruments; to impart a detailed knowledge of the software and hardware architecture of a typical modern microcontroller, and an understanding of the use of these resources in product design; and to provide experience of working in a project team to prototype a realistic product to meet a specification.

At the end of this unit students will understand microprocessor system organization, and the organization of multiple and distributed processor systems, special purpose architectures (DSPs etc.) and their application. The student will have a detailed knowledge of the software and hardware architecture of a modern microcontroller. This knowledge will include an in-depth understanding of the relationship between assembly language, high-level language, and the hardware, of the utilisation and interfacing of microcontroller hardware resources, and of the design and development of software comprised of multiple interrupt-driven processes. The student will have the competence to develop prototype microprocessor-based products.

Course content will include single processor systems, multiple and distributed processing systems, special purpose architectures (DSPs etc) and their application; standard interfacing of sensor and actuation systems; ADC/DAC, SSI, parallel, CAN bus etc.; specific requirements for microprocessor-based products; problem definition and system design; tools for design, development and testing of prototype systems; the unit of study will include a project, where groups of students design, develop and commission a microprocessor-based product.

Required Core Unit of Study in Semester 2: MECH2660 Engineering Management. This unit of study will be available commencing in 2015. Students in combined degrees will be exempt from this unit.

Fourth year

MECH4601
Professional Engineering 2

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** ENGG1803, ENGG4000 It is recommended that you have undertaken ENGG4000 Practical Experience in a period prior to undertaking this course, or be able to demonstrate equivalent understanding of professional practice as some assessment tasks will draw upon your experiences in professional engineering practice. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to create an awareness of issues surrounding the management of projects; impart knowledge resulting in a more global approach to the practice of engineering and engineering management; and provide a vehicle for improving communication skills (both written and oral). The course also aims, when taken together with other courses offered by the School, to substantially meet the requirement of the Institution of Engineers, Australia, for undergraduate training in management theory and Professional Engineering skills. On completion of this unit students should be able to: plan small projects and contribute effectively to planning of larger projects; work effectively in small teams; understand their role and expected conduct in the management of engineering projects; perform well in that role from the outset, with performance limited only by experience; prepare an interesting and relevant presentation on aspects of their work for their peers or senior managers; recognise the range of expertise they may need to call on in their role as an engineer working on a project (e.g. in safety and environmental fields); understand what the experts are saying, and be able to contribute effectively to that discussion.

ENGG4000
Practical Experience

Session: Semester 1, Semester 2 **Classes:** Practical Experience, **Prerequisites:** 36 Credit Points of Senior Units **Assessment:** Through semester assessment (100%) **Mode of delivery:** Professional practice

Note: Students should have completed three years of their BE program before enrolling in this unit.

The aim of this unit is to give students exposure to work in an engineering organisation and gain some professional experience; to enhance a student's abilities and experience in report writing; to encourage self-evaluation in the context of applying their theoretical knowledge to real industry practise. Students will gain a better appreciation of the role of engineers in the workplace. The assessment will enhance the student's ability to present structured observations and reflections in the mode of a formal written report.

Each student is required to gain exposure to professional engineering practice and environments and to submit a satisfactory written report of his or her work. The report will include the requirement of a detail logbook recording tasks given and timelines set for achieving these. Self-evaluation of a student's personal level of knowledge and its applicability to the workplace is a major component of the reporting. Normally 12 weeks (60 days) of practical work experience is required, though the Faculty may accept alternatives that are judged as equivalent. Students are strongly encouraged to undertake their work experience in the break between Year 3 and 4 and definitely prior to commencing their final semester of study, however any engineering work taken after completing 28 credit points of 3rd year units of study may be accepted for the requirements of this unit. The University Careers and Appointments Service is available to assist students to obtain suitable employment. This unit of study is a core unit of study in all BE programs and must be passed in order to graduate from those programs.

Students must enrol in 12cp of Thesis units.

AMME4111
Honours Thesis A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research 10 hrs/week. **Prerequisites:** 36 credits of 3rd year units of study. **Prohibitions:** AMME4010, AMME4121, AMME4122 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: Honours Thesis A is only available to students with an HWAM of 65 or over. HWAM is a weighted average based on all 2000, 3000 and 4000 level units completed prior to enrolment in this unit. Prospective students in Honours Thesis A are expected to have consulted with supervisors and selected a topic of interest at the end of third year, guided by the advertised list of suggested thesis topics and supervisors. Availability of topics is limited and students should undertake to speak with prospective supervisors as soon as possible. Students who are unable to secure a supervisor and topic will be allocated a supervisor by the unit coordinator. Alternatively, students may do a thesis with a supervisor in industry or in another university department. In this case, the student must also find a second supervisor within the School of AMME.

The fourth year honours thesis aims to provide students with the opportunity to carry out a defined piece of independent research in a setting and in a manner that fosters the development of engineering research skills. These skills include the capacity to define a research question, showing how it relates to existing knowledge, identifying the tools needed to investigate the question, carrying out the research in a systematic way, analysing the results obtained and presenting the outcomes in a report that is clear, coherent and logically structured. Honours thesis is undertaken across two semesters of enrolment, in two successive Units of Study of 6 credits points each. Honours Thesis A covers first steps of thesis research starting with development of research proposal. Thesis B covers the second of stage writing up and presenting the research results.

Students are asked to write a thesis based on a research project, which is very often related to some aspect of a staff member's research interests. Some projects will be experimental in nature, others may involve computer-based simulation, feasibility studies or the design, construction and testing of equipment. Direction of thesis work may be determined by the supervisor or be of an original nature, but in either case the student is responsible for the execution of the practical work and the general layout and content of the thesis itself. The final thesis must be the student's individual work, although research is sometimes conducted in the framework of a group project shared with others. Students undertaking research on this basis will need to take care in ensuring the individual quality of their own research work and the final thesis submission. The thesis will be judged on the extent and quality of the student's original work and particularly how critical, perceptive and constructive he or she has been in assessing his/her work and that of others. Students will also be required to present the results of their findings to their peers and supervisors as part of a seminar program.

It is not expected that a thesis at this level will represent a significant contribution to new knowledge; nor is it expected that theses will resolve great intellectual problems. The timeframe available for the thesis is simply too short to permit students to tackle complex or difficult problems. Indeed, a key aim of the thesis is to specify a research topic that arouses sufficient intellectual curiosity, and presents an appropriate range and diversity of technical and conceptual challenges, while remaining manageable and allowing achievable outcomes within the time and resources available. It is important that the topic be of sufficient scope and complexity to allow a student to learn their craft and demonstrate their research skills. Equally imperative is that the task not be so demanding as to elude completion.

Normally taken in Semester 1.

AMME4112
Honours Thesis B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research 10 hrs/week. **Prerequisites:** 36 credits of 3rd year units of study and WAM 65 or over **Prohibitions:** AMME4010, AMME4122, AMME4121 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: HWAM of 65 or greater required for enrolment. HWAM is the weighted average of all 2000, 3000 and 4000 level units completed prior to enrolment in this unit.

The fourth year honours thesis aims to provide students with the opportunity to carry out a defined piece of independent research or design work in a setting and in a manner that fosters the development of engineering skills in research or design. These skills include the capacity to define a research or design question, showing how it relates to existing knowledge, identifying the tools needed to investigate the question, carrying out the research or design in a systematic way, analysing the results obtained and presenting the outcomes in a report that is clear, coherent and logically structured. Honours thesis is undertaken across two semesters of enrolment, in two successive Units of Study of 6 credits points each. Honours Thesis A covers first steps of thesis research starting with development of research proposal. Thesis B covers the second of stage writing up and presenting the research results.

Students are asked to write a thesis based on a research or major design project, which is very often related to some aspect of a staff member's research interests. Some projects will be experimental in nature, others may involve computer-based simulation, feasibility studies or the design, construction and testing of equipment. Direction of thesis work may be determined by the supervisor or be of an original nature, but in either case the student is responsible for the execution of the practical work and the general layout and content of the thesis itself. The final thesis must be the student's individual work, although research is sometimes conducted in the framework of a group project shared with others. Students undertaking research on this basis will need to take care in ensuring the individual quality of their own research work and the final thesis submission. The thesis will be judged on the extent and quality of the student's original work and particularly how critical, perceptive and constructive he or she has been in assessing his/her work and that of others. Students will also be required to present the results of their findings to their peers and supervisors as part of a seminar program.

It is not expected that a thesis at this level will represent a significant contribution to new knowledge; nor is it expected that theses will resolve great intellectual problems. The time frame available for the thesis is simply too short to permit students to tackle complex or difficult problems. Indeed, a key aim of the thesis is to specify a research or design topic that arouses sufficient intellectual curiosity, and presents an appropriate range and diversity of technical and conceptual challenges, while remaining manageable and allowing achievable outcomes within the time and resources available. It is important that the topic be of sufficient scope and complexity to allow a student to learn their craft and demonstrate their research or design skills. Equally imperative is that the task not be so demanding as to elude completion.

Normally taken in Semester 2

Acceptable alternative units of study

Most units of study offered by the Faculty of Science shown in the tables can be replaced by an equivalent advanced level unit, subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing advanced options should seek advice from their department before enrolling.Students undertaking Study Abroad in a particular year of their degree must enrol in the appropriate AMME International Exchange Program units of study as an alternative to a semester's standard units.

Resolutions of the Faculty of Engineering and Information Technologies relating to this table:

Bachelor of Engineering Honours (Mechatronic)

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete 30 credit points of recommended elective units of study for Mechatronic Engineering and 6 credit points of free elective units of study. A minimum of 192 credit points is required to be eligible for the award of the degree.

BEHons(Mechatronic)/BSc or BCom or BMedSci or BPM

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete at least 12 credit points of recommended elective units of study for Mechatronic Engineering and 96 credit points of units of study given by the Faculty of Science for the BE/BSc and BMedSci, or the Business Schoole for the BE/BCom or from the core unit table for BPM. A minimum of 240 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies the faculty in which they are undertaking the combined degree.

BEHons(Mechatronic)/BA

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete at least 18 credit points of recommended elective units of study for Mechatronic Engineering and 84 credit points of units of study given by the Faculty of Arts and Social Sciences for the BE/BA. A minimum of 240 credit points is required to be eligible for the combined degree. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies the faculty in which they are undertaking the combined degree.

BEHons(Mechatronic)/LLB

In addition to gaining credit for the ore units of study set out in the above table, candidates are required to complete at least 12 credit points of recommended elective units of study for Mechatronic Engineering and at least 144 credit points of units of study given by the Faculty of Law for the BE/LLB. A minimum of 288 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies the faculty in which they are undertaking the combined degree.

Recommended elective units of study

AMME4710
Computer Vision and Image Processing

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week. **Assumed knowledge:** Mandatory prerequisite MECH4720 Sensors and Signals or MECH4730 Computers in Real-Time Control and Instrumentation **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Current Lectures: Dr. Thierry Peynot, tpeynot@acfr.usyd.edu.au, Dr. Shrihari Vasudevan, s.vasudevan@acfr.usyd.edu.au

This unit of study introduces students to vision sensors, computer vision analysis and digital image processing. This course will cover the following areas: fundamental principles of vision sensors such as physics laws, radiometry, CMOS/CDD imager architectures, colour reconstruction; the design of physics-based models for vision such as reflectance models, photometric invariants, radiometric calibration. This course will also present algorithms for video/image analysis, transmission and scene interpretation. Topics such as image enhancement, restoration, stereo correspondence, pattern recognition, object segmentation and motion analysis will be covered.

AMME4790
Introduction to Biomechatronics

Credit points: 6 **Session:** Semester 2 **Classes:** Tutorial 1 hr/week; Lecture 2 hrs/week; Project Work - own time 4 hrs/week; Laboratory 2 hrs/week; Presentation 4 hrs/week. **Prerequisites:** MTRX3700 or MECH3921 **Assumed knowledge:** 1. A good practical knowledge and an interest in mechanical and electronic engineering; 2. Adequate maths and applied maths skills; 3. Background knowledge of physics, chemistry and biology; 4. Some programming capability, MATLAB, C, C++; 5. The ability to use, and experience of, common software tools used by engineers including CAD and EDA packages. **Assessment:** Through semester assessment (70%) Final Exam (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: AMME4790 is the last in a series of practical Mechatronic and Electrical courses taken over three years. It takes these engineering concepts, along with the associated mathematical, electronic and mechanical theory and applies this knowledge to a series of practical, albeit specialized biomechatronic applications that will be encountered by Mechatronic Engineers who enter this broad field on graduation.

Biomechatronics is the application of mechatronic engineering to human biology and as such it forms an important subset of the overall biomedical engineering discipline. This course focusses on a number of areas of interest including auditory and optical prostheses, artificial hearts and active and passive prosthetic limbs and examines the biomechatronic systems (hardware & signal processing) that underpin their operation

AMME5510
Vibration and Acoustics

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/week. **Assumed knowledge:** (AMME2301 OR AMME9301) AND AMME2200 AND (AMME2500 OR AMME9500) **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This UoS should prepare the student to be able to undertake vibration and acoustic measurement calculations for industry design situations.

The unit aims to introduce a number of new concepts required for analysis of vibrations and acoustics. The response of structure under different dynamic forces, including human and aerodynamic, will be investigated. A number of hands-on experiments will be performed to allow an understanding of the concepts and applicability.

The acoustics component will include: basic acoustics theory, sound generation and propagation, impedance, absorbing materials, industrial noise sources, isolation methods of noise control, enclosures, instrumentation and measurement, frequency analysis, noise regulations and computational acoustics.

AMME5520
Advanced Control and Optimisation

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Research 1 hr/week. **Prerequisites:** AMME3500 OR AMME5501

OR AMME9501 **Assumed knowledge:** Students have an interest and a strong understanding of feedback control systems, specifically in the area of system modelling and control design in the frequency domain. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces engineering design via optimization, i.e. finding the "best possible" solution to a particular problem. For example, an autonomous vehicle must find the fastest route between two locations over a road network; a biomedical sensing device must compute the most accurate estimate of important physiological parameters from noise-corrupted measurements; a feedback control system must stabilize and control a multivariable dynamical system (such as an aircraft) in an optimal fashion.

The student will learn how to formulate a design in terms of a "cost function", when it is possible to find the "best" design via minimization of this "cost", and how to do so. The course will introduce widely-used optimization frameworks including linear and quadratic programming (LP and QP), dynamic programming (DP), path planning with Dijkstra's algorithm, A*, and probabilistic roadmaps (PRMs), state estimation via Kalman filters, and control via the linear quadratic regulator (LQR) and Model Predictive Control (MPC). There will be constant emphasis on connections to real-world engineering problems in control, robotics, aerospace, biomedical engineering, and manufacturing.

MECH5416
Advanced Design and Analysis

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** ENGG1802 - Eng Mechanics, balance of forces and moments; AMME2301 - Mechanics of Solids, 2 and 3 dimensional stress and strain; AMME2500 - Engineering Dynamics - dynamic forces and moments; MECH2400 - Mechanical Design 1, approach to design problems and report writing, and preparation of engineering drawing; MECH3460 - Mechanical design 2, means of applying fatigue analysis to a wide range of machine components **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

1. This UoS utilises assumed theoretical knowledge and skills to elucidate the stresses and strains that exit in the different categories of machine parts. It sets out to make the students familiar with the simplifications that are applied to arrive at the analytic expressions commonly used to analyse each individual categories parts. These simplifications usually begin by assuming that only particular types of loads are carried by teh parts in that category. The resulting analyses provide approximations to the actual stresses. It is possible to have different degrees of simplifications, requiring more or less work, giving better or poorer approximations. Should a part be used to carry loads that were not allowed for in the traditional method then some more appropriate method must be found or developed. An important aspect is to make the student practiced in a range of modern concepts, techniques and tools, and to be made aware of their strengths and limitations.

2. This UoS teaches the student how to recognise where and how their theoretical skills can be applied to the practical situations that they may encounter in this field of design.

3. Options may be provided in the choice of design assignments. Biomedical engineering and vehicle design problems may be provided as options to more general machine design problems.

MECH5720
Sensors and Signals

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Project Work - own time 2 hrs/week; Presentation 2 hrs; Laboratory 2 hrs; Tutorial 2 hrs/week. **Prohibitions:** MECH4720 **Assumed knowledge:** Strong MATLAB skills **Assessment:** Through semester assessment (75%) Final Exam (25%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Syllabus Summary: This course starts by providing a background to the signals and transforms required to understand modern sensors. It goes on to provide an overview of the workings of typical active sensors (Radar, Lidar and Sonar). It provides insight into basic sensing methods as well as aspects of interfacing and signal processing. It includes both background material and a number of case studies.

The course covers the following topics:

a) SIGNALS: Convolution, The Fourier Transform, Modulation (FM, AM, FSK, PSK etc), Frequency shifting (mixing)

b) PASSIVE SENSORS: Infrared Radiometers, Imaging Infrared, Passive Microwave Imaging, Visible Imaging & Image Intensifiers

c) ACTIVE SENSORS THE BASICS: Operational Principles, Time of flight (TOF) Measurement & Imaging of Radar, Lidar and Sonar, Radio Tags and Transponders, Range Tacking, Doppler Measurement, Phase Measurement

d) SENSORS AND THE ENVIRONMENT: Atmospheric Effects, Target Characteristics, Clutter Characteristics, Multipath

e) ACTIVE SENSORS: ADVANCED TECHNIQUES: Probability of Detection, Angle Measurement and Tracking, Combined Range/Doppler and Angle Tracking, Frequency Modulation and the Fast Fourier Transform, High Range Resolution, Wide Aperture Methods, Synthetic Aperture Methods (SAR)

Objectives: The course aims to provide students with a good practical knowledge of a broad range of sensor technologies, operational principles and relevant signal processing techniques.

Expected Outcomes: A good understanding of active sensors, their outputs and applicable signal processing techniques. An appreciation of the basic sensors that are available to engineers and when they should be used.

MTRX5700
Experimental Robotics

Credit points: 6 **Session:** Semester 1 **Classes:** Laboratory 3 hrs/week; Lecture 2 hrs/week. **Prerequisites:** (AMME3500 OR AMME9501) AND MTRX3700 **Assumed knowledge:** Knowledge of statics and dynamics, rotation matrices, programming and some electronic and mechanical design experience is assumed. **Assessment:** Through semester assessment (70%) Final Exam (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to present a broad overview of the technologies associated with industrial and mobile robots. Major topics covered are sensing, mapping, navigation and control of mobile robots and kinematics and control of industrial robots. The subject consists of a series of lectures on robot fundamentals and case studies on practical robot systems. Material covered in lectures is illustrated through experimental laboratory assignments. The objective of the course is to provide students with the essential skills necessary to be able to develop robotic systems for practical applications.

At the end of this unit students will: be familiar with sensor technologies relevant to robotic systems; understand conventions used in robot kinematics and dynamics; understand the dynamics of mobile robotic systems and how they are modeled; have implemented navigation, sensing and control algorithms on a practical robotic system; apply a systematic approach to the design process for robotic systems; understand the practical application of robotic systems in manufacturing, automobile systems and assembly systems; develop the capacity to think critically and independently about new design problems; undertake independent research and analysis and to think creatively about engineering problems.

Course content will include: history and philosophy of robotics; hardware components and subsystems; robot kinematics and dynamics; sensors, measurements and perception; robotic architectures, multiple robot systems; localization, navigation and obstacle avoidance, robot planning; robot learning; robot vision and vision processing.

Additional Electives

Students can select from the units below or other elective units offered within the University that are approved by the Head of the School of Aerospace, Mechanical and Mechatronic Engineering.

ENGG1000
History and Philosophy of Engineering

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Tutorial 1 hr/week; Independent research/study 5 hrs/week; E-Learning 2 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

ENGG1000 is a unique course that aims to provide students with an understanding of the historical development of Engineering with relation to societal expectations of the period. Engineering as a field of study and profession has developed over millennia from simple (yet significant) advances in technology such as the lever and wheel, to modern day examples such as advanced computers, nanomaterials and space flight.

Interaction between human society and Engineers has helped develop and guide the advancement of engineering technology; with society posing problems for Engineers to solve and Engineers developing new technology that changed the course of human history, and helped shape the world we live in.

The general philosophy behind Engineering is that Engineers work to fulfil the needs of society (water, electricity, technological improvements etc.), and as such Engineers are expected to act ethically towards society. The role of Engineers in society will be analysed and discussed from a humanistic perspective, with relation to the current Engineers Australia code of ethics. Other relevant philosophical analyses of Engineering as a skill and profession will also be examined such as, aesthetics, creativity, the epistemology of Engineering and more.

This course will use online resources extensively and help develop research and communication skills of students, whilst providing an overview of the historical significance of Engineers in society, and what it means to be an Engineer.

AMME2000
Engineering Analysis

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** (MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) and ENGG1801. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **Assessment:** Through semester assessment (35%) Final Exam (65%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This course is designed to provide students with the necessary tools for mathematically modelling and solving problems in engineering. Solution methods will be considered for a range of standard engineering problems including; Conduction heat transfer in one and two dimensions, hydrostatics and hydrodynamic balance for internal and external flows, spring/mass systems, vibration and stability problems. The focus will be on real problems and numerical solution methods and will include separation of variables; Fourier series and Fourier transforms; Laplace transforms; scaling and finite differences.

Note

Choice of electives as shown in the above table will depend on subject availability, timetabling and prerequisite conditions.
For a standard enrolment plan for Mechatronic Engineering visit http://cusp.sydney.edu.au/students/view-degree-page/name/BE(Mtrx)

Bachelor of Engineering Honours (Mechatronic) (Space)

Course Overview

The space engineering specialisation at the University of Sydney is the only one of its kind in Australia. Space engineering is an exciting and challenging new area of teaching and research concerned with the theory, design, testing, construction and use of engineering components in aerospace.

In the Bachelor of Engineering Honours (Mechatronic) (Space) you will undertake four core units of study providing a foundation in orbital mechanics, aerospace systems design, satellite subsystems, launch technology, and remote sensing.

You may also choose to complete optional advanced space engineering projects. As a graduate you will be able to meet the challenges of evolving space industries in fields such as propulsion systems, aeronautical design, communications, and navigation.

Course Requirements

To meet requirements for the Bachelor of Engineering Honours (Mechatronic) (Space), a candidate must successfully complete 192 credit points, comprising:

1. core and elective units of study relating to the specialist stream, as prescribed by the table of units of study for the stream; and
2. any additional free elective units of study as may be necessary to gain credit to complete the award.

For a standard enrolment plan for Mechatronic (Space) Engineering visit http://cusp.sydney.edu.au/students/view-degree-page/name/BE(Mtrx)(Space)

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Bachelor of Engineering Honours (Mechatronic) (Space)			
Candidates for the Bachelor of Engineering Honours (Mechatronic) (Space) are required to gain credit for the core units of study set out below. Any additional credit necessary shall be gained by completing additional credit points of elective units of study as recommended by the Faculty, as may be necessary to gain credit for a total of not less than 192 credit points			
Core units of study			
First year			
MATH1001 **Differential Calculus**	3	**A** HSC Mathematics Extension 1 **N** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001	Semester 1 Summer Main
MATH1002 **Linear Algebra**	3	**A** HSC Mathematics or MATH1111 **N** MATH1902, MATH1012, MATH1014	Semester 1 Summer Main
MTRX1701 **Mechatronic Engineering Introductory**	6	**N** AERO1560, MECH1560, ENGG1800 *Note: Department permission required for enrolment*	Semester 1
MATH1003 **Integral Calculus and Modelling**	3	**A** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **N** MATH1013, MATH1903, MATH1907	Semester 2 Summer Main
MATH1005 **Statistics**	3	**A** HSC Mathematics **N** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021	Semester 2 Summer Main Winter Main
ELEC1103 **Fundamentals of Elec and Electronic Eng**	6	**A** Basic knowledge of differentiation & integration, and HSC Physics	Semester 1
MTRX1702 **Mechatronics 1**	6	**A** MTRX1701 **N** COSC1002, COSC1902, ELEC1101, ELEC2602	Semester 2
ENGG1802 **Engineering Mechanics**	6		Semester 2 Summer Main
ENGG1801 **Engineering Computing** INFO 1103 is an acceptable alternative.	6		Semester 1 Summer Late
AMME1362 **Materials 1**	6	**N** AMME2302, CIVL2110	Semester 2
Second year			
MATH2067 **DEs and Vector Calculus for Engineers**	6	**P** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **N** MATH2901, MATH2961, MATH2005, MATH2965, MATH2001, MATH2905, MATH2061, MATH2065	Semester 1
Students in the combined BEHons/BSc degree program can take both MATH2061 and MATH2065 as an alternative.			
ELEC2104 **Electronic Devices and Circuits**	6	**A** Knowledge: ELEC1103. Ohm's Law and Kirchoff's Laws; action of Current and Voltage sources; network analysis and the superposition theorem; Thevenin and Norton equivalent circuits; inductors and capacitors, transient response of RL, RC and RLC circuits; the ability to use power supplies, oscilloscopes, function generators, meters, etc.	Semester 2
AMME2301 **Mechanics of Solids**	6	**P** ENGG1802, MATH1001, MATH1002, MATH1003	Semester 2
AMME2500 **Engineering Dynamics**	6	**P** ENGG1802 and (MATH1001 or MATH1901) and (MATH1002 or MATH1902)	Semester 1
BEHons/BSc students can enrol in PHYS2011, PHYS2012 as acceptable alternatives or advanced equivalent.			
MECH2400 **Mechanical Design 1**	6	**A** ENGG1801 and ENGG1802, HSC Maths and Physics	Semester 2
AMME2261 **Fluid Mechanics 1**	6	**A** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **N** AMME2200	Semester 1
AERO2705 **Space Engineering 1**	6	**A** First Year Maths and basic MATLAB programming skills. **P** (AERO1560 OR MECH1560 OR MTRX1701 OR ENGG1800) AND MATH1001 AND MATH1002 AND MATH1003	Semester 2
MTRX2700 **Mechatronics 2**	6	**A** MTRX1701. Students are assumed to know how to program using the 'C' programming language. Additionally, students should understand the basic concepts behind simple digital logic circuits. **P** MTRX1702 **N** ELEC2601, ELEC3607	Semester 1
Third year			
AMME3500 **System Dynamics and Control**	6	**P** ((MATH2061 or MATH2961) and (MATH2065 or MATH2965)) or MATH2067	Semester 1

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
AMME2262 **Thermal Engineering 1**	6	**A** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **N** AMME2200	Semester 2
Combined degree students are exempt from this unit.			
AERO3760 **Space Engineering 2**	6	**P** AERO2705	Semester 2
MECH3660 **Manufacturing Engineering**	6	**P** MECH2400 or ENGG1960	Semester 1
MTRX3700 **Mechatronics 3**	6	**A** Completion of a first course in microprocessor systems, including assembly and C language programming, interfacing, introductory digital and analogue electronics. **P** MTRX2700 **N** MECH4710	Semester 2
ELEC3404 **Electronic Circuit Design**	6	**A** A background in basic electronics and circuit theory is assumed.	Semester 1
ELEC3204 **Power Electronics and Applications**	6	**A** 1. Differential equations, linear algebra, complex variables, analysis of linear circuits. 2. Fourier theory applied to periodic and non-periodic signals. 3. Software such as MATLAB to perform signal analysis and filter design. 4. Familiarity with the use of basic laboratory equipment such as oscilloscope, function generator, power supply, etc. 5. Basic electric circuit theory and analysis **P** ELEC2104	Semester 1
Combined degree students are exempt from this unit.			

Fourth year

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
AERO4701 **Space Engineering 3**	6	**P** AERO3760	Semester 1
ENGG4000 **Practical Experience**		**P** 36 Credit Points of Senior Units *Students should have completed three years of their BE program before enrolling in this unit.*	Semester 1 Semester 2
MECH4601 **Professional Engineering 2**	6	**A** ENGG1803, ENGG4000 It is recommended that you have undertaken ENGG4000 Practical Experience in a period prior to undertaking this course, or be able to demonstrate equivalent understanding of professional practice as some assessment tasks will draw upon your experiences in professional engineering practice.	Semester 1

Students must enrol in 12cp of Thesis units.

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
AMME4111 **Honours Thesis A**	6	**P** 36 credits of 3rd year units of study. **N** AMME4010, AMME4121, AMME4122 *Note: Department permission required for enrolment* *Honours Thesis A is only available to students with an HWAM of 65 or over. HWAM is a weighted average based on all 2000, 3000 and 4000 level units completed prior to enrolment in this unit. Prospective students in Honours Thesis A are expected to have consulted with supervisors and selected a topic of interest at the end of third year, guided by the advertised list of suggested thesis topics and supervisors. Availability of topics is limited and students should undertake to speak with prospective supervisors as soon as possible. Students who are unable to secure a supervisor and topic will be allocated a supervisor by the unit coordinator. Alternatively, students may do a thesis with a supervisor in industry or in another university department. In this case, the student must also find a second supervisor within the School of AMME.*	Semester 1 Semester 2
Normally taken in Semester 1			
AMME4112 **Honours Thesis B**	6	**P** 36 credits of 3rd year units of study and WAM 65 or over **N** AMME4010, AMME4122, AMME4121 *Note: Department permission required for enrolment* *HWAM of 65 or greater required for enrolment. HWAM is the weighted average of all 2000, 3000 and 4000 level units completed prior to enrolment in this unit.*	Semester 1 Semester 2
Normally taken in Semster 2			

Acceptable alternative units of study

Most units of study offered by the Faculty of Science shown in the tables can be replaced by an equivalent advanced level unit, subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing advanced options should seek advice from their department before enrolling.

Students undertaking Study Abroad in a particular year of their degree must enrol in the appropriate AMME International Exchange Program units of study as an alternative to a semester's standard units.

Resolutions of the Faculty of Engineering and Information Technologies relating to this table:

BEHons(Mechatronic)(Space)

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete 24 credit points of recommended elective units of study for Mechatronic (Space) Engineering and 6 credit points of free elective units of study. A minimum of 192 credit points is required to be eligible for the award of BE(Mechatronic)(Space).

BEHons(Mechatronic)(Space)/BSc or BCom or BMedSci or BPM

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete at least 6 credit points of recommended elective units of study for Mechatronic (Space) Engineering and 96 credit points of units of study given by the Faculty of Science for the BE/BSc and BMedSci, or the Business School for the BE/BCom or from the core unit table for BPM. A minimum of 240 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies and the faculty in which they are undertaking the combined degree.

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
BEHons(Mechatronic)(Space)/BA			
In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete at least 12 credit points of recommended elective units of study for Mechatronic (Space) Engineering and 84 credit points of units of study given by the Faculty of Arts and Social Sciences for the BE/BA. A minimum of 240 credit points is required to be eligible for the combined degree. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies and the faculty in which they are undertaking the combined degree.			
BEHons(Mechatronic)(Space)/LLB			
In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete at least 6 credit points of recommended elective units of study for Mechatronic (Space) Engineering and 144 credit points of units of study given by the Faculty of Law for the BE/LLB. A minimum of 288 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies and the Faculty of Law.			
Recommended elective units of study			
AMME4710 **Computer Vision and Image Processing**	6	**A** Mandatory prerequisite MECH4720 Sensors and Signals or MECH4730 Computers in Real-Time Control and Instrumentation *Current Lectures: Dr. Thierry Peynot, tpeynot@acfr.usyd.edu.au, Dr. Shrihari Vasudevan, s.vasudevan@acfr.usyd.edu.au*	Semester 2
AMME4790 **Introduction to Biomechatronics**	6	**A** 1. A good practical knowledge and an interest in mechanical and electronic engineering; 2. Adequate maths and applied maths skills; 3. Background knowledge of physics, chemistry and biology; 4. Some programming capability, MATLAB, C, C++; 5. The ability to use, and experience of, common software tools used by engineers including CAD and EDA packages. **P** MTRX3700 or MECH3921 *AMME4790 is the last in a series of practical Mechatronic and Electrical courses taken over three years. It takes these engineering concepts, along with the associated mathematical, electronic and mechanical theory and applies this knowledge to a series of practical, albeit specialized biomechatronic applications that will be encountered by Mechatronic Engineers who enter this broad field on graduation.*	Semester 2
AMME5510 **Vibration and Acoustics**	6	**A** (AMME2301 OR AMME9301) AND AMME2200 AND (AMME2500 OR AMME9500) *Note: Department permission required for enrolment*	Semester 2
AMME5520 **Advanced Control and Optimisation**	6	**A** Students have an interest and a strong understanding of feedback control systems, specifically in the area of system modelling and control design in the frequency domain. **P** AMME3500 OR AMME5501 OR AMME9501	Semester 1
MECH5416 **Advanced Design and Analysis**	6	**A** ENGG1802 - Eng Mechanics, balance of forces and moments; AMME2301 - Mechanics of Solids, 2 and 3 dimensional stress and strain; AMME2500 - Engineering Dynamics - dynamic forces and moments; MECH2400 - Mechanical Design 1, approach to design problems and report writing, and preparation of engineering drawing; MECH3460 - Mechanical design 2, means of applying fatigue analysis to a wide range of machine components	Semester 1
MECH5720 **Sensors and Signals**	6	**A** Strong MATLAB skills **N** MECH4720	Semester 2
MTRX5700 **Experimental Robotics**	6	**A** Knowledge of statics and dynamics, rotation matrices, programming and some electronic and mechanical design experience is assumed. **P** (AMME3500 OR AMME9501) AND MTRX3700	Semester 1
These units are also available to other Space stream students.			
Additional Electives			
Students can select from the units below or other elective units offered within the University that are approved by the Head of the School of Aerospace, Mechanical and Mechatronic Engineering.			
ENGG1000 **History and Philosophy of Engineering**	6		Semester 1 Semester 2
AMME2000 **Engineering Analysis**	6	**A** (MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) and ENGG1801. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. *Note: Department permission required for enrolment*	Semester 1
Note			
Choice of electives as shown in the above table will depend on subject availability, timetabling and prerequisite conditions.			

For a standard enrolment plan for Mechatronic (Space) Engineering visit http://cusp.sydney.edu.au/students/view-degree-page/name/BE(Mtrx)(Space)

Unit of Study Descriptions

Bachelor of Engineering Honours (Mechatronic) (Space)

Candidates for the Bachelor of Engineering Honours (Mechatronic) (Space) are required to gain credit for the core units of study set out below. Any additional credit necessary shall be gained by completing additional credit points of elective units of study as recommended by the Faculty, as may be necessary to gain credit for a total of not less than 192 credit points

Core units of study

First year

MATH1001
Differential Calculus

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001 **Assumed knowledge:** HSC Mathematics Extension 1 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1001 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study looks at complex numbers, functions of a single variable, limits and continuity, vector functions and functions of two variables. Differential calculus is extended to functions of two variables. Taylor's theorem as a higher order mean value theorem.

Textbooks
As set out in the Junior Mathematics Handbook.

MATH1002
Linear Algebra

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1902, MATH1012, MATH1014 **Assumed knowledge:** HSC Mathematics or MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1002 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study introduces vectors and vector algebra, linear algebra including solutions of linear systems, matrices, determinants, eigenvalues and eigenvectors.

Textbooks
As set out in the Junior Mathematics Handbook

MTRX1701
Mechatronic Engineering Introductory

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 1 hr/week; Tutorial/Laboratory 2 hrs/week; Workshop 3 hrs/week. **Prohibitions:** AERO1560, MECH1560, ENGG1800 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit of study aims to introduce students to the fundamental principles that underlie the study of mechatronic engineering. It lays the foundation for later studies, including advanced mechatronic engineering, computing, control and system design courses. The subject also provides students with the opportunity to develop an understanding of a range of machining and manufacturing processes required to make mechanical components.

Introduction to Mechatronic Engineering (70%): (a) Introduction to mechatronics and to the structure of the BE in Mechatronic Engineering. (b) Systems Modelling and Control - Fundamental concepts which underlie the modelling and control of dynamic systems. (c) Design Process - The process of design synthesis as an important part of engineering. (d) Actuators - Components that exert effort to accomplish a given task. (e) Sensors - Components that take measurements of the environment. (f) Computers - Hardware and software components that, when combined, allow a system to be controlled. (g) Advanced Topics - Case studies relating to the application of mechatronic engineering principles.

Workshop Technology (30%): An overview of a range of machining and manufacturing processes, with hands-on experience provided. Workshop Technology practical work is undertaken in: (a) Hand tools (b) Machining and (c) Soldering. Safety requirements: All students are required to provide their own personal protective equipment (PPE) and comply with safety regulations. Students who fail to do this will not be permitted to enter the workshops. In particular, approved industrial footwear must be worn, and long hair must be protected by a hair net. Safety glasses must be worn at all times.

MATH1003
Integral Calculus and Modelling

Credit points: 3 **Session:** Semester 2, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1013, MATH1903, MATH1907 **Assumed knowledge:** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1003 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.This unit of study first develops the idea of the definite integral from Riemann sums, leading to the Fundamental Theorem of Calculus. Various techniques of integration are considered, such as integration by parts.The second part is an introduction to the use of first and second order differential equations to model a variety of scientific phenomena.

Textbooks
As set out in the Junior Mathematics Handbook

MATH1005
Statistics

Credit points: 3 **Session:** Semester 2, Summer Main, Winter Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021 **Assumed knowledge:** HSC Mathematics **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1005 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit offers a comprehensive introduction to data analysis, probability, sampling, and inference including t-tests, confidence intervals and chi-squared goodness of fit tests.

Textbooks
As set out in the Junior Mathematics Handbook

ELEC1103
Fundamentals of Elec and Electronic Eng

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Basic knowledge of differentiation & integration, and HSC Physics **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to develop knowledge of the fundamental concepts and building blocks of electrical and electronics circuits. This is a foundation unit in circuit theory. Circuit theory is the electrical engineer's fundamental tool.

The concepts learnt in this unit will be made use of heavily in many units of study (in later years) in the areas of electronics, instrumentation, electrical machines, power systems, communication systems, and signal processing.

Topics: a) Basic electrical and electronic circuit concepts: Circuits, circuit elements, circuit laws, node and mesh analysis, circuit theorems, energy storage, capacitors and inductors, circuits with switches, transient response, sine waves and complex analysis, phasors, impedance, ac power.; b) Project management, teamwork, ethics; c) Safety issues

MTRX1702
Mechatronics 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 1 hr/week; Digital Systems Laboratory/Tutorial 2 hrs/week; Tutorial 2 hrs/week. **Prohibitions:** COSC1002, COSC1902, ELEC1101, ELEC2602 **Assumed knowledge:** MTRX1701 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to provide an introduction to the analysis and design of digital logic circuits and to provide a foundation for the study of systems and embedded programming for the degree in Mechatronic Engineering.

Introductory Digital Systems (3 CR): Number systems and codes; Logic gates and Boolean algebra, universal (NAND) logic gates; Digital arithmetic: operations and circuits, Two`s complement addition and subtraction, overflow; Combinational logic circuits; Flip-flops and related devices; Counters and registers, shift register applications; sequential circuits, designs of synchronous, cascadable counters (BCD and binary). Integrated circuit logic families and interfacing; practical issues including, fan out, pull-up/down, grounds, power supplies and decoupling; timing issues, race conditions. Tri-state signals and buses; MSI logic circuits, multiplexers, demultiplexers, decoders, magnitude comparators; Introduction to programmable logic devices. The unit of study will include a practical component where students design and implement logic circuits. Purchase of a basic laboratory tool kit as described in classes will be required.

Introductory Software Engineering (3 CR): This unit of study provides an introduction to software design, implementation, debugging and testing in the context of C programming language. Problem definition and decomposition; the design process; designing for testing and defensive coding methods; modular code structure and abstract data types; best practice in programming. Preprocessor, tokens, storage classes and types. Arithmetic, relational and bit manipulation operators. Constructs for control flow: if, switch, for, do and while. Arrays. Pointers and character strings. Dynamic memory. Functions and parameter passing. Derived storage classes: structures and unions. File I/O.

ENGG1802
Engineering Mechanics

Credit points: 6 **Session:** Semester 2, Summer Main **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit aims to provide students with an understanding of and competence in solving statics and introductory dynamics problems in engineering. Tutorial sessions will help students to improve their group work and problem solving skills, and gain competency in extracting a simplified version of a problem from a complex situation. Emphasis is placed on the ability to work in 3D as well as 2D, including the 2D and 3D visualization of structures and structural components, and the vectorial 2D and 3D representations of spatial points, forces and moments. Introduction to kinematics and dynamics topics includes position, velocity and acceleration of a point; relative motion, force and acceleration, momentum, collisions and energy methods.

ENGG1801
Engineering Computing

Credit points: 6 **Session:** Semester 1, Summer Late **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will introduce students to fundamental principles of programming. The language used will be Matlab but the principles taught are readily portable to other languages like C and Java. The unit material will be presented in a manner which will help students to draw a connection between programming constructs and real engineering applications. The unit will use engineering inspired case-studies : especially from Civil, Chemical, Aerospace and Mechanical streams, to motivate new material. There will be a major project which uses programming to solve a real world engineering problem. The extensive Matlab library for visualization will also be introduced. Matlab will cover two-thirds of the unit. The remaining one-third will be devoted to the use of Excel in engineering scenarios. Furthermore, cross integration between Matlab and Excel will also be highlighted.

INFO 1103 is an acceptable alternative.

AMME1362
Materials 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/semester. **Prohibitions:** AMME2302, CIVL2110 **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

AMME1362 is an introductory unit in engineering materials. The unit aims to develop students' understanding of the structures, mechanical properties and manufacture of a range of engineering materials as well as how the mechanical properties relate to microstructure and forming and treatment methods. The unit has no prerequisite subject and is therefore intended for those with little or no previous background in engineering materials. However the unit does require students to take a significant degree of independent responsibility for developing their own background knowledge of materials and their properties. The electrical, magnetic, thermal and optical properties of materials are a critical need-to-know area where students are expected to do some independent study.

Second year

MATH2067
DEs and Vector Calculus for Engineers

Credit points: 6 **Session:** Semester 1 **Classes:** Three 1 hour lectures, one 1 hour tutorial and one 1 hour practice class per week. **Prerequisites:** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **Prohibitions:** MATH2901, MATH2961, MATH2005, MATH2965, MATH2001, MATH2905, MATH2061, MATH2065 **Assessment:** One 2 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH2067 starts by introducing students to solution techniques of ordinary and partial differential equations (ODEs and PDEs) relevant to the engineering disciplines: it provides a basic grounding in these techniques to enable students to build on the concepts in their subsequent engineering classes. The main topics are Fourier series, second order ODEs, including inhomogeneous equations and Laplace transforms, and second order PDEs in rectangular domains (solution by separation of variables).

The unit moves on to topics from vector calculus, including vector-valued functions (parametrised curves and surfaces; vector fields; div, grad and curl; gradient fields and potential functions), line integrals (arc length; work; path-independent integrals and conservative fields; flux across a curve), iterated integrals (double and triple integrals; polar, cylindrical and spherical coordinates; areas, volumes and mass; Green's Theorem), flux integrals (flow through a surface; flux integrals through a surface defined by a function of two variables, though cylinders, spheres and parametrised surfaces), Gauss's Divergence Theorem and Stokes' Theorem.

Students in the combined BEHons/BSc degree program can take both MATH2061 and MATH2065 as an alternative.

ELEC2104
Electronic Devices and Circuits

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/fortnight; Laboratory 3 hrs/fortnight **Assumed knowledge:** Knowledge: ELEC1103. Ohm's Law and Kirchoff's Laws; action of Current and Voltage sources; network analysis and the superposition theorem; Thevenin and Norton equivalent circuits; inductors and capacitors, transient response of RL, RC and RLC circuits; the ability to use power supplies, oscilloscopes, function generators, meters, etc. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Modern Electronics has come to be known as microelectronics which refers to the Integrated Circuits (ICs) containing millions of discrete devices. This course introduces some of the basic electronic devices like diodes and different types of transistors. It also aims to introduce students the analysis and design techniques of circuits involving these discrete devices as well as the integrated circuits.

Completion of this course is essential to specialize in Electrical, Telecommunication or Computer Engineering stream. The knowledge of ELEC1103 is assumed.

AMME2301
Mechanics of Solids

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** ENGG1802, MATH1001, MATH1002, MATH1003 **Assessment:** Through semester assessment (35%) Final Exam (65%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Equilibrium of deformable structures; basic concept of deformation compatibility; stress and strain in bars, beams and their structures subjected to tension, compression, bending, torsion and combined loading; statically determinate and indeterminate structures; energy methods for bar and beam structures; simple buckling; simple vibration; deformation of simple frames and cell box beams; simple two-dimensional stress and Morh's circle; problem-based applications in aerospace, mechanical and biomedical engineering.

AMME2500
Engineering Dynamics

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs **Prerequisites:** ENGG1802 and (MATH1001 or MATH1901) and (MATH1002 or MATH1902) **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to teach: Dynamics of Rigid Bodies: Analysis of Planar mechanisms; Kinematics of rigid bodies; Kinetics of rigid bodies. Students will also develop their skills in: how to model and analyse dynamic systems and the application of theory to real systems through practical/laboratory sessions.

At the end of this unit students will have developed skills in modelling and analysing planar mechanisms and rigid body dynamic systems.

Course content will include planar mechanisms, linkages, mobility; instant centres of rotation, Kennedy's theorem; velocity and acceleration polygons; kinematics of rigid bodies, frames of reference, velocity and acceleration, rotating frame of reference, relative velocity and acceleration, gyroscopic acceleration; kinetics of rigid bodies, linear momentum and Euler's first law; angular momentum and Euler's second law; centre of mass; moments of inertia, parallel axis and parallel plane theorems, principal axes and principal moments of inertia, rotation about an axis; impulse and momentum; work and energy, kinetic and potential energies; applications to orbital and gyroscopic motion; introduction to Lagrangian methods.

BEHons/BSc students can enrol in PHYS2011, PHYS2012 as acceptable alternatives or advanced equivalent.

MECH2400
Mechanical Design 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 1 hr/week. **Assumed knowledge:** ENGG1801 and ENGG1802, HSC Maths and Physics **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Aim: For students to experience a realistic the design process and to develop good engineering skills.

Course Objectives: To develop an understanding of:

1. the need for and use of standard drawings in the communication and definition of parts and assemblies,
2. Efficient use of a CAD package
3. creativity,
4. the design process from initial idea to finished product
5. Methods used to analyse designs
6. standard components.

AMME2261
Fluid Mechanics 1

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs/semester. **Prohibitions:** AMME2200 **Assumed knowledge:** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit covers the fundamentals of fluid statics and fluid dynamics. At the end of this unit students will have: an understanding of the basic equations governing the statics and dynamics of fluids; the ability to analyze and determine the forces applied by a static fluid; the ability to analyse fluids in motion. The course will cover both inviscid and viscous fluid flow. The course will introduce the relevant parameters for fluid flow in internal engineering systems such as pipes and pumps and external systems such as flow over wings and airfoils. Course content will cover the basic concepts such as viscosity, density, continuum, pressure, force, buoyancy and acceleration; and more detailed methods including continuity, conservation of momentum, streamlines and potential flow theory, Bernoulli equation, Euler equation, Navier-Stokes equation. Experiments will introduce flow measuring devices and flow observation.

AERO2705
Space Engineering 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** (AERO1560 OR MECH1560 OR MTRX1701 OR ENGG1800) AND MATH1001 AND MATH1002 AND MATH1003 **Assumed knowledge:** First Year Maths and basic MATLAB programming skills. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to introduce students to the terminology, technology and current practice in the field of Space Engineering. Course content will include a variety of topics in the area of orbital mechanics, satellite systems and launch requirements. Case studies of current systems will be the focus of this unit.

MTRX2700
Mechatronics 2

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2.5 hrs/week; Laboratory 3 hrs/week. **Prerequisites:** MTRX1702 **Prohibitions:** ELEC2601, ELEC3607 **Assumed knowledge:** MTRX1701. Students are assumed to know how to program using the 'C' programming language. Additionally, students should understand the basic concepts behind simple digital logic circuits. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The aim of the unit is to introduce students to microprocessor and microcomputer systems, emphasizing assembly language programming and building on the digital logic foundations from first year. In particular, the following subjects are addressed:

Introduction to microprocessors, stored-program computer architecture, instruction codes and addressing modes, instruction execution cycle; Memory devices. Computer architecture and assembly language programming. Microprocessor and microcontroller systems, memory and IO interfacing, interrupts and interrupt handling. Serial and parallel communications. System design, documentation, implementation, debugging and testing.

MTRX2700 is the introductory course in the basics of real Mechatronic systems. This course builds on knowledge obtained in the courses ENGG1801, MTRX1701, ELEC1103 and MTRX1702. This course extends this knowledge by introducing students to their first practical applications in Mechatronic Engineering. By passing this subject, the student will have obtained the necessary skills to undertake Mechatronics 3 (MTRX3700).

Third year

AMME3500
System Dynamics and Control

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week. **Prerequisites:** ((MATH2061 or MATH2961) and (MATH2065 or MATH2965)) or MATH2067 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to allow students to develop an understanding of methods for modeling and controlling linear, time-invariant systems. Techniques examined will include the use of differential equations and frequency domain approaches to modeling of systems. This will allow students to examine the response of a system to changing inputs and to examine the influence of external stimuli such as disturbances on system behaviour. Students will also gain an understanding of how the responses of these mechanical systems can be altered to meet desired specifications and why this is important in many engineering problem domains.

The study of control systems engineering is of fundamental importance to most engineering disciplines, including Electrical, Mechanical, Mechatronic and Aerospace Engineering. Control systems are found in a broad range of applications within these disciplines, from aircraft and spacecraft to robots, automobiles, computers and process control systems. The concepts taught in this course introduce students to the mathematical foundations behind the modelling and control of linear, time-invariant dynamic systems. In particular, topics addressed in this course will include:

1. Techniques for modelling mechanical systems and understanding their response to control inputs and disturbances. This will include the use of differential equations and frequency domain methods as well as tools such as Root Locus and Bode plots.

2. Representation of systems in a feedback control system as well as techniques for determining what desired system performance specifications are achievable, practical and important when the system is under control

3. Theoretical and practical techniques that help engineers in designing control systems, and an examination of which technique is best in solving a given problem.

AMME2262
Thermal Engineering 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs. **Prohibitions:** AMME2200 **Assumed knowledge:** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to teach the basic laws of thermodynamics and heat transfer. At the end of this unit students will have: an understanding of the basic laws of thermodynamics and heat transfer; The ability to analyze the thermodynamics of a simple open or closed engineering system. The basic knowledge to analyse and design 1D thermal circuits. Course content will include concepts of heat and work, properties of substances, first law of thermodynamics, control mass and control volume analysis, thermal efficiency, entropy, second law of thermodynamics, reversible and irreversible processes, isentropic efficiency, power and refrigeration cycles, heat transfer by conduction, convection and radiation, 1D thermal circuits and transient heat transfer.

Combined degree students are exempt from this unit.

AERO3760
Space Engineering 2

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Practical Experience 2 hrs/week. **Prerequisites:** AERO2705 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to provide students with a learning environment that promotes systems thinking and allows students to develop skills in systems analysis and design. In particular the UoS will focus on Aerospace systems, and students will develop both theoretical and practical skills in the area of systems engineering for this discipline. The primary objective is to develop fundamental systems engineering and systems thinking skills. At the end of this unit students will be able to: define the requirements process and be able to apply it to aerospace systems design.; conduct requirements analysis for an aerospace system and to drill down through requirements breakdown and the use of the V-diagram in this analysis; conduct functional and technical analysis and determine design drivers in a system; manage the use of a log book and its application in engineering design; develop technical skills in the design and development of satellite subsystems; conduct appropriate interaction processes between team members for the successful achievement of goals. Course content will include fundamentals of systems engineering; satellite subsystems; systems design.

MECH3660
Manufacturing Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Laboratory, Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** MECH2400 or ENGG1960 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit aims to teach the fundamentals of manufacturing processes and systems in mechanical, mechatronic and biomedical engineering, including traditional and advanced manufacturing technologies.

This unit aims to develop the following attributes: to understand the fundamental principles of manufacturing technologies for the above mentioned engineering areas; to gain the ability to select existing manufacturing processes and systems for direct engineering applications; to develop ability to create innovative new manufacturing technologies for advanced industrial applications; to develop ability to invent new manufacturing systems

At the end of this unit students will have a good understanding of the following: merits and advantages of individual manufacturing processes and systems; principles of developing new technologies; comprehensive applications and strategic selection of manufacturing processes and systems.

Course content will include:

Manufacturing Processes: Common processes and their science (machining, casting, powder metallurgy, metal working, welding); merits and limitations; CNC and CAM;

Manufacturing Systems: Economics in manufacturing; flexible manufacturing; group technology; materials selection and requirements planning; quality control; introduction to new technology; introduction to e-manufacturing; human factors; plant layout.

MTRX3700
Mechatronics 3

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2.5 hrs/week; Laboratory 3 hrs/week. **Prerequisites:** MTRX2700 **Prohibitions:** MECH4710 **Assumed knowledge:** Completion of a first course in microprocessor systems, including assembly and C language programming, interfacing, introductory digital and analogue electronics. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to provide experience, confidence and competence in the design and implementation of microprocessor-based products and instruments; to impart a detailed knowledge of the software and hardware architecture of a typical modern microcontroller, and an understanding of the use of these resources in product design; and to provide experience of working in a project team to prototype a realistic product to meet a specification.

At the end of this unit students will understand microprocessor system organization, and the organization of multiple and distributed processor systems, special purpose architectures (DSPs etc.) and their application. The student will have a detailed knowledge of the software and hardware architecture of a modern microcontroller. This knowledge will include an in-depth understanding of the relationship between assembly language, high-level language, and the hardware, of the utilisation and interfacing of microcontroller hardware resources, and of the design and development of software comprised of multiple interrupt-driven processes. The student will have the competence to develop prototype microprocessor-based products.

Course content will include single processor systems, multiple and distributed processing systems, special purpose architectures (DSPs etc) and their application; standard interfacing of sensor and actuation systems; ADC/DAC, SSI, parallel, CAN bus etc.; specific requirements for microprocessor-based products; problem definition and system design; tools for design, development and testing of prototype systems; the unit of study will include a project, where groups of students design, develop and commission a microprocessor-based product.

ELEC3404
Electronic Circuit Design

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/fortnight; Laboratory 3 hrs/fortnight. **Assumed knowledge:** A background in basic electronics and circuit theory is assumed. **Assessment:** Through semester assessment (70%) Final Exam (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to teach students analysis and design techniques for electronic systems such as signal amplifiers, differential amplifiers and power amplifiers. Completion of this unit will allow progression to advanced studies or to work in electronics and telecommunication engineering.

Topics covered are as follows. The BJT and MOSFET as an amplifier. Biasing in amplifier circuits. Small signal operation and models. Single stage amplifiers. Internal capacitances and high frequency models. The frequency response of the common-emitter amplifier. Current sources and current mirrors. Differential amplifiers. Output stages and power amplifiers:class A, class B and class AB.

ELEC3204
Power Electronics and Applications

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs/week; Project Work - own time 2 hrs/week. **Prerequisites:** ELEC2104 **Assumed knowledge:** 1. Differential equations, linear algebra, complex variables, analysis of linear circuits. 2. Fourier theory applied to periodic and non-periodic signals. 3. Software such as MATLAB to perform signal analysis and filter design. 4. Familiarity with the use of basic laboratory equipment such as oscilloscope, function generator, power supply, etc. 5. Basic electric circuit theory and analysis **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to teach the fundamentals of advanced energy conversion systems based on power electronics. It provides description of the operation principles and control of these blocks. Through analysis and design methodologies, it delivers an in depth understanding of modern enabling technologies associated with energy conversion. Through laboratory hands-on experience on actual industrial systems, such electrical motor drives, robotic arms, and power supplies, it enhances the link between the theory and the "real" engineering world. The unit clarifies unambiguously the role these imperative technologies play in every human activity; from mobile telephone chargers to energy electricity grids; from electric vehicles and industrial automation to wind energy conversion to name just few.

The following topics are covered:

Introduction to power electronic converters and systems; applications of power electronic converters; power semiconductor devices; uncontrolled rectifiers: single- and three-phase; non-isolated dc-dc converters: buck, boost and buck-boost; isolated dc-dc converters; inverters: single- and three-phase; uninterruptible power supplies; battery chargers and renewable energy systems; electric and hybrid electric vehicles technologies, design of converters and systems.

Combined degree students are exempt from this unit.

Fourth year

AERO4701
Space Engineering 3

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** AERO3760 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This UoS aims to teach students the fundamental principles and methods of designing solutions to optimal estimation and control problems in space engineering applications. Students will apply learned techniques in optimal estimation and control theory to solving a wide range of different problems in engineering such as satellite orbit determination, satellite attitude determination, satellite positioning systems and remote sensing, optimal flight control, space shuttle re-entry and orbit transfers. Students will learn to recognize and appreciate the coupling between the different elements within an estimation and control task, from a systems-theoretic perspective.

ENGG4000
Practical Experience

Session: Semester 1, Semester 2 **Classes:** Practical Experience, **Prerequisites:** 36 Credit Points of Senior Units **Assessment:** Through semester assessment (100%) **Mode of delivery:** Professional practice

Note: Students should have completed three years of their BE program before enrolling in this unit.

The aim of this unit is to give students exposure to work in an engineering organisation and gain some professional experience; to enhance a student's abilities and experience in report writing; to encourage self-evaluation in the context of applying their theoretical knowledge to real industry practise. Students will gain a better appreciation of the role of engineers in the workplace. The assessment will enhance the student's ability to present structured observations and reflections in the mode of a formal written report.

Each student is required to gain exposure to professional engineering practice and environments and to submit a satisfactory written report of his or her work. The report will include the requirement of a detail logbook recording tasks given and timelines set for achieving these. Self-evaluation of a student's personal level of knowledge and its applicability to the workplace is a major component of the reporting. Normally 12 weeks (60 days) of practical work experience is required, though the Faculty may accept alternatives that are judged as equivalent. Students are strongly encouraged to undertake their work experience in the break between Year 3 and 4 and definitely prior to commencing their final semester of study, however any engineering work taken after completing 28 credit points of 3rd year units of study may be accepted for the requirements of this unit. The University Careers and Appointments Service is available to assist students to obtain suitable employment. This unit of study is a core unit of study in all BE programs and must be passed in order to graduate from those programs.

MECH4601
Professional Engineering 2

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** ENGG1803, ENGG4000 It is recommended that you have undertaken ENGG4000 Practical Experience in a period prior to undertaking this course, or be able to demonstrate equivalent understanding of professional practice as some assessment tasks will draw upon your experiences in professional engineering practice. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to create an awareness of issues surrounding the management of projects; impart knowledge resulting in a more global approach to the practice of engineering and engineering management; and provide a vehicle for improving communication skills (both written and oral). The course also aims, when taken together with other courses offered by the School, to substantially meet the requirement of the Institution of Engineers, Australia, for undergraduate training in management theory and Professional Engineering skills. On completion of this unit students should be able to: plan small projects and contribute effectively to planning of larger projects; work effectively in small teams; understand their role and expected conduct in the management of engineering projects; perform well in that role from the outset, with performance limited only by experience; prepare an interesting and relevant presentation on aspects of their work for their peers or senior managers; recognise the range of expertise they may need to call on in their role as an engineer working on a project (e.g. in safety and environmental fields); understand what the experts are saying, and be able to contribute effectively to that discussion.

Students must enrol in 12cp of Thesis units.

AMME4111
Honours Thesis A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research 10 hrs/week. **Prerequisites:** 36 credits of 3rd year units of study. **Prohibitions:** AMME4010, AMME4121, AMME4122 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: Honours Thesis A is only available to students with an HWAM of 65 or over. HWAM is a weighted average based on all 2000, 3000 and 4000 level units completed prior to enrolment in this unit. Prospective students in Honours Thesis A are expected to have consulted with supervisors and selected a topic of interest at the end of third year, guided by the advertised list of suggested thesis topics and supervisors. Availability of topics is limited and students should undertake to speak with prospective supervisors as soon as possible. Students who are unable to secure a supervisor and topic will be allocated a supervisor by the unit coordinator. Alternatively, students may do a thesis with a supervisor in industry or in another university department. In this case, the student must also find a second supervisor within the School of AMME.

The fourth year honours thesis aims to provide students with the opportunity to carry out a defined piece of independent research in a setting and in a manner that fosters the development of engineering research skills. These skills include the capacity to define a research question, showing how it relates to existing knowledge, identifying the tools needed to investigate the question, carrying out the research in a systematic way, analysing the results obtained and presenting the outcomes in a report that is clear, coherent and logically structured. Honours thesis is undertaken across two semesters of enrolment, in two successive Units of Study of 6 credits points each. Honours Thesis A covers first steps of thesis research starting with development of research proposal. Thesis B covers the second of stage writing up and presenting the research results.

Students are asked to write a thesis based on a research project, which is very often related to some aspect of a staff member's research interests. Some projects will be experimental in nature, others may involve computer-based simulation, feasibility studies or the design, construction and testing of equipment. Direction of thesis work may be determined by the supervisor or be of an original nature, but in either case the student is responsible for the execution of the practical work and the general layout and content of the thesis itself. The final thesis must be the student's individual work, although research is sometimes conducted in the framework of a group project shared with others. Students undertaking research on this basis will need to take care in ensuring the individual quality of their own research work and the final thesis submission. The thesis will be judged on the extent and quality of the student's original work and particularly how critical, perceptive and constructive he or she has been in assessing his/her work and that of others. Students will also be required to present the results of their findings to their peers and supervisors as part of a seminar program.

It is not expected that a thesis at this level will represent a significant contribution to new knowledge; nor is it expected that theses will resolve great intellectual problems. The timeframe available for the thesis is simply too short to permit students to tackle complex or difficult problems. Indeed, a key aim of the thesis is to specify a research topic that arouses sufficient intellectual curiosity, and presents an appropriate range and diversity of technical and conceptual challenges, while remaining manageable and allowing achievable outcomes within the time and resources available. It is important that the topic be of sufficient scope and complexity to allow a student to learn their craft and demonstrate their research skills. Equally imperative is that the task not be so demanding as to elude completion.

Normally taken in Semester 1

AMME4112
Honours Thesis B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research 10 hrs/week. **Prerequisites:** 36 credits of 3rd year units of study and WAM 65 or over **Prohibitions:** AMME4010, AMME4122, AMME4121 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: HWAM of 65 or greater required for enrolment. HWAM is the weighted average of all 2000, 3000 and 4000 level units completed prior to enrolment in this unit.

The fourth year honours thesis aims to provide students with the opportunity to carry out a defined piece of independent research or design work in a setting and in a manner that fosters the development of engineering skills in research or design. These skills include the capacity to define a research or design question, showing how it relates to existing knowledge, identifying the tools needed to investigate the question, carrying out the research or design in a systematic way, analysing the results obtained and presenting the outcomes in a report that is clear, coherent and logically structured. Honours thesis is undertaken across two semesters of enrolment, in two successive Units of Study of 6 credits points each. Honours Thesis A covers first steps of thesis research starting with development of research proposal. Thesis B covers the second of stage writing up and presenting the research results.

Students are asked to write a thesis based on a research or major design project, which is very often related to some aspect of a staff member's research interests. Some projects will be experimental in nature, others may involve computer-based simulation, feasibility studies or the design, construction and testing of equipment. Direction of thesis work may be determined by the supervisor or be of an original nature, but in either case the student is responsible for the execution of the practical work and the general layout and content of the thesis itself. The final thesis must be the student's individual work, although research is sometimes conducted in the framework of a group project shared with others. Students undertaking research on this basis will need to take care in ensuring the individual quality of their own research work and the final thesis submission. The thesis will be judged on the extent and quality of the student's original work and particularly how critical, perceptive and constructive he or she has been in assessing his/her work and that of others. Students will also be required to present the results of their findings to their peers and supervisors as part of a seminar program.

It is not expected that a thesis at this level will represent a significant contribution to new knowledge; nor is it expected that theses will resolve great intellectual problems. The time frame available for the thesis is simply too short to permit students to tackle complex or difficult problems. Indeed, a key aim of the thesis is to specify a research or design topic that arouses sufficient intellectual curiosity, and presents an appropriate range and diversity of technical and conceptual challenges, while remaining manageable and allowing achievable outcomes within the time and resources available. It is important that the topic be of sufficient scope and complexity to allow a student to learn their craft and demonstrate their research or design skills. Equally imperative is that the task not be so demanding as to elude completion.

Normally taken in Semster 2

Acceptable alternative units of study

Most units of study offered by the Faculty of Science shown in the tables can be replaced by an equivalent advanced level unit, subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing advanced options should seek advice from their department before enrolling.Students undertaking Study

Abroad in a particular year of their degree must enrol in the appropriate AMME International Exchange Program units of study as an alternative to a semester's standard units.

Resolutions of the Faculty of Engineering and Information Technologies relating to this table:

BEHons(Mechatronic)(Space)

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete 24 credit points of recommended elective units of study for Mechatronic (Space) Engineering and 6 credit points of free elective units of study. A minimum of 192 credit points is required to be eligible for the award of BE(Mechatronic)(Space).

BEHons(Mechatronic)(Space)/BSc or BCom or BMedSci or BPM

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete at least 6 credit points of recommended elective units of study for Mechatronic (Space) Engineering and 96 credit points of units of study given by the Faculty of Science for the BE/BSc and BMedSci, or the Business School for the BE/BCom or from the core unit table for BPM. A minimum of 240 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies and the faculty in which they are undertaking the combined degree.

BEHons(Mechatronic)(Space)/BA

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete at least 12 credit points of recommended elective units of study for Mechatronic (Space) Engineering and 84 credit points of units of study given by the Faculty of Arts and Social Sciences for the BE/BA. A minimum of 240 credit points is required to be eligible for the combined degree. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies and the faculty in which they are undertaking the combined degree.

BEHons(Mechatronic)(Space)/LLB

In addition to gaining credit for the core units of study set out in the above table, candidates are required to complete at least 6 credit points of recommended elective units of study for Mechatronic (Space) Engineering and 144 credit points of units of study given by the Faculty of Law for the BE/LLB. A minimum of 288 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies and the Faculty of Law.

Recommended elective units of study

AMME4710
Computer Vision and Image Processing

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week. **Assumed knowledge:** Mandatory prerequisite MECH4720 Sensors and Signals or MECH4730 Computers in Real-Time Control and Instrumentation **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Current Lectures: Dr. Thierry Peynot, tpeynot@acfr.usyd.edu.au, Dr. Shrihari Vasudevan, s.vasudevan@acfr.usyd.edu.au

This unit of study introduces students to vision sensors, computer vision analysis and digital image processing. This course will cover the following areas: fundamental principles of vision sensors such as physics laws, radiometry, CMOS/CDD imager architectures, colour reconstruction; the design of physics-based models for vision such as reflectance models, photometric invariants, radiometric calibration. This course will also present algorithms for video/image analysis, transmission and scene interpretation. Topics such as image enhancement, restoration, stereo correspondence, pattern recognition, object segmentation and motion analysis will be covered.

AMME4790
Introduction to Biomechatronics

Credit points: 6 **Session:** Semester 2 **Classes:** Tutorial 1 hr/week; Lecture 2 hrs/week; Project Work - own time 4 hrs/week; Laboratory 2 hrs/week; Presentation 4 hrs/week. **Prerequisites:** MTRX3700 or MECH3921 **Assumed knowledge:** 1. A good practical knowledge and an interest in mechanical and electronic engineering; 2. Adequate maths and applied maths skills; 3. Background knowledge of physics, chemistry and biology; 4. Some programming capability, MATLAB, C, C++; 5. The ability to use, and experience of, common software tools used by engineers including CAD and EDA packages. **Assessment:** Through semester assessment (70%) Final Exam (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: AMME4790 is the last in a series of practical Mechatronic and Electrical courses taken over three years. It takes these engineering concepts, along with the associated mathematical, electronic and mechanical theory and applies this knowledge to a series of practical, albeit specialized biomechatronic applications that will be encountered by Mechatronic Engineers who enter this broad field on graduation.

Biomechatronics is the application of mechatronic engineering to human biology and as such it forms an important subset of the overall biomedical engineering discipline. This course focusses on a number of areas of interest including auditory and optical prostheses, artificial hearts and active and passive prosthetic limbs and examines the biomechatronic systems (hardware & signal processing) that underpin their operation

AMME5510
Vibration and Acoustics

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/week. **Assumed knowledge:** (AMME2301 OR AMME9301) AND AMME2200 AND (AMME2500 OR AMME9500) **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This UoS should prepare the student to be able to undertake vibration and acoustic measurement calculations for industry design situations.

The unit aims to introduce a number of new concepts required for analysis of vibrations and acoustics. The response of structure under different dynamic forces, including human and aerodynamic, will be investigated. A number of hands-on experiments will be performed to allow an understanding of the concepts and applicability.

The acoustics component will include: basic acoustics theory, sound generation and propagation, impedance, absorbing materials, industrial noise sources, isolation methods of noise control, enclosures, instrumentation and measurement, frequency analysis, noise regulations and computational acoustics.

AMME5520
Advanced Control and Optimisation

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Research 1 hr/week. **Prerequisites:** AMME3500 OR AMME5501 OR AMME9501 **Assumed knowledge:** Students have an interest and a strong understanding of feedback control systems, specifically in the area of system modelling and control design in the frequency domain. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces engineering design via optimization, i.e. finding the "best possible" solution to a particular problem. For example, an autonomous vehicle must find the fastest route between two locations over a road network; a biomedical sensing device must compute the most accurate estimate of important physiological parameters from noise-corrupted measurements; a feedback control system must stabilize and control a multivariable dynamical system (such as an aircraft) in an optimal fashion.

The student will learn how to formulate a design in terms of a "cost function", when it is possible to find the "best" design via minimization of this "cost", and how to do so. The course will introduce widely-used optimization frameworks including linear and quadratic programming (LP and QP), dynamic programming (DP), path planning with Dijkstra's algorithm, A*, and probabilistic roadmaps (PRMs), state estimation via Kalman filters, and control via the linear quadratic regulator (LQR) and Model Predictive Control (MPC). There will be constant emphasis on connections to real-world engineering problems in control, robotics, aerospace, biomedical engineering, and manufacturing.

MECH5416
Advanced Design and Analysis

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** ENGG1802 - Eng Mechanics, balance of forces and moments; AMME2301 - Mechanics of Solids, 2 and 3 dimensional stress and strain; AMME2500 - Engineering Dynamics - dynamic forces and moments; MECH2400 - Mechanical Design 1, approach to design problems and report writing, and preparation of engineering drawing; MECH3460 - Mechanical design 2, means of applying fatigue analysis to a wide range of machine components **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

1. This UoS utilises assumed theoretical knowledge and skills to elucidate the stresses and strains that exit in the different categories of machine parts. It sets out to make the students familiar with the simplifications that are applied to arrive at the analytic expressions commonly used to analyse each individual categories parts. These simplifications usually begin by assuming that only particular types of loads are carried by teh parts in that category. The resulting analyses provide approximations to the actual stresses. It is possible to have different degrees of simplifications, requiring more or less work, giving better or poorer approximations. Should a part be used to carry loads that were not allowed for in the traditional method then some more appropriate method must be found or developed. An important aspect is to make the student practiced in a range of modern concepts, techniques and tools, and to be made aware of their strengths and limitations.

2. This UoS teaches the student how to recognise where and how their theoretical skills can be applied to the practical situations that they may encounter in this field of design.

3. Options may be provided in the choice of design assignments. Biomedical engineering and vehicle design problems may be provided as options to more general machine design problems.

MECH5720
Sensors and Signals

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Project Work - own time 2 hrs/week; Presentation 2 hrs; Laboratory 2 hrs; Tutorial 2 hrs/week. **Prohibitions:** MECH4720 **Assumed knowledge:** Strong MATLAB skills **Assessment:** Through semester assessment (75%) Final Exam (25%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Syllabus Summary: This course starts by providing a background to the signals and transforms required to understand modern sensors. It goes on to provide an overview of the workings of typical active sensors (Radar, Lidar and Sonar). It provides insight into basic sensing methods as well as aspects of interfacing and signal processing. It includes both background material and a number of case studies.

The course covers the following topics:

a) SIGNALS: Convolution, The Fourier Transform, Modulation (FM, AM, FSK, PSK etc), Frequency shifting (mixing)

b) PASSIVE SENSORS: Infrared Radiometers, Imaging Infrared, Passive Microwave Imaging, Visible Imaging & Image Intensifiers

c) ACTIVE SENSORS THE BASICS: Operational Principles, Time of flight (TOF) Measurement & Imaging of Radar, Lidar and Sonar, Radio Tags and Transponders, Range Tacking, Doppler Measurement, Phase Measurement

d) SENSORS AND THE ENVIRONMENT: Atmospheric Effects, Target Characteristics, Clutter Characteristics, Multipath

e) ACTIVE SENSORS: ADVANCED TECHNIQUES: Probability of Detection, Angle Measurement and Tracking, Combined Range/Doppler and Angle Tracking, Frequency Modulation and the Fast Fourier Transform, High Range Resolution, Wide Aperture Methods, Synthetic Aperture Methods (SAR)

Objectives: The course aims to provide students with a good practical knowledge of a broad range of sensor technologies, operational principles and relevant signal processing techniques.

Expected Outcomes: A good understanding of active sensors, their outputs and applicable signal processing techniques. An appreciation of the basic sensors that are available to engineers and when they should be used.

MTRX5700
Experimental Robotics

Credit points: 6 **Session:** Semester 1 **Classes:** Laboratory 3 hrs/week; Lecture 2 hrs/week. **Prerequisites:** (AMME3500 OR AMME9501) AND MTRX3700 **Assumed knowledge:** Knowledge of statics and dynamics, rotation matrices, programming and some electronic and mechanical design experience is assumed. **Assessment:** Through semester assessment (70%) Final Exam (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to present a broad overview of the technologies associated with industrial and mobile robots. Major topics covered are sensing, mapping, navigation and control of mobile robots and kinematics and control of industrial robots. The subject consists of a series of lectures on robot fundamentals and case studies on practical robot systems. Material covered in lectures is illustrated through experimental laboratory assignments. The objective of the course is to provide students with the essential skills necessary to be able to develop robotic systems for practical applications.

At the end of this unit students will: be familiar with sensor technologies relevant to robotic systems; understand conventions used in robot kinematics and dynamics; understand the dynamics of mobile robotic systems and how they are modeled; have implemented navigation, sensing and control algorithms on a practical robotic system; apply a systematic approach to the design process for robotic systems; understand the practical application of robotic systems in manufacturing, automobile systems and assembly systems; develop the capacity to think critically and independently about new design problems; undertake independent research and analysis and to think creatively about engineering problems.

Course content will include: history and philosophy of robotics; hardware components and subsystems; robot kinematics and dynamics; sensors, measurements and perception; robotic architectures, multiple robot systems; localization, navigation and obstacle avoidance, robot planning; robot learning; robot vision and vision processing.

These units are also available to other Space stream students.

Additional Electives

Students can select from the units below or other elective units offered within the University that are approved by the Head of the School of Aerospace, Mechanical and Mechatronic Engineering.

ENGG1000
History and Philosophy of Engineering

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Tutorial 1 hr/week; Independent research/study 5 hrs/week; E-Learning 2 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

ENGG1000 is a unique course that aims to provide students with an understanding of the historical development of Engineering with relation to societal expectations of the period. Engineering as a field of study and profession has developed over millennia from simple (yet significant) advances in technology such as the lever and wheel, to modern day examples such as advanced computers, nanomaterials and space flight.

Interaction between human society and Engineers has helped develop and guide the advancement of engineering technology; with society posing problems for Engineers to solve and Engineers developing new technology that changed the course of human history, and helped shape the world we live in.

The general philosophy behind Engineering is that Engineers work to fulfil the needs of society (water, electricity, technological improvements etc.), and as such Engineers are expected to act ethically towards society. The role of Engineers in society will be analysed and discussed from a humanistic perspective, with relation to the current Engineers Australia code of ethics. Other relevant philosophical analyses of Engineering as a skill and profession will also be examined such as, aesthetics, creativity, the epistemology of Engineering and more.

This course will use online resources extensively and help develop research and communication skills of students, whilst providing an overview of the historical significance of Engineers in society, and what it means to be an Engineer.

AMME2000
Engineering Analysis

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** (MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) and ENGG1801. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **Assessment:** Through semester assessment (35%) Final Exam (65%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This course is designed to provide students with the necessary tools for mathematically modelling and solving problems in engineering. Solution methods will be considered for a range of standard engineering problems including; Conduction heat transfer in one and two dimensions, hydrostatics and hydrodynamic balance for internal and external flows, spring/mass systems, vibration and stability problems. The focus will be on real problems and numerical solution methods and will include separation of variables; Fourier series and Fourier transforms; Laplace transforms; scaling and finite differences.

Note

Choice of electives as shown in the above table will depend on subject availability, timetabling and prerequisite conditions.
For a standard enrolment plan for Mechatronic (Space) Engineering visit http://cusp.sydney.edu.au/students/view-degree-page/name/BE(Mtrx)(Space)

Biomedical Engineering Program

The Biomedical Program is administered by the School of Aerospace, Mechanical and Mechatronic Engineering.

Biomedical Engineering combines knowledge of electronic, mechanical, chemical and materials-engineering, with the life sciences of medicine, biology and molecular biology. Biomedical devices support and enhance human life, help individuals to overcome physical disabilities, aid in delivering medical procedures, and test and deliver data which improve health and safety.

Biomedical engineers work with doctors and medical scientists, researching and designing ways to improve health care and medical services. They may be involved in the development of medical products and different types of equipment used to monitor and treat patients, and in designing and improving equipment for disabled people.

The Faculty of Engineering and Information Technologies offers a faculty-wide program in Biomedical Engineering. Approximately 12 months of your studies will be dedicated to a chosen major in the following: mechanical engineering, mechatronic engineering, electrical engineering, information technology or chemical engineering.

The Bachelor of Engineering Honours (Biomedical) can be taken with the following majors:

- Chemical and Biomolecular Engineering
- Electrical Engineering
- Information Technology
- Mechanical Engineering
- Mechatronic Engineering

Please note that candidates for combined Engineering degrees are not required to complete a major.

Bachelor of Engineering Honours (Biomedical)

Course Overview

The Bachelor of Engineering Honours (Biomedical) is concerned with the study of biomedical technology, biomechanics, biomaterials and orthopaedic engineering.

Biomedical engineering combines knowledge of electronic, mechanical, chemical and materials-engineering, with the life sciences of medicine, biology and molecular biology. Biomedical devices support and enhance human life, help individuals to overcome physical disabilities, aid in delivering medical procedures, and test and deliver data which improve health and safety.

Biomedical engineers work with doctors and medical scientists, researching and designing ways to improve health care and medical services. They may be involved in the development of medical products and different types of equipment used to monitor and treat patients, and in designing and improving equipment for disabled people.

The Faculty of Engineering and Information Technologies offers a faculty wide program in Biomedical Engineering. Approximately 12 months of your studies will be dedicated to a chosen major in the following: mechanical engineering, mechatronic engineering, electrical engineering, information technology or chemical engineering.

The following streams are available for the Bachelor of Engineering Honours (Biomedical):

- Chemical and Biomolecular Engineering
- Electrical Engineering
- Information Technology
- Mechanical Engineering
- Mechatronic Engineering

The Biomedical program can also be taken as a combined degree with either Arts, Commerce, Law, Medical Science or Science.

Candidates for combined Engineering degrees are not required to complete a major.

Course Requirements

Candidates for the degree of Bachelor of Biomedical Engineering are required to gain credit for the 144 credits of core units of study set out below. Additional credit necessary shall be gained by completing the credit points for the requirements of a specialist major and elective units of study as recommended by the Faculty, as may be necessary to gain credit for a total of not less than 192 credit points.

For a standard enrolment plan for Biomedical Engineering visit http://cusp.sydney.edu.au/students/view-degree-page/name/BE(Biomed)

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Bachelor of Engineering Honours (Biomedical)			
Candidates for the degree of Bachelor of Engineering Honours (Biomedical) are required to gain credit for the 144 credits of core units of study set out below. Additional credit necessary shall be gained by completing the credit points for the requirements of a specialist major and elective units of study as recommended by the Faculty, as may be necessary to gain credit for a total of not less than 192 credit points.			
The Biomedical Engineering program can be taken with the following majors: (a) Mechanical Engineering (b) Electrical Engineering (c) Chemical and Biomolecular Engineering (d) Information Technology (e) Mechatronic Engineering			
Note Candidates for combined Engineering Honours degrees are not required to complete a major.			
Core units of study			
First year			
MATH1001 **Differential Calculus**	3	**A** HSC Mathematics Extension 1 **N** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001	Semester 1 Summer Main
MATH1002 **Linear Algebra**	3	**A** HSC Mathematics or MATH1111 **N** MATH1902, MATH1012, MATH1014	Semester 1 Summer Main
ENGG1801 **Engineering Computing**	6		Semester 1 Summer Late
ENGG1960 **Introduction to Biomedical Engineering**	6	**A** HSC extension 1 Math	Semester 1
CHEM1101 **Chemistry 1A**	6	**A** HSC Chemistry and Mathematics **N** CHEM1905, CHEM1906, CHEM1903, CHEM1001, CHEM1909, CHEM1109, CHEM1901	Semester 1 Semester 2 Summer Main
MATH1003 **Integral Calculus and Modelling**	3	**A** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **N** MATH1013, MATH1903, MATH1907	Semester 2 Summer Main
MATH1005 **Statistics**	3	**A** HSC Mathematics **N** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021	Semester 2 Summer Main Winter Main
CHEM1102 **Chemistry 1B**	6	**P** CHEM1101 or CHEM1901 or a Distinction in CHEM1001 or equivalent **N** CHEM1904, CHEM1907, CHEM1902, CHEM1108, CHEM1908, CHEM1002	Semester 1 Semester 2 Summer Main
MBLG1001 **Molecular Biology and Genetics (Intro)**	6	**A** 6 credit points of Junior Biology and 6 credit points of Junior Chemistry. **N** MBLG1901; MBLG1991	Semester 2
Second year			
MATH2067 **DEs and Vector Calculus for Engineers**	6	**P** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **N** MATH2901, MATH2961, MATH2005, MATH2965, MATH2001, MATH2905, MATH2061, MATH2065	Semester 1
ELEC1103 **Fundamentals of Elec and Electronic Eng**	6	**A** Basic knowledge of differentiation & integration, and HSC Physics	Semester 1
ELEC2104 **Electronic Devices and Circuits**	6	**A** Knowledge: ELEC1103. Ohm's Law and Kirchoff's Laws; action of Current and Voltage sources; network analysis and the superposition theorem; Thevenin and Norton equivalent circuits; inductors and capacitors, transient response of RL, RC and RLC circuits; the ability to use power supplies, oscilloscopes, function generators, meters, etc.	Semester 2
AMME1362 **Materials 1**	6	**N** AMME2302, CIVL2110	Semester 2
MECH2901 **Anatomy and Physiology for Engineers**	6	**P** (ENGG1960 OR BIOL1003 OR BIOL1903) AND [6cp junior Chemistry] *Note: Department permission required for enrolment*	Semester 2
Select 6 cp from the following block of core units:			
AMME2261 **Fluid Mechanics 1**	6	**A** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **N** AMME2200	Semester 1

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
CHNG2803 **Energy and Fluid Systems Practice**	6	**A** Ability to conduct mass and energy balances, and the integration of these concepts to solve real chemical engineering problems Ability to understand basic principles of physical chemistry, physics and mechanics. Ability to use mathematics of calculus (including vector calculus) and linear algebra, and carry out computations with MATLAB and MS EXCEL. Ability to read widely outside of the technical literature, and to synthesise arguments based on such literature. Ability to write coherent reports and essays based on qualitative and quantitative information. **P** (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 OR MATH1015 OR MATH1905) AND ENGG1801 AND CHNG1103 AND (CHEM1101 OR CHEM1901) AND (CHEM1102 OR CHEM1902) **C** CHNG2801 AND CHNG2802	Semester 1
ELEC2302 **Signals and Systems**	6	**A** MATH1001 Differential Calculus and MATH1002 Linear Algebra and MATH1003 Integral Calculus and Modelling. Basic knowledge of differentiation & integration, differential equations, and linear algebra.	Semester 2
MECH2400 **Mechanical Design 1**	6	**A** ENGG1801 and ENGG1802, HSC Maths and Physics	Semester 2
Third year			
MECH3921 **Biomedical Design and Technology**	6	**A** A basic understanding of human physiology and anatomy and an understanding of the engineering design process. **P** (AMME2302 OR AMME1362) AND MECH2901 AND (MECH2400 OR ENGG1960).	Semester 2
MECH3660 **Manufacturing Engineering**	6	**P** MECH2400 or ENGG1960	Semester 1
Select 6 cp from the following block of core units:			
ELEC3802 **Fundamentals of Biomedical Engineering**	6	**A** ELEC2004 or ELEC2104 A knowledge of basic electrical engineering is required: Ohm's law, Thevenin and Nortons' theorems, basic circuit theory involving linear resistors, capacitors and inductors, a basic knowledge of bipolar and field effect transistor theory, simplified theoretical mechanism of operation of transformers.	Semester 1
AMME4790 **Introduction to Biomechatronics**	6	**A** 1. A good practical knowledge and an interest in mechanical and electronic engineering; 2. Adequate maths and applied maths skills; 3. Background knowledge of physics, chemistry and biology; 4. Some programming capability, MATLAB, C, C++; 5. The ability to use, and experience of, common software tools used by engineers including CAD and EDA packages. **P** MTRX3700 or MECH3921 *AMME4790 is the last in a series of practical Mechatronic and Electrical courses taken over three years. It takes these engineering concepts, along with the associated mathematical, electronic and mechanical theory and applies this knowledge to a series of practical, albeit specialized biomechatronic applications that will be encountered by Mechatronic Engineers who enter this broad field on graduation.*	Semester 2
Fourth year			
MECH4961 **Biomechanics and Biomaterials**	6	**P** (AMME2302 or AMME1362); MECH2901; MECH3921; (BIOL1003 or MBLG1001)	Semester 2
AMME4971 **Tissue Engineering**	6	**A** 6 credit points of Junior Biology, 6 credit points of Junior Chemistry and 6 credit points of Intermediate Physiology, or equivalent. *The primary teaching delivery method will be lectures. This UoS builds on the assumed knowledge of junior and intermediate biology and thus students will already have practical hands-on biological training. The purpose of this UoS is to elaborate the theory and latest developments of this very new field of tissue engineering, thereby building on the existing practical and theoretical knowledge base the students have in cell biology.*	Semester 1
ENGG4000 **Practical Experience**		**P** 36 Credit Points of Senior Units *Students should have completed three years of their BE program before enrolling in this unit.*	Semester 1 Semester 2
Select 6cp from the following block of units:			
AMME4981 **Applied Biomedical Engineering**	6	**A** MECH2901 and AMME2301 and AMME2500 and MECH3362 and MECH3921. Anatomy and Physiology, engineering dynamics and mechanics of solids in the second year level and knowledge of materials engineering and mechanical design in the third year level	Semester 1
COMP5424 **Information Technology in Biomedicine**	6		Semester 1
COMP5456 **Introduction to Bioinformatics** *This unit of study is not available in 2015*	6	**A** Some experience with basic programming (coding) in Java, C, C++ or Perl; Some proven ability in mathematical or information sciences (as evinced in the prerequisites); Some knowledge of molecular biology either through first year BIOL papers or MBLG1001. **N** COMP3456	Summer Main
Select 18cp from the following list of Biomedical electives:			
AMME2262 **Thermal Engineering 1**	6	**A** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **N** AMME2200	Semester 2
MECH4720 **Sensors and Signals** *This unit of study is not available in 2015*	6	**A** Strong Matlab skills **P** MTRX3700	Semester 1
MTRX4700 **Experimental Robotics** *This unit of study is not available in 2015*	6	**P** AMME3500; MTRX3700	Semester 1
AMME5951 **Fundamentals of Neuromodulation**	6	**A** Basic electronics at the junior or intermediate level, junior biology and chemistry, intermediate materials science, anatomy and physiology, senior engineering design practice, and biomedical engineering: BIOL1003 or 6 credit points of junior biology; CHEM1101 or 6 credit points of junior chemistry; AMME2302 or 6 credit points of materials science; ELEC2004 or 6 credit points of general electronics; MECH2901 or 6 credit points of intermediate physiology or equivalent.	Semester 1
CHNG5601 **Membrane Science**	6		Semester 1

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
CHNG5602 **Cellular Biophysics**	6	*Note: Department permission required for enrolment*	Semester 1
CHNG5603 **Analysis, Modelling, Control: BioPhy Sys**	6	**A** It is assumed that students have a general knowledge of: MATH 1001 Differential Calculus MATH 1003 Integral Calculus and Modeling *This course is for Master degree students and also is offered as an elective course for fourth year students. Some lectures my be given by a guest lecturer. this*	Semester 1
ELEC3404 **Electronic Circuit Design**	6	**A** A background in basic electronics and circuit theory is assumed.	Semester 1
ELEC3305 **Digital Signal Processing**	6	**A** Specifically the following concepts are assumed knowledge for this unit: familiarity with basic Algebra, Differential and Integral Calculus, continuous linear time-invariant systems and their time and frequency domain representations, Fourier transform, sampling of continuous time signals. **P** ELEC2302	Semester 1
ELEC5614 **Real Time Computing**	6	**A** SOFT2130 Software Construction (or SOFT2004 Software Development Methods 1) and ELEC3607 Embedded Computing (or ELEC2601 Microprocessor Systems) **N** MECH5701	Semester 1
MECH4902 **Orthopaedic and Surgical Engineering**	6	**A** MECH3362. 1.Basic concepts in engineering mechanics - statics, dynamics, and solid mechanics. 2.Basic concepts in materials science, specifically with regard to types of materials and the relation between properties and microstructure. 3.A basic understanding of human biology and anatomy. **P** AMME2301 AND (AMME2302 OR AMME1362) AND (BIOL1003 OR MBLG1001) AND (ENGG1802 OR ENGG1960) AND MECH2901 AND MECH3921. Any 6cp of junior biology is an acceptable substitute for BIOL1003 or MBLG1001	Semester 2
AMME4990 **Biomedical Product Development**	6	**A** Junior level chemistry, intermediate level biology, and specific knowledge of cell biology at least at the junior level, and preferably at the intermediate level. **P** BIOL1003 OR 6 credit points of junior biology CHEM1101 OR 6 credit points of junior chemistry MECH2901 OR 6 credit points of junior intermediate physiology or equivalent, MECH3921.	Semester 1
AMME4992 **Regulatory Affairs in Medical Industry**	6	**A** BIOL1003 or 6 credit points of junior biology, CHEM1101 or 6 credit points of junior chemistry. **P** MECH2901 AND MECH3921 *Biomedical Engineering Elective Unit of Study.*	Semester 2
AMME4710 **Computer Vision and Image Processing**	6	**A** Mandatory prerequisite MECH4720 Sensors and Signals or MECH4730 Computers in Real-Time Control and Instrumentation *Current Lectures: Dr. Thierry Peynot, tpeynot@acfr.usyd.edu.au, Dr. Shrihari Vasudevan, s.vasudevan@acfr.usyd.edu.au*	Semester 2
CHNG5605 **Bio-Products: Laboratory to Marketplace**	6	*This course is for Master degree students and also is offered as an elective course for fourth year students. .*	Semester 2
CHNG5604 **Membrane Engineering Laboratory**	6	**A** CHNG5601	Semester 2
COMP5048 **Visual Analytics**	6	**A** It is assumed that students will have basic knowledge of data structures, algorithms and programming skills.	Semester 2
ELEC5701 **Technology Venture Creation**	6	**N** ENGG5102	Semester 2
ELEC3803 **Bioelectronics**	6	**P** ELEC2104 OR ELEC2602. *Familiarity with transistor operations, basic electrical circuits, embedded programming is required.*	Semester 2
ELEC5514 **Networked Embedded Systems**	6	**A** ELEC3305, ELEC3506, ELEC3607 and ELEC5508	Semester 2
Students must enrol in 12 credit points from the following block of Thesis units.			
Select 6 cp from:			
AMME4111 **Honours Thesis A**	6	**P** 36 credits of 3rd year units of study. **N** AMME4010, AMME4121, AMME4122 *Note: Department permission required for enrolment* *Honours Thesis A is only available to students with an HWAM of 65 or over. HWAM is a weighted average based on all 2000, 3000 and 4000 level units completed prior to enrolment in this unit. Prospective students in Honours Thesis A are expected to have consulted with supervisors and selected a topic of interest at the end of third year, guided by the advertised list of suggested thesis topics and supervisors. Availability of topics is limited and students should undertake to speak with prospective supervisors as soon as possible. Students who are unable to secure a supervisor and topic will be allocated a supervisor by the unit coordinator. Alternatively, students may do a thesis with a supervisor in industry or in another university department. In this case, the student must also find a second supervisor within the School of AMME.*	Semester 1 Semester 2
CHNG4811 **Honours Thesis A**	6	**A** Enrolment in this unit of study assumes that all (six) core chemical engineering UoS in third year have been successfully completed. **P** CHNG3801, CHNG3802, CHNG3803, CHNG3805, CHNG3806, CHNG3807. **N** CHNG4814, CHNG4813 *Note: Department permission required for enrolment* *This unit is available to only those students who have gained an entry to the Honours degree. School permission required for enrolment in semester 2.*	Semester 1 Semester 2
ELEC4712 **Honours Thesis A**	6	**P** 36 credits of 3rd year units of study *Note: Department permission required for enrolment* *Note that students require permission from the HOS to do both A and B units in the same Semester, and will have an accelerated assessment schedule. Note also that entry to Honours Thesis is by permission.*	Semester 1 Semester 2
These units are normally taken in Semester 1.			

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Select 6 cp from:			
AMME4112 **Honours Thesis B**	6	**P** 36 credits of 3rd year units of study and WAM 65 or over **N** AMME4010, AMME4122, AMME4121 *Note: Department permission required for enrolment* *HWAM of 65 or greater required for enrolment. HWAM is the weighted average of all 2000, 3000 and 4000 level units completed prior to enrolment in this unit.*	Semester 1 Semester 2
CHNG4812 **Honours Thesis B**	6	**A** Enrolment in this unit of study assumes that Honours Thesis A and all (six) core chemical engineering units of study in third year have been successfully completed. **C** CHNG4811 **N** CHNG4814, CHNG4813 *Note: Department permission required for enrolment* *This unit is available to only those students who have gained an entry to the Honours degree. School permission required for enrolment in the semester 1.*	Semester 1 Semester 2
ELEC4713 **Honours Thesis B**	6	*Note: Department permission required for enrolment* *Note that students require permission from the HOS to do both A and B units in the same Semester, and will have an accelerated assessment schedule. Note also that entry to Honours Thesis is by permission.*	Semester 1 Semester 2
These units are normally taken in semester 2			
Acceptable alternative units of study			
Most units of study offered by the Faculty of Science shown in the tables can be replaced by an equivalent advanced level unit, subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing advanced options should seek advice from their department before enrolling.			
Students undertaking Study Abroad in a particular year of their degree must enrol in the appropriate International Exchange Program units of study as an alternative to a semester's standard units.			
Requirements for a major			
Completion of the Bachelor of Engineering(Biomedical) as a stand alone degree requires that a major sequence of units be completed in order to meet total degree requirements. The available majors are: (1) Mechanical Engineering (2) Electrical Engineering (3) Chemical and Biomolecular Engineering (4) Information Technology (5) Mechatronic Engineering The sequence of units required to complete a major in one of these areas is shown in the following tables.			
Mechanical Engineering Major			
ENGG1802 **Engineering Mechanics**	6		Semester 2 Summer Main
AMME2500 **Engineering Dynamics**	6	**P** ENGG1802 and (MATH1001 or MATH1901) and (MATH1002 or MATH1902)	Semester 1
AMME2301 **Mechanics of Solids**	6	**P** ENGG1802, MATH1001, MATH1002, MATH1003	Semester 2
MECH3261 **Fluid Mechanics 2**	6	**P** AMME2200 OR AMME2261.	Semester 1
AMME3500 **System Dynamics and Control**	6	**P** ((MATH2061 or MATH2961) and (MATH2065 or MATH2965)) or MATH2067	Semester 1
MECH2400 **Mechanical Design 1**	6	**A** ENGG1801 and ENGG1802, HSC Maths and Physics	Semester 2
MECH3361 **Mechanics of Solids 2**	6	**P** AMME2301 and AMME2302	Semester 2
MECH3362 **Materials 2**	6	**A** This subject requires you to have two important skills to bring in: (1) A good understanding of basic knowledge and principles of material science and engineering from AMME2302 (MECH2300) Materials I and mechanics of solids for simple structural elements (in tension, bending, torsion) from AMME2301 (AERO2300); (2) Reasonable mathematical skills in calculation of stresses and strains in simple structural elements. **P** AMME2301 and AMME2302	Semester 1
Electrical Engineering Major			
ELEC1601 **Foundations of Computer Systems**	6	**A** HSC Mathematics extension 1 or 2	Semester 2
PHYS1001 **Physics 1 (Regular)**	6	**A** HSC Physics **P** HSC Physics with a minimum mark of 65 **N** PHYS1002, EDUH1017, PHYS1901	Semester 1
PHYS1003 **Physics 1 (Technological)**	6	**A** HSC Physics or PHYS1001 or PHYS1002 or PHYS1901 or equivalent. **N** PHYS1902, PHYS1004 *It is recommended that PHYS1001 or PHYS1002 or PHYS1901 be completed before this unit*	Semester 2
ELEC2602 **Digital Logic**	6	**A** ELEC1601. This unit of study assumes some knowledge of digital data representation and basic computer organisation	Semester 1
ELEC3803 **Bioelectronics**	6	**P** ELEC2104 OR ELEC2602. *Familiarity with transistor operations, basic electrical circuits, embedded programming is required.*	Semester 2
Select 18 cp from the following block of units,			

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
ELEC3304 **Control**	6	**A** Specifically the following concepts are assumed knowledge for this unit: familiarity with basic Algebra, Differential and Integral Calculus, Physics; solution of linear differential equations, Matrix Theory, eigenvalues and eigenvectors; linear electrical circuits, ideal op-amps; continuous linear time-invariant systems and their time and frequency domain representations, Laplace transform, Fourier transform. **P** MATH2061 and ELEC2302 **N** AMME3500	Semester 2
ELEC3305 **Digital Signal Processing**	6	**A** Specifically the following concepts are assumed knowledge for this unit: familiarity with basic Algebra, Differential and Integral Calculus, continuous linear time-invariant systems and their time and frequency domain representations, Fourier transform, sampling of continuous time signals. **P** ELEC2302	Semester 1
ELEC3404 **Electronic Circuit Design**	6	**A** A background in basic electronics and circuit theory is assumed.	Semester 1
ELEC3607 **Embedded Systems**	6	**A** ELEC1601 AND ELEC2602. Logic operations, theorems and Boolean algebra, data representation, number operations (binary, hex, integers and floating point), combinational logic analysis and synthesis, sequential logic, registers, counters, bus systems, state machines, simple CAD tools for logic design, basic computer organisation, the CPU, peripheral devices, software organisation, machine language, assembly language, operating systems, data communications and computer networks. **P** ELEC1601 and ELEC2602	Semester 1
Chemical and Biomolecular Major			
CHNG1103 **Material & Energy Transformations Intro**	6		Semester 2
CHNG2801 **Conservation and Transport Processes**	6	**A** Calculus, Computations (Matlab, Excel), Mass and Energy Balances. **P** (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 OR MATH1015 OR MATH1905) AND ENGG1801 AND CHNG1103 AND (CHEM1101 OR CHEM1901) AND (CHEM1102 OR CHEM1902) **C** CHNG2802 AND CHNG2803.	Semester 1
CHNG2804 **Chemical & Biological Systems Behaviour**	6	**A** Ability to conduct mass and energy balances, and the integration of these concepts to solve real chemical engineering problems. Ability to understand basic principles of physical chemistry, physics and mechanics. Ability to use mathematics of calculus (including vector calculus) and linear algebra, and to carry out computations with Matlab and MS-Excel. **P** (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 OR MATH1015 OR MATH1905) AND ENGG1801 AND CHNG1103 AND (CHEM1101 OR CHEM1901) AND (CHEM1102 OR CHEM1902) **C** CHNG2805 AND CHNG2806.	Semester 2
CHNG2805 **Industrial Systems and Sustainability**	6	**A** Ability to conduct mass and energy balances, and the integration of these concepts to solve real chemical engineering problems. Ability to understand basic principles of physical chemistry, physics and mechanics. Ability to use mathematics of calculus (including vector calculus) and linear algebra, and carry out computations with MATLAB and MS EXCEL. **P** (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 OR MATH1015 OR MATH1905) AND ENGG1801 AND CHNG1103 AND (CHEM1101 OR CHEM1901) AND (CHEM1102 OR CHEM1902) **C** CHNG2804 AND CHNG2806.	Semester 2
CHNG2806 **Materials Purification and Recovery**	6	**A** Ability to conduct mass and energy balances, and the integration of these concepts to solve real chemical engineering problems. Ability to understand basic principles of physical chemistry, physics and mechanics. Ability to use mathematics of calculus (including vector calculus) and linear algebra, and carry out computations with MATLAB and MS EXCEL. Ability to read widely outside of the technical literature, and to synthesise arguments based on such literature. Ability to write coherent reports and essays based on qualitative and quantitative information **P** (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 OR MATH1015 OR MATH1905) AND ENGG1801 AND CHNG1103 AND (CHEM1101 OR CHEM1901) AND (CHEM1102 OR CHEM1902) **C** CHNG2804 AND CHNG2805.	Semester 2
CHNG3801 **Process Design**	6	**A** Enrolment in this unit of study assumes that all (six) core chemical engineering UoS in second year have been successfully completed. **P** CHNG2801; CHNG2802; CHNG2803; CHNG2804; CHNG2805; CHNG2806 **C** CHNG3803, CHNG3802	Semester 1
CHNG3802 **Control and Reaction Engineering**	6	**A** Enrolment in this unit of study assumes that all (six) core chemical engineering UoS in second year have been successfully completed. **P** CHNG2801; CHNG2802; CHNG2803; CHNG2804; CHNG2805; CHNG2806 **C** CHNG3801; CHNG3803	Semester 1
CHNG3804 **Biochemical Engineering**	6	**A** Enrolment in this unit of study assumes that all (six) core chemical engineering units of study in second year have been successfully completed. **P** CHEM1101 and CHEM1102 and CHNG1103 and CHNG2801 and CHNG2802 and CHNG2803 and CHNG2804 and CHNG2805 and CHNG2806 and MATH1001 and MATH1002 and MATH1003 and MATH1005	Semester 2
Information Technology Major			
INFO1105 **Data Structures**	6	**P** INFO1003 or INFO1103 or INFO1903 or INFS1000	Semester 2
INFO2120 **Database Systems 1**	6	**P** INFO1003 OR INFO1103 OR INFO1903 OR INFS1000 OR DECO1012. **N** INFO2820, INFO2905, COMP5138	Semester 1
COMP2129 **Operating Systems and Machine Principles**	6	**A** INFO1105 OR INFO1905. **P** INFO1103.	Semester 1
COMP2007 **Algorithms and Complexity**	6	**A** MATH1004 **P** INFO1105 OR INFO1905.	Semester 2
INFO2110 **Systems Analysis and Modelling**	6	**A** Experience with a data model as in INFO1003 or INFO1103 or INFS1000	Semester 2
Select 18 cp from the following block of units			

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
COMP3308 **Introduction to Artificial Intelligence**	6	**A** COMP2007. Programing skills (e.g. Java, Python, C, C++, Matlab) **N** COMP3608	Semester 1
COMP3419 **Graphics and Multimedia**	6	**P** (COMP2007 or COMP 2907), and 6 credit points of Junior Math	Semester 1
INFO3220 **Object Oriented Design**	6	**P** INFO2110 and COMP2129	Semester 1
COMP3456 **Computational Methods for Life Sciences** *This unit of study is not available in 2015*	6	**P** (INFO1105 or INFO1905) and (COMP2007 or INFO2120) and 6 credit points from BIOL or MBLG	Semester 2
INFO3315 **Human-Computer Interaction**	6	**A** Background in programming and operating systems that is sufficient for the student to independently learn new programming tools from standard online technical materials. Ability to conduct a literature search. Ability to write reports of work done.	Semester 2
INFO3404 **Database Systems 2**	6	**A** This unit of study assumes that students have previous knowledge of database concepts including (1) ER modelling, (2) the relational data model and (3) SQL. The prerequisite material is covered in INFO 2120/2820. Familiarity with a programming language (e.g. Java or C) is also expected. **N** INFO3504	Semester 2
COMP3615 **Software Development Project**	6	**P** INFO3402 AND COMP2129 AND (COMP2007 OR COMP2907 OR COMP2121) **N** INFO3600	Semester 2
Mechatronic Engineering Major			
MTRX1702 **Mechatronics 1**	6	**A** MTRX1701 **N** COSC1002, COSC1902, ELEC1101, ELEC2602	Semester 2
ENGG1802 **Engineering Mechanics**	6		Semester 2 Summer Main
AMME2500 **Engineering Dynamics**	6	**P** ENGG1802 and (MATH1001 or MATH1901) and (MATH1002 or MATH1902)	Semester 1
MTRX2700 **Mechatronics 2**	6	**A** MTRX1701. Students are assumed to know how to program using the 'C' programming language. Additionally, students should understand the basic concepts behind simple digital logic circuits. **P** MTRX1702 **N** ELEC2601, ELEC3607	Semester 1
AMME2301 **Mechanics of Solids**	6	**P** ENGG1802, MATH1001, MATH1002, MATH1003	Semester 2
AMME3500 **System Dynamics and Control**	6	**P** ((MATH2061 or MATH2961) and (MATH2065 or MATH2965)) or MATH2067	Semester 1
ELEC3404 **Electronic Circuit Design**	6	**A** A background in basic electronics and circuit theory is assumed.	Semester 1
MTRX3700 **Mechatronics 3**	6	**A** Completion of a first course in microprocessor systems, including assembly and C language programming, interfacing, introductory digital and analogue electronics. **P** MTRX2700 **N** MECH4710	Semester 2

Resolutions of the Faculty of Engineering and Information Technologies relating to this table:

BE (Biomedical) Engineering

A minimum of 192 credit points is required to be eligible for the award of the degree of BE(Biomedical). 144 cp are selected from the core and recommended unit tables and 48 cp are selected from a table of major units.

BE(Biomedical)/BSc or BCom or BMedSci or BPM or BA or LLB

In addition to gaining credit for the units of study set out in the above tables, candidates are required to complete sufficient Biomedical Engineering electives so as to bring their total of eligible engineering credit points to at least 144. Further to this they are required to complete at least 96 credit points of units of study given by the Faculty of Science for the BE/BSc and BMedSci, or the School of Business for the BE/BCom or from the core units table for BPM. In the case of the BE/BA, they are required to complete at least 84 credit points of units of study given by the Faculty of Arts and Social Sciences, and the remaining 12 credit points will be Biomedical Engineering electives from the table above.

A minimum of 240 credit points is required to be eligible for the combined degrees BE/BSc, BMedSci, BE/BCom and BE/BA.

In the case of the BE/LLB, they are required to complete 96 credit points of compulsory Law units of study and a further 48 credit points of elective Law units of study.

A minimum of 288 credit points is required to be eligible for the combined degree BE/LLB.

Candidates should refer to the joint resolutions of the faculty in which they are undertaking the second degree.

For a standard enrolment plan for Biomedical Engineering visit http://cusp.sydney.edu.au/students/view-degree-page/name/BE(Biomed)

Unit of Study Descriptions

Bachelor of Engineering Honours (Biomedical)

Candidates for the degree of Bachelor of Engineering Honours (Biomedical) are required to gain credit for the 144 credits of core units of study set out below. Additional credit necessary shall be gained by completing the credit points for the requirements of a specialist major and elective units of study as recommended by the Faculty, as may be necessary to gain credit for a total of not less than 192 credit points.The Biomedical Engineering program can be taken with the following majors:(a) Mechanical Engineering(b) Electrical Engineering(c) Chemical and Biomolecular Engineering(d) Information Technology(e) Mechatronic Engineering

Note

Candidates for combined Engineering Honours degrees are not required to complete a major.

Core units of study

First year

MATH1001
Differential Calculus

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001 **Assumed knowledge:** HSC Mathematics Extension 1 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1001 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study looks at complex numbers, functions of a single variable, limits and continuity, vector functions and functions of two variables. Differential calculus is extended to functions of two variables. Taylor's theorem as a higher order mean value theorem.

Textbooks
As set out in the Junior Mathematics Handbook.

MATH1002
Linear Algebra

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1902, MATH1012, MATH1014 **Assumed knowledge:** HSC Mathematics or MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1002 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study introduces vectors and vector algebra, linear algebra including solutions of linear systems, matrices, determinants, eigenvalues and eigenvectors.

Textbooks
As set out in the Junior Mathematics Handbook

ENGG1801
Engineering Computing

Credit points: 6 **Session:** Semester 1, Summer Late **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will introduce students to fundamental principles of programming. The language used will be Matlab but the principles taught are readily portable to other languages like C and Java. The unit material will be presented in a manner which will help students to draw a connection between programming constructs and real engineering applications. The unit will use engineering inspired case-studies : especially from Civil, Chemical, Aerospace and Mechanical streams, to motivate new material. There will be a major project which uses programming to solve a real world engineering problem. The extensive Matlab library for visualization will also be introduced. Matlab will cover two-thirds of the unit. The remaining one-third will be devoted to the use of Excel in engineering scenarios. Furthermore, cross integration between Matlab and Excel will also be highlighted.

ENGG1960
Introduction to Biomedical Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** HSC extension 1 Math **Assessment:** Through semester assessment (65%) Final Exam (35%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The purpose of this unit of study is to introduce students to the fundamentals of their chosen discipline: biomedical engineering. This involves lectures on the the medical device technology and key industry players in the medical device industry, fundamental human biology, engineering mechanics with a focus on the biomechanics of the human body, and the basics of biomedical design through engineering drawing. As well as this there will be a segment on introduction to the 5 majors for the BE Biomedical degree: Mechanical, Mechatronic, Chemical, Electrical, and IT. This will be achieved as follows:

1. Lectures introducing the various Biomedical Technologies in the global market, and under development, as well as the Biomedical Engineering Industry itself. This will help answer the questions "what is biomedical engineering and what are the job opportunities?"

2. Weekly lectures on the fundamentals of human biology and the key anatomical systems relevant to biomedical engineering to prepare students for MECH2901 Anatomy and Physiology for Engineers.

3. Weekly lectures and tutorial on engineering mechanics with a biomechanics and biomedical design focus to give students a good grounding in biomechanics which will serve as a fundamental knowledge for intermediate units in the field (Mechanical, Mechatronics majors) and to give all students a useful working grasp of engineering mechanics, the basis of biomechanics, as a pre-requisite for the senior core unit MECH4961 Biomechanics and Biomaterials (Chemical, IT, Electrical majors, and combined degree students).

4. Weekly lectures introducing the 5 BE Biomedical Majors: Mechanical, Mechatronic, Chemical, Electrical, and IT

5. Introductory lectures and computer tutorials on engineering drawing and design, which will serve as a fundamental knowledge for intermediate units in the field and to give students a useful working grasp of engineering drawing and design essential for all practising engineers (Chemical, IT, Electrical majors, and combined degree students) and as a pre-requisite for the senior core unit MECH3660 Manufacturing Engineering.

Strand 1: Introduction to Biomedical Engineering. This strand will comprise 8 hrs of lectures in weeks 1 and 2. The purpose is to develop for students an understanding of what Biomedical Engineering is, the range of medical devices and device manufacturers in the market today, an overview of biotechnology, and the key companies both local and multinational in the field. At the end of this component, students will have a clear understanding of what biomedical engineering is, current medical device technology on the market and the key manufacturers of these devices, and the biotechnology industry in terms of processes, products, and key companies involved.

Strand 2: Introduction to Human Biology. This strand will comprise 13 hrs of lectures as a weekly 1 hour lecture from week 1 to 13. It will provide an introduction to human anatomy and physiology. The first part of the strand involves a theoretical overview of cell and tissue structures. The second part of the strand gives a theoretical overview of specific relevant anatomical systems for biomedical engineers. Support and Movement: skeletal system and muscular system. Control Systems: nervous system. Regulation and Maintenance: cardiovascular system.

Strand 3: Biomechanics. This strand will comprise a weekly 2 hour lecture from weeks 3 to 9, and a 2 hour tutorial from weeks 3 to 9. The strand aims to provide students with an understanding of and competence in solving statics problems in engineering with a biomechanics focus. Tutorial sessions will help students to improve their group work and problem solving skills, and gain competency in extracting a simplified version of a problem from a complex situation. Emphasis is placed on the ability to work in 3D as well as 2D, including the 2D and 3D visualization of structures and structural components, and the vectorial 2D and 3D representations of spatial points, forces and moments.

Strand 4: Introduction to the BE Biomedical Majors: Mechanical, Mechatronic, Chemical, Electrical, and IT. This strand will involve 8 hrs of lectures in weeks 10-13

Strand 5: Biomedical design: Introduction to engineering design and drawing. This strand also involve 8 hrs of lectures on Engineering Drawing in weeks 10-13 and CAD (computer-aided-design) supplemented by laboratories working on actual CAD designs.

CHEM1101
Chemistry 1A

Credit points: 6 **Session:** Semester 1, Semester 2, Summer Main **Classes:** Three 1 hour lectures and one 1 hour tutorial per week; one 3 hour practical per week for 9 weeks. **Prohibitions:** CHEM1905, CHEM1906, CHEM1903, CHEM1001, CHEM1909, CHEM1109, CHEM1901 **Assumed knowledge:** HSC Chemistry and Mathematics **Assessment:** Theory examination (60%), laboratory work (15%), online assignment (10%) and continuous assessment quizzes (15%) **Practical field work:** A series of 9 three-hour laboratory sessions, one per week for 9 weeks of the semester. **Mode of delivery:** Normal (lecture/lab/tutorial) day

Chemistry 1A is built on a satisfactory prior knowledge of the HSC Chemistry course. Chemistry 1A covers chemical theory and physical chemistry. Lectures: A series of 39 lectures, three per week throughout the semester.

Textbooks

A booklist is available from the First Year Chemistry website. http://sydney.edu.au/science/chemistry/firstyear

MATH1003
Integral Calculus and Modelling

Credit points: 3 **Session:** Semester 2, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1013, MATH1903, MATH1907 **Assumed knowledge:** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1003 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.This unit of study first develops the idea of the definite integral from Riemann sums, leading to the Fundamental Theorem of Calculus. Various techniques of integration are considered, such as integration by parts.The second part is an introduction to the use of first and second order differential equations to model a variety of scientific phenomena.

Textbooks

As set out in the Junior Mathematics Handbook

MATH1005
Statistics

Credit points: 3 **Session:** Semester 2, Summer Main, Winter Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021 **Assumed knowledge:** HSC Mathematics **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1005 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit offers a comprehensive introduction to data analysis, probability, sampling, and inference including t-tests, confidence intervals and chi-squared goodness of fit tests.

Textbooks

As set out in the Junior Mathematics Handbook

CHEM1102
Chemistry 1B

Credit points: 6 **Session:** Semester 1, Semester 2, Summer Main **Classes:** One 3 hour lecture and 1 hour tutorial per week; one 3 hour practical per week for 9 weeks. **Prerequisites:** CHEM1101 or CHEM1901 or a Distinction in CHEM1001 or equivalent **Prohibitions:** CHEM1904, CHEM1907, CHEM1902, CHEM1108, CHEM1908, CHEM1002 **Assessment:** Theory examination (60%), laboratory work (15%), online assignment (10%) and continuous assessment quizzes (15%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Chemistry 1B is built on a satisfactory prior knowledge of Chemistry 1A and covers inorganic and organic chemistry. Successful completion of Chemistry 1B is an acceptable prerequisite for entry into Intermediate Chemistry units of study. Lectures: A series of 39 lectures, three per week throughout the semester.

Textbooks

A booklist is available from the First Year Chemistry website. http://sydney.edu.au/science/chemistry/firstyear

MBLG1001
Molecular Biology and Genetics (Intro)

Credit points: 6 **Teacher/Coordinator:** Dr Dale Hancock **Session:** Semester 2 **Classes:** Two 1-hour lectures per week; one 1-hour tutorial and one 4-hour practical per fortnight **Prohibitions:** MBLG1901; MBLG1991 **Assumed knowledge:** 6 credit points of Junior Biology and 6 credit points of Junior Chemistry. **Assessment:** One 2.5-hour exam (60%), Lab reports (15%), assignments (10%), prac test (15%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The lectures in this unit of study introduce the "Central Dogma" of molecular biology and genetics -i.e., the molecular basis of life. The course begins with the information macromolecules in living cells: DNA, RNA and protein, and explores how their structures allow them to fulfill their various biological roles. This is followed by a review of how DNA is organised into genes leading to discussion of replication and gene expression (transcription and translation). The unit concludes with an introduction to the techniques of molecular biology and, in particular, how these techniques have led to an explosion of interest and research in Molecular Biology. The practical component complements the lectures by exposing students to experiments which explore the measurement of enzyme activity, the isolation of DNA and the 'cutting' of DNA using restriction enzymes. However, a key aim of the practicals is to give students higher level generic skills in computing, communication, criticism, data analysis/evaluation and experimental design.

Textbooks

Introduction to Molecular Biology MBLG1001 & MBLG1901, 3rd edition compiled by D. Hancock, G. Denyer and B. Lyon, Pearson ISBN 978 1 4860 0039 5

Second year

MATH2067
DEs and Vector Calculus for Engineers

Credit points: 6 **Session:** Semester 1 **Classes:** Three 1 hour lectures, one 1 hour tutorial and one 1 hour practice class per week. **Prerequisites:** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **Prohibitions:**

MATH2901, MATH2961, MATH2005, MATH2965, MATH2001, MATH2905, MATH2061, MATH2065 **Assessment:** One 2 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH2067 starts by introducing students to solution techniques of ordinary and partial differential equations (ODEs and PDEs) relevant to the engineering disciplines: it provides a basic grounding in these techniques to enable students to build on the concepts in their subsequent engineering classes. The main topics are Fourier series, second order ODEs, including inhomogeneous equations and Laplace transforms, and second order PDEs in rectangular domains (solution by separation of variables).

The unit moves on to topics from vector calculus, including vector-valued functions (parametrised curves and surfaces; vector fields; div, grad and curl; gradient fields and potential functions), line integrals (arc length; work; path-independent integrals and conservative fields; flux across a curve), iterated integrals (double and triple integrals; polar, cylindrical and spherical coordinates; areas, volumes and mass; Green's Theorem), flux integrals (flow through a surface; flux integrals through a surface defined by a function of two variables, though cylinders, spheres and parametrised surfaces), Gauss's Divergence Theorem and Stokes' Theorem.

ELEC1103
Fundamentals of Elec and Electronic Eng

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Basic knowledge of differentiation & integration, and HSC Physics **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to develop knowledge of the fundamental concepts and building blocks of electrical and electronics circuits. This is a foundation unit in circuit theory. Circuit theory is the electrical engineer's fundamental tool.

The concepts learnt in this unit will be made use of heavily in many units of study (in later years) in the areas of electronics, instrumentation, electrical machines, power systems, communication systems, and signal processing.

Topics: a) Basic electrical and electronic circuit concepts: Circuits, circuit elements, circuit laws, node and mesh analysis, circuit theorems, energy storage, capacitors and inductors, circuits with switches, transient response, sine waves and complex analysis, phasors, impedance, ac power.; b) Project management, teamwork, ethics; c) Safety issues

ELEC2104
Electronic Devices and Circuits

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/fortnight; Laboratory 3 hrs/fortnight **Assumed knowledge:** Knowledge: ELEC1103. Ohm's Law and Kirchoff's Laws; action of Current and Voltage sources; network analysis and the superposition theorem; Thevenin and Norton equivalent circuits; inductors and capacitors, transient response of RL, RC and RLC circuits; the ability to use power supplies, oscilloscopes, function generators, meters, etc. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Modern Electronics has come to be known as microelectronics which refers to the Integrated Circuits (ICs) containing millions of discrete devices. This course introduces some of the basic electronic devices like diodes and different types of transistors. It also aims to introduce students the analysis and design techniques of circuits involving these discrete devices as well as the integrated circuits.

Completion of this course is essential to specialize in Electrical, Telecommunication or Computer Engineering stream. The knowledge of ELEC1103 is assumed.

AMME1362
Materials 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/semester. **Prohibitions:** AMME2302, CIVL2110 **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

AMME1362 is an introductory unit in engineering materials. The unit aims to develop students' understanding of the structures, mechanical properties and manufacture of a range of engineering materials as well as how the mechanical properties relate to microstructure and forming and treatment methods. The unit has no prerequisite subject and is therefore intended for those with little or no previous background in engineering materials. However the unit does require students to take a significant degree of independent responsibility for developing their own background knowledge of materials and their properties. The electrical, magnetic, thermal and optical properties of materials are a critical need-to-know area where students are expected to do some independent study.

MECH2901
Anatomy and Physiology for Engineers

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2.5 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** (ENGG1960 OR BIOL1003 OR BIOL1903) AND [6cp junior Chemistry] **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit of study provides the underpinning knowledge needed in biomedical engineering designs. It is not a pre-requisite for any units of study. However, the anatomic and physiological functional knowledge gained in this subject will enhance prototype development of biomedical designs. Students should gain familiarity with anatomical and physiological terms and their meaning, understanding of the gross anatomy of the major systems in the human body and their importance in the design of biomedical devices and understanding of the major physiological principles which govern the operation of the human body.

Select 6 cp from the following block of core units:

AMME2261
Fluid Mechanics 1

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs/semester. **Prohibitions:** AMME2200 **Assumed knowledge:** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit covers the fundamentals of fluid statics and fluid dynamics. At the end of this unit students will have: an understanding of the basic equations governing the statics and dynamics of fluids; the ability to analyze and determine the forces applied by a static fluid; the ability to analyse fluids in motion. The course will cover both inviscid and viscous fluid flow. The course will introduce the relevant parameters for fluid flow in internal engineering systems such as pipes and pumps and external systems such as flow over wings and airfoils. Course content will cover the basic concepts such as viscosity, density, continuum, pressure, force, buoyancy and acceleration; and more detailed methods including continuity, conservation of momentum, streamlines and potential flow theory, Bernoulli equation, Euler equation, Navier-Stokes equation. Experiments will introduce flow measuring devices and flow observation.

CHNG2803
Energy and Fluid Systems Practice

Credit points: 6 **Session:** Semester 1 **Classes:** Project Work - in class 6 hrs/week; Project Work - own time 6 hrs/week. **Prerequisites:** (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 OR MATH1015 OR MATH1905) AND ENGG1801 AND CHNG1103 AND (CHEM1101 OR CHEM1901) AND (CHEM1102 OR CHEM1902) **Corequisites:** CHNG2801 AND CHNG2802 **Assumed knowledge:** Ability to conduct mass and energy balances, and the integration of these concepts to solve real chemical engineering problems Ability to understand basic principles of physical chemistry, physics and mechanics. Ability to use mathematics of calculus (including vector calculus) and linear algebra, and carry out computations with MATLAB and MS EXCEL. Ability to read widely outside of the technical literature, and to synthesise arguments based on such literature. Ability to write coherent reports and essays based on qualitative and quantitative information. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

CHNG2803 is a practically and theoretically-based course, where students will be introduced to types of problems that the modern chemical engineer may be asked to solve. The material is contemporary in nature, and the projects link with the key concepts taught in CHNG2801and CHNG2802 and across the curriculum.

The objectives in this unit are to provide an interesting, enjoyable, and challenging introduction to fundamental aspects of chemical engineering, particularly conservation and transport processes involving fluids and energy, as well as to the application of mathematical techniques in typical engineering problems.

In this course there is one overall project. The overall goal of the project work throughout this semester is to build a small cooling tower. This cooling tower may be used to cool water from processes that make the water hot, to humidify air that is cold and dry (as in a Sydney winter) or to dehumidify warm wet air (as in a Sydney summer).

The overall project will be split into two sub-projects

i.Fluid mechanics: 4 weeks

ii.Heat and mass transfer: 8 weeks

The project in CHNG2803 addresses transport processes, including the movement of momentum (fluid mechanics), thermal energy (heat transfer) and components with mass. The projects are underpinned by a critical and constructive analysis and best practice in learning and teaching. In addition to the basic knowledge and skills required to pass this unit, the development of an understanding sufficient to enable you to tackle new and unfamiliar problems will be emphasized. You will learn to work in largely unsupervised groups and to be responsible for managing your individual and group performance.

Completion of this unit of study is a minimum requirement of your undergraduate degree program.

ELEC2302
Signals and Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/week; E-Learning 1 hr/week. **Assumed knowledge:** MATH1001 Differential Calculus and MATH1002 Linear Algebra and MATH1003 Integral Calculus and Modelling. Basic knowledge of differentiation & integration, differential equations, and linear algebra. **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to teach some of the basic properties of many engineering signals and systems and the necessary mathematical tools that aid in this process. The particular emphasis is on the time and frequency domain modeling of linear time invariant systems. The concepts learnt in this unit will be heavily used in many units of study (in later years) in the areas of communication, control, power systems and signal processing. A basic knowledge of differentiation and integration, differential equations, and linear algebra is assumed.

MECH2400
Mechanical Design 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 1 hr/week. **Assumed knowledge:** ENGG1801 and ENGG1802, HSC Maths and Physics **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Aim: For students to experience a realistic the design process and to develop good engineering skills.

Course Objectives: To develop an understanding of:

1. the need for and use of standard drawings in the communication and definition of parts and assemblies,
2. Efficient use of a CAD package
3. creativity,
4. the design process from initial idea to finished product
5. Methods used to analyse designs
6. standard components.

Third year

MECH3921
Biomedical Design and Technology

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 4 hrs/week; Presentation 4 hrs. **Prerequisites:** (AMME2302 OR AMME1362) AND MECH2901 AND (MECH2400 OR ENGG1960). **Assumed knowledge:** A basic understanding of human physiology and anatomy and an understanding of the engineering design process. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to give students an understanding of the Australian and International biomedical industry and in the development, manufacture and uses of biomedical engineering products in therapeutic, rehabilitation and clinical settings. Students will gain an understanding of the process of biomedical regulation in Australia and other major international markets as well as the entire process of creating a new biomedical engineering product, from design through to marketing and monitoring of the product. Students will design a biomedical device including the preparation of a detailed design brief.

This will be done as a team project. Each team will work on a specific biomedical design project following formal design protocols, including design control, regulatory considerations, and commercialisation/IP considerations.

Course content will include:

- Biomedical Design: A team design project on a medical device.
- Intellectual Property in the biomedical industry.
- Biomedical devices and technology.
- Regulatory and clinical considerations in the biomedical industry.
- Commercialisation strategies in the biomedical industry.
- The Australian biomedical industry - an overview. Includes site visits.
- The global biomedical industry - an overview. Includes site visits.

MECH3660
Manufacturing Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Laboratory, Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** MECH2400 or ENGG1960 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit aims to teach the fundamentals of manufacturing processes and systems in mechanical, mechatronic and biomedical engineering, including traditional and advanced manufacturing technologies.

This unit aims to develop the following attributes: to understand the fundamental principles of manufacturing technologies for the above mentioned engineering areas; to gain the ability to select existing manufacturing processes and systems for direct engineering applications; to develop ability to create innovative new manufacturing technologies for advanced industrial applications; to develop ability to invent new manufacturing systems

At the end of this unit students will have a good understanding of the following: merits and advantages of individual manufacturing processes and systems; principles of developing new technologies; comprehensive applications and strategic selection of manufacturing processes and systems.

Course content will include:

Manufacturing Processes: Common processes and their science (machining, casting, powder metallurgy, metal working, welding); merits and limitations; CNC and CAM;

Manufacturing Systems: Economics in manufacturing; flexible manufacturing; group technology; materials selection and requirements planning; quality control; introduction to new technology; introduction to e-manufacturing; human factors; plant layout.

Select 6 cp from the following block of core units:

ELEC3802
Fundamentals of Biomedical Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Project Work - in class 2 hrs/week. **Assumed knowledge:** ELEC2004 or ELEC2104 A knowledge of basic electrical engineering is required: Ohm's law, Thevenin and Nortons' theorems, basic circuit theory involving linear resistors, capacitors and inductors, a basic knowledge of bipolar and field effect transistor theory, simplified theoretical mechanism of operation of transformers. **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit assumes a knowledge of basic principles in physics, mathematics, circuit theory and electronics. In particular, some understanding of the following is required: Thevenins and Nortons theorems, Fourier analysis, radiation, filtering, bipolar and field effect transistors, and operational amplifiers.

The following topics are covered. Biology of the heart, circulatory and respiratory systems, physiology of nerve and muscle cells, fundamental organization of the brain and spinal cord. Medical instrumentation. ElectrocardioGram and automated diagnosis. Heart pacemakers and defibrillators. The bionic ear. Apparatus for treatment of sleep disordered breathing(sleep apnoea).

This unit is descriptive and does not require detailed knowledge of electronics or mathematics, but does require an understanding of some key aspects of mathematical and electronic theory. The unit concentrates on some of the practical applications of biomedical engineering to patient diagnosis and treatment.

AMME4790
Introduction to Biomechatronics

Credit points: 6 **Session:** Semester 2 **Classes:** Tutorial 1 hr/week; Lecture 2 hrs/week; Project Work - own time 4 hrs/week; Laboratory 2 hrs/week; Presentation 4 hrs/week. **Prerequisites:** MTRX3700 or MECH3921 **Assumed knowledge:** 1. A good practical knowledge and an interest in mechanical and electronic engineering; 2. Adequate maths and applied maths skills; 3. Background knowledge of physics, chemistry and biology; 4. Some programming capability, MATLAB, C, C++; 5. The ability to use, and experience of, common software tools used by engineers including CAD and EDA packages. **Assessment:** Through semester assessment (70%) Final Exam (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: AMME4790 is the last in a series of practical Mechatronic and Electrical courses taken over three years. It takes these engineering concepts, along with the associated mathematical, electronic and mechanical theory and applies this knowledge to a series of practical, albeit specialized biomechatronic applications that will be encountered by Mechatronic Engineers who enter this broad field on graduation.

Biomechatronics is the application of mechatronic engineering to human biology and as such it forms an important subset of the overall biomedical engineering discipline. This course focusses on a number of areas of interest including auditory and optical prostheses, artificial hearts and active and passive prosthetic limbs and examines the biomechatronic systems (hardware & signal processing) that underpin their operation

Fourth year

MECH4961
Biomechanics and Biomaterials

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Independent Study. **Prerequisites:** (AMME2302 or AMME1362); MECH2901; MECH3921; (BIOL1003 or MBLG1001) **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course is divided into two parts: biomechanics and biomaterials:

Biomechanics

Biomechanics is the study of the body from the point of view of it being an engineering structure. There are many aspects to this since the human body contains soft tissues, hard tissues (skeletal system), and articulating joints. We will begin with a general introduction to biomechanics, modelling the human body from the macroscopic level to the microscopic level. We will then study soft tissue mechanics, with respect to both non-linear and viscoelastic descriptions, with a significant focus on the mathematical methods used in relation to the mechanics of the system. We will then look at specific aspects of biomechanics: muscle mechanics, joint mechanics, kinematics and dynamics of human gait (gait analysis), biomechanics of cells, physiological fluid flow, biomechanics of injury, functional and mechanical response of tissues to mechanical loading.

Biomaterials

This course will involve the study of biomaterials from two perspectives: firstly, the response of the body towards the biomaterial - an immune response and foreign body reaction; secondly, the response of the biomaterial to the body - corrosion, biodegradation, and mechanical failure. Our study will begin with the response of the body towards the biomaterial. We will begin by looking at the immune system itself and then move on to look at the normal inflammatory response. We will then study in detail the foreign body reaction caused by biomaterials. The final part of this section is the study of protein adsorption onto biomaterials, with a strong focus on the Vroman effect. Then we will move onto the response of the biomaterial to the body. We will begin by a review of biomaterials, their applications, and compositions, and mechanical properties. We will then look at key problems such as corrosion, stress shielding, static fatigue, and mechanical failure. Finally, we will take a practical look at the materials themselves. Beginning with metals, then polymers (thermoplastic, thermosetting, and biodegradable), and finally ceramics (bioinert, biodegradable, and bioactive).

AMME4971
Tissue Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** 6 credit points of Junior Biology, 6 credit points of Junior Chemistry and 6 credit points of Intermediate Physiology, or equivalent. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: The primary teaching delivery method will be lectures. This UoS builds on the assumed knowledge of junior and intermediate biology and thus students will already have practical hands-on biological training. The purpose of this UoS is to elaborate the theory and latest developments of this very new field of tissue engineering, thereby building on the existing practical and theoretical knowledge base the students have in cell biology.

Core Unit of Study: With the severe worldwide shortage of donor organs and the ubiquitous problem of donor organ rejection, there is a strong need for developing technologies for engineering replacement organs and other body parts. Recent developments in biochemistry and cell biology have begun to make this possible, and as a consequence, the very new field of tissue engineering has been making dramatic progress in the last few years.

This UoS will provide an introduction to the principles of tissue engineering, as well as an up to date overview of recent progress in the field of tissue engineering is and where it is going. This UoS assumes prior knowledge of cell biology and chemistry and builds on that foundation to elaborate on the important aspects of tissue engineering. The objectives are:

1. To gain a basic understanding of the major areas of interest in tissue engineering

2. To learn to apply basic engineering principles to tissue engineering systems

3. To understand the challenges and difficulties of tissue engineering.

4. Understand the ethical issues of stem cell applications.

5. Practical classes in the preparation and evaluation of scaffolds for tissue regeneration.

6. Enable student to access web-based resources in tissue engineering (for example: Harvard-MIT Principles and Practice of Tissue Engineering).

7. Research basic skills in Tissue Engineering.

ENGG4000
Practical Experience

Session: Semester 1, Semester 2 **Classes:** Practical Experience, **Prerequisites:** 36 Credit Points of Senior Units **Assessment:** Through semester assessment (100%) **Mode of delivery:** Professional practice

Note: Students should have completed three years of their BE program before enrolling in this unit.

The aim of this unit is to give students exposure to work in an engineering organisation and gain some professional experience; to enhance a student's abilities and experience in report writing; to encourage self-evaluation in the context of applying their theoretical knowledge to real industry practise. Students will gain a better appreciation of the role of engineers in the workplace. The assessment will enhance the student's ability to present structured observations and reflections in the mode of a formal written report.

Each student is required to gain exposure to professional engineering practice and environments and to submit a satisfactory written report of his or her work. The report will include the requirement of a detail logbook recording tasks given and timelines set for achieving these. Self-evaluation of a student's personal level of knowledge and its applicability to the workplace is a major component of the reporting. Normally 12 weeks (60 days) of practical work experience is required, though the Faculty may accept alternatives that are judged as equivalent. Students are strongly encouraged to undertake their work experience in the break between Year 3 and 4 and definitely prior to commencing their final semester of study, however any engineering work taken after completing 28 credit points of 3rd year units of study may be accepted for the requirements of this unit. The University Careers and Appointments Service is available to assist students to obtain suitable employment. This unit of study is a core unit of study in all BE programs and must be passed in order to graduate from those programs.

Select 6cp from the following block of units:

AMME4981
Applied Biomedical Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Research 2 hrs/week; Seminar 3 hrs/week; Lecture 3 hrs/week; Tutorial 2 hrs/week; Meeting 1 hr/week; Project Work - own time 1 hr/week. **Assumed knowledge:** MECH2901 and AMME2301 and AMME2500 and MECH3362 and MECH3921. Anatomy and Physiology, engineering dynamics and mechanics of solids in the second year level and knowledge of materials engineering and mechanical design in the third year level **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Computer modelling and simulation signify a very important aspect of engineering in general, and biomedical engineering specifically. This is because it allows overcoming some significant problems of clinical, ethical, and design involved in testing early prototypes on live subjects. This unit of study will take a project-based-learning approach to the topic of computer modelling and simulation for design optimization of biomedical prostheses and devices through lectures, tutorials, team work and research seminars. The primary focus will be on CT/MRI based finite element modelling, design analysis and optimisation for biomedical implantable devices. The students will form into teams and use computer modeling and simulation techniques to develop and optimize their design. Projects are to be conducted for some real-life problems from the biomedical industry, and it is anticipated that students will spend a significant amount of time with their research and development. It is anticipated that students will gain detailed knowledge not only in the design topic assigned to them, but also in the topics assigned to their peers.

COMP5424
Information Technology in Biomedicine

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Information technology (IT) has significantly contributed to the research and practice of medicine, biology and health care. The IT field is growing enormously in scope with biomedicine taking a lead role in utilizing the evolving applications to its best advantage. The goal of this unit of study is to provide students with the necessary knowledge to understand the information technology in biomedicine. The major emphasis will be on the principles associated with biomedical digital imaging systems and related biomedicine data processing, analysis, visualization, registration, modelling, compression, management, communication and security. Specialist areas such as Picture Archiving and Communication Systems (PACS), computer-aided diagnosis (CAD), content-based medical image retrieval (CBMIR), and ubiquitous m-Health, etc. will be addressed. A broad range of practical integrated clinical applications will be also elaborated.

COMP5456
Introduction to Bioinformatics

Credit points: 6 **Session:** Summer Main **Classes:** Laboratory 2 hrs/week; Lecture 2 hrs/week. **Prohibitions:** COMP3456 **Assumed knowledge:** Some experience with basic programming (coding) in Java, C, C++ or Perl; Some proven ability in mathematical or information sciences (as evinced in the prerequisites); Some knowledge of molecular biology either through first year BIOL papers or MBLG1001. **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit brings together a wide range of skills that are routinely practised in bioinformatics, from the 'hard' subjects of mathematics, statistics and computer science, to the 'soft' subjects in the biological / health sciences and pharmacology. The unit covers the essentials of bioinformatics data gathering, manipulation, mining and storage that underpin bioinformatics research. It further provides additional practice in the graduate attributes of Research and Inquiry, Information Literacy and Communication through analysis of scientific research, use of large bioinformatics data sets, and writing of reports.

Select 18cp from the following list of Biomedical electives:

AMME2262
Thermal Engineering 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs. **Prohibitions:** AMME2200 **Assumed knowledge:** MATH1001, MATH1002, MATH1003. Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to teach the basic laws of thermodynamics and heat transfer. At the end of this unit students will have: an understanding of the basic laws of thermodynamics and heat transfer; The ability to analyze the thermodynamics of a simple open or closed engineering system. The basic knowledge to analyse and design 1D thermal circuits. Course content will include concepts of heat and work, properties of substances, first law of thermodynamics, control mass and control volume analysis, thermal efficiency, entropy, second law of thermodynamics, reversible and irreversible processes, isentropic efficiency, power and refrigeration cycles, heat transfer by conduction, convection and radiation, 1D thermal circuits and transient heat transfer.

MECH4720
Sensors and Signals

Credit points: 6 **Session:** Semester 1 **Classes:** 3 hours of lectures and 2 hours of tutorials per week. **Prerequisites:** MTRX3700 **Assumed knowledge:** Strong Matlab skills **Assessment:** Final Exam (30%), Assignment (35%), Lab Report (35%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit aims to provide students with a good practical knowledge of a broad range of sensor technologies, operational principles and relevant signal processing techniques. MECH4720 is the last in a series of practical Mechatronic and Electrical courses taken over three years. It takes these practical engineering concepts, along with the associated mathematical, electronic and mechanical theory and applies this knowledge to a series of practical, albeit specialized applications that will be encountered by most Mechatronic Engineers at sometime during their careers.

This unit will starts by looking at signal characteristics, modulation, filtering and convolution before examining some passive sensors. It goes on to provide an overview of the workings of typical active sensors with a strong emphasis on optical systems and image processing (Radar, Lidar and Sonar). It provides insight into basic sensing methods as well as aspects of interfacing and signal processing. It includes both background material and a number of case studies.

At the end of this unit students will have a good understanding of passive and active sensors, their outputs and applicable signal processing techniques; an appreciation of the basic sensors that are available to engineers and when they should be used.

MTRX4700
Experimental Robotics

Credit points: 6 **Session:** Semester 1 **Classes:** 2 hours of lectures and 3 hours of lab work per week **Prerequisites:** AMME3500; MTRX3700 **Assessment:** Assignment (30%), Project (40%), Final Exam (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to present a broad overview of the technologies associated with industrial and mobile robots. Major topics covered are sensing, mapping, navigation and control of mobile robots and kinematics and control of industrial robots. The subject consists of a series of lectures on robot fundamentals and case studies on practical robot systems. Material covered in lectures is illustrated through experimental laboratory assignments. The objective of the course is to provide students with the essential skills necessary to be able to develop robotic systems for practical applications.

At the end of this unit students will: be familiar with sensor technologies relevant to robotic systems; understand conventions used in robot kinematics and dynamics; understand the dynamics of mobile robotic systems and how they are modeled; have implemented navigation, sensing and control algorithms on a practical robotic system; apply a systematic approach to the design process for robotic systems; understand the practical application of robotic systems in applications such as manufacturing, automobile systems and assembly systems; develop the capacity to think creatively and independently about new design problems; undertake independent research and analysis and to think creatively about engineering problems.

Course content will include: history and philosophy of robotics; hardware components and subsystems; robot kinematics and dynamics; sensors, measurements and perception; robotic architectures, multiple robot systems; localisation, navigation and obstacle avoidance, robot planning; robot learning; robot vision and vision processing.

AMME5951
Fundamentals of Neuromodulation

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week. **Assumed knowledge:** Basic electronics at the junior or intermediate level, junior biology and chemistry, intermediate materials science, anatomy and physiology, senior engineering design practice, and biomedical engineering: BIOL1003 or 6 credit points of junior biology; CHEM1101 or 6 credit points of junior chemistry; AMME2302 or 6 credit points of materials science; ELEC2004 or 6 credit points of general electronics; MECH2901 or 6 credit points of intermediate physiology or equivalent. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Implantable microelectronic devices functioning either as nerve stimulators or nerve blockers comprise one of the largest markets in the global medical device industry. The aim of this unit of study is to give students a complete overview of the underlying technology (microelectronics, encapsulation biomaterials, electrode biomaterials, electrode-neural interactions, inductive power systems and data links, signal processing) and an expert review of the major technological applications on the market, which include Cochlear implants, pacemakers and implantable defibrillators, deep brain stimulators, pain control nerve blockers, bionic eye implants, functional electrical stimulation systems. The unit will also review emerging applications such as gastrointestinal disorders, obesity; vagal nerve stimulation - epilepsy, depression, carotid artery stimulation - hypertension, spinal cord stimulation - ischemic disorders, angina, peripheral vascular disease, incontinence, erectile dysfunction. The unit will conclude with a snapshot of the future: "brain on a chip" progress, nerve regrowth, neurotropins, drug/device combinations. This is a Master of Professional Engineering Unit of Study intended for biomedical engineering students with an interest in working in the medical device industry in the large market sector area of implantable electronic devices.

CHNG5601
Membrane Science

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 4 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

"Membrane Science" provides background in the physics and electrochemistry of a variety of synthetic membranes used in industry as well as cellular membranes.

The course aims to provide students with an understand of:

membrane self-assembly and manufacture;

membrane separation processes such as filtration, desalination, ion exchange and water-splitting;

and techniques for membrane characterisation and monitoring.

CHNG5602
Cellular Biophysics

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 4 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

Students will be given a good background in the physics of biological processes. Students will understand the differences between thermodynamically closed and open systems and its relevance to cells and other biological systems. Students will be provided with an introduction to the thermodynamics of irreversible and evolutionary processes of relevance to biology. Students will be introduced to the statistical mechanics of self assembly and equilibrium structures and its relevance to biology at the molecular level.

CHNG5603
Analysis, Modelling, Control: BioPhy Sys

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Project Work - own time 2 hrs/week. **Assumed knowledge:** It is assumed that students have a general knowledge of: MATH 1001 Differential Calculus MATH 1003 Integral Calculus and Modeling **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This course is for Master degree students and also is offered as an elective course for fourth year students. Some lectures my be given by a guest lecturer. this

This course will give students an insight into the use of (computer-based) statistical techniques in extracting information from experimental data obtained from real life bio-physical systems. The issues and techniques required for mathematical modeling as well as monitoring and/or control scheme for bio-physical systems will be discussed and implemented in diverse range of bioprocesses, including biomaterials and fermentation products.

We will review statistical distribution; tests based on z, t, F variables; calculation of confidence intervals; hypothesis testing; linear and nonlinear regression; analysis of variance; principal component analysis; and use of computer-based statistical tools. The issues associated with dynamic response of bio-physical processes; inferred or estimated variables; control system design and implementation; introduction to model-based control; use of computer-based control system design and analysis tools will be elaborated.

When this course is successfully completed you will acquire knowledge to choose the appropriate statistical techniques within a computer based environment, such as Excel or MATLAB, for a given situation. The students will also obtain potential for monitoring/control scheme based on the key dynamic features of the process. Such information would be beneficial for any future career in Bio-manufacturing companies. Students are encouraged to promote an interactive environment for exchange of information.

ELEC3404
Electronic Circuit Design

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/fortnight; Laboratory 3 hrs/fortnight. **Assumed knowledge:** A background in basic electronics and circuit theory is assumed. **Assessment:** Through semester assessment (70%) Final Exam (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to teach students analysis and design techniques for electronic systems such as signal amplifiers, differential amplifiers and power amplifiers. Completion of this unit will allow progression to advanced studies or to work in electronics and telecommunication engineering.

Topics covered are as follows. The BJT and MOSFET as an amplifier. Biasing in amplifier circuits. Small signal operation and models. Single stage amplifiers. Internal capacitances and high frequency models. The frequency response of the common-emitter amplifier. Current sources and current mirrors. Differential amplifiers. Output stages and power amplifiers:class A, class B and class AB.

ELEC3305
Digital Signal Processing

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs; Laboratory 2 hrs; Project Work - own time 1 hr. **Prerequisites:** ELEC2302 **Assumed knowledge:** Specifically the following concepts are assumed knowledge for this unit: familiarity with basic Algebra, Differential and Integral Calculus, continuous linear time-invariant systems and their time and frequency domain representations, Fourier transform, sampling of continuous time signals. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to teach how signals are processed by computers. It describes the key concepts of digital signal processing, including details of various transforms and filter design. Students are expected to implement and test some of these ideas on a digital signal processor (DSP). Completion of the unit will facilitate progression to advanced study in the area and to work in the industrial use of DSP.

The following topics are covered. Review of analog and digital signals. Analog to digital and digital to analog conversion. Some useful digital signals. Difference equations and filtering. Impulse and step response of filters. Convolution representation of filters. The Z-transform. Transfer functions and stability. Discrete time Fourier transform (DTFT) and frequency response of filters. Finite impulse response (FIR) filter design: windowing method. Infinite impulse response (IIR) filter design: Butterworth filters, Chebyshev filters, Elliptic filters and impulse invariant design. Discrete Fourier Transform (DFT): windowing effects. Fast Fourier Transform (FFT): decimation in time algorithm. DSP hardware.

ELEC5614
Real Time Computing

Credit points: 6 **Session:** Semester 1 **Classes:** Project Work - own time 2 hrs; Lecture 2 hrs/week; Laboratory 2 hrs/week; Tutorial 1 hr/week; E-Learning 1 hr. **Prohibitions:** MECH5701 **Assumed knowledge:** SOFT2130 Software Construction (or SOFT2004 Software Development Methods 1) and ELEC3607 Embedded Computing (or ELEC2601 Microprocessor Systems) **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit is concerned with the theory and practice of real time computer systems as applied to the design of embedded systems and computer control systems in engineering, manufacturing and automation.

Some background in programming, object oriented design and system architecture is assumed. A prime aim of this unit of study is to develop a capacity for research and inquiry in the field of real-time and embedded systems. Completion of this unit will facilitate progression to advanced study or to work in embedded systems and industrial real-time computer systems.

The following topics are covered. Hard real time and embedded systems, as applied to engineering, manufacturing and automation. Timing and scheduling: periodic vs aperiodic processes, deadlines, rate monotonic, deadline monotonic and earliest deadline scheduling. Management of shared resources. Real-time languages and their features. Real time operating systems. Real time software design. Embedded Systems: overview, signal flow, interfacing. Reliability and fault tolerance in hardware and software. SCADA and DCCS. Some case studies.

MECH4902
Orthopaedic and Surgical Engineering

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Independent Study. **Prerequisites:** AMME2301 AND (AMME2302 OR AMME1362) AND (BIOL1003 OR MBLG1001) AND (ENGG1802 OR ENGG1960) AND MECH2901 AND MECH3921. Any 6cp of junior biology is an acceptable substitute for BIOL1003 or MBLG1001 **Assumed knowledge:** MECH3362. 1.Basic concepts in engineering mechanics - statics, dynamics, and solid mechanics. 2.Basic concepts in materials science, specifically with regard to types of materials and the relation between properties and microstructure. 3.A basic understanding of human biology and anatomy. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The aims and objectives of the UoS are:

1.To introduce the student to the details and practice of orthopaedic engineering.

2.To give students an overview of the diverse knowledge necessary for the design and evaluation of implants used in orthopaedic surgery.

3.To enable students to learn the language and concepts necessary for interaction with orthopaedic surgeons and the orthopaedic implant industry.

4.To introduce the student to the details and practice of other engineering applications in surgery, particularly in the cardiovascular realm.

AMME4990
Biomedical Product Development

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Independent Study, **Prerequisites:** BIOL1003 OR 6 credit points of junior biology CHEM1101 OR 6 credit points of junior chemistry MECH2901 OR 6 credit points of junior intermediate physiology or equivalent, MECH3921. **Assumed knowledge:** Junior level chemistry, intermediate level biology, and specific knowledge of cell biology at least at the junior level, and preferably at the intermediate level. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Elective Unit of Study: Product development in the biomedical area presents unique challenges that need to be addressed to efficiently satisfy strict regulatory requirements and to successfully advance products to approval for marketing. Biomedical engineers need a broad understanding of these challenges as the main components of product development are complex and interdependent. Development of good manufacturing and quality control processes, preclinical and clinical validation of product safety and efficacy, and regulatory filings, are each progressive and interdependent processes. This UoS will provide a broad understanding of regulatory requirements for biomedical product development, with particular emphasis on the dependence of each component on the development of processes and control systems that conform to Good Manufacturing Practice. This UoS assumes prior knowledge of cell biology and chemistry and builds on that foundation to elaborate on the important aspects of biomedical product development.

AMME4992
Regulatory Affairs in Medical Industry

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week. **Prerequisites:** MECH2901 AND MECH3921 **Assumed knowledge:** BIOL1003 or 6 credit points of junior biology, CHEM1101 or 6 credit points of junior chemistry. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Biomedical Engineering Elective Unit of Study.

Supply of medical devices, diagnostics and related therapeutic products is regulated in most jurisdictions, with sophisticated and complex regulatory regimes in all large economies. These regulations are applied both to manufacturers and designers and to biomedical engineers undertaking device custom manufacture or maintenance in clinical environments. This UoS will explore the different regulatory frameworks in the "Global Harmonisation Task Force" group of jurisdictions (US, EU, Canada, Japan, Australia) as well as emerging regulatory practices in Asia and South America. Emphasis will be on the commonality of the underlying technical standards and the importance of sophisticated risk management approaches to compliance.

AMME4710
Computer Vision and Image Processing

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week. **Assumed knowledge:** Mandatory prerequisite MECH4720 Sensors and Signals or MECH4730 Computers in Real-Time Control and Instrumentation

Assessment: Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Current Lectures: Dr. Thierry Peynot, tpeynot@acfr.usyd.edu.au, Dr. Shrihari Vasudevan, s.vasudevan@acfr.usyd.edu.au

This unit of study introduces students to vision sensors, computer vision analysis and digital image processing. This course will cover the following areas: fundamental principles of vision sensors such as physics laws, radiometry, CMOS/CDD imager architectures, colour reconstruction; the design of physics-based models for vision such as reflectance models, photometric invariants, radiometric calibration. This course will also present algorithms for video/image analysis, transmission and scene interpretation. Topics such as image enhancement, restoration, stereo correspondence, pattern recognition, object segmentation and motion analysis will be covered.

CHNG5605
Bio-Products: Laboratory to Marketplace

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Project Work - own time 6 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This course is for Master degree students and also is offered as an elective course for fourth year students. .

The objectives of the course are to provide students with an overview of biochemical and pharmaceutical industry. It will give students an insight into drug delivery systems and formulation; how therapeutic drugs work; and a general overview of biochemical and pharmaceutical marketing. The design and management of clinical trials, which are key factors for development of any new therapeutic agent will also be covered in the course. The challenges for commercialisation of innovative methods and/or biochemical and pharmaceutical products and aspects of intellectual property protection will be elaborated. Ultimately the aspects of Good Manufacturing Practice (GMP) and international legislation for marketing pharmaceutical products will be illuminated.

Lectures in this course will be delivered by both University of Sydney staff and by a number of visiting professional representatives from industry and government agencies. We will also arrange a site visit for a bio-manufacturing company as warranted.

When you successfully complete this course you acquire knowledge about drug formulation, pharmaceutical processing including physical processes, legislation governing the bio-manufacturing and commercialisation of biochemicals and pharmaceuticals. The information would be beneficial for your future career in pharmaceutical manufacturing companies.

Students are encouraged to engage in an interactive environment for exchange of information. This course will be assessed by quizzes, assignments, oral presentation and final report.This unit of study is offered as an advanced elective unit of study to final year undergraduate students. Students may be required to attend lectures off-campus.

CHNG5604
Membrane Engineering Laboratory

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 4 hrs/week. **Assumed knowledge:** CHNG5601 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This a practical unit of study where students apply the theoretical concepts of membrane science to engineering practice via a series of laboratory experiments. The students will gain practical insights into mass transport processes through various membranes. Students will understand the construction and functional properties of synthetic separation membranes and also will explore experimentally the various factors affecting the performance of membranes.

COMP5048
Visual Analytics

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assumed knowledge:** It is assumed that students will have basic knowledge of data structures, algorithms and programming skills. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Visual Analytics aims to facilitate the data analytics process through Information Visualisation. Information Visualisation aims to make good pictures of abstract information, such as stock prices, family trees, and software design diagrams. Well designed pictures can convey this information rapidly and effectively.

The challenge for Visual Analytics is to design and implement "effective Visualisation methods that produce pictorial representation of complex data so that data analysts from various fields (bioinformatics, social network, software visualisation and network) can visually inspect complex data and carry out critical decision making.

This unit will provide basic HCI concepts, Visualisaiton techniques and fundamental algorithms to achieve good visualisation of abstract information. Further, it will also provide opportunities for academic research and developing new methods for Visual Analytic methods.

ELEC5701
Technology Venture Creation

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Workgroup 1 hr/week. **Prohibitions:** ENGG5102 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study prepares graduating students with insight and skills in how to turn a concept into a high technology startup company. The class will provide students with knowledge, practical experience and frameworks to assist in evaluating the market for a technology product or service, the design & viability of business models around it, the formulation of a funding-reading business plan & financials, capital raising options & process, venture capital, building distribution channels, intellectual property protection, putting together an A-grade management team, term sheets & funding documentation, technology sales models and going global. We will look at real world case studies of successful technology companies (and flame outs). Does Twitter have a viable business model? Will Facebook eat its lunch? Is YouTube just burning cash? Will Google rule the world?

During the period of the course, students will form teams and write a business plan around a concept they propose. Each student will assume a role in the team (CEO, CTO, CFO, VP Sales & Marketing). The plan will be judged by a panel of real world venture capitalists, entrepreneurs and angel investors to determine the final grade for the course.

Be warned that a serious commitment will be required in developing the concept into a viable business plan. The outcome, however, will be very rewarding to those students interested in starting the next Google.

This course is taught by instructors experienced in technology startups & venture capital. The course will include a number of guest lectures by industry.

ELEC3803
Bioelectronics

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; LaboratoryTutorial 2 hrs/week. **Prerequisites:** ELEC2104 OR ELEC2602. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Familiarity with transistor operations, basic electrical circuits, embedded programming is required.

This unit will cover recent advances in bioelectronics circuits and systems including electronic medical devices, implanted devices, lab on a chip devices, biomedical signal processing and neuromorphic engineering. Regulatory aspects of bioelectronic system design will be addressed including the IEC standards and TGA approval processes. The unit will have a strong practical design focus with laboratories focused on dealing with real life bioelectronic signals and subject-device interfaces. Industry, clinical and research guest lecturers will introduce current topics and design needs.

ELEC5514
Networked Embedded Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Assumed knowledge:** ELEC3305, ELEC3506, ELEC3607 and ELEC5508 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aim to teach the fundamentals concepts associated with:

oNetworked Embedded Systems, wireless sensor networks

oWireless channel propagation and radio power consumption

oWireless networks, ZigBee, Bluetooth, etc.

oSensor principle, data fusion, source detection and identification

oMultiple source detection, multiple access communications.

oNetwork topology, routing, network information theory

oDistributed source channel coding for sensor networks

oPower-aware and energy-aware communication protocols.

oDistributed embedded systems problems such as time synchronization and node localization,

Exposure to several recently developed solutions to address problems in wireless sensor networks and ubiquitous computing giving them a well-rounded view of the state-of the-art in the networked embedded systems field.

Student involvement with projects will expose them to the usage of simulators and/or programming some types of networked embedded systems platforms.

oAbility to identify the main issues and trade-offs in networked embedded systems.

oUnderstanding of the state-of-the-art solutions in the area

oBased on the above understanding, ability to analyze requirements and devise first-order solutions for particular networked embedded systems problems.

oFamiliarization with a simulator platform and real hardware platforms for network embedded systems through the students involvement in project

Students must enrol in 12 credit points from the following block of Thesis units.

Select 6 cp from:

AMME4111
Honours Thesis A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research 10 hrs/week. **Prerequisites:** 36 credits of 3rd year units of study. **Prohibitions:** AMME4010, AMME4121, AMME4122 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: Honours Thesis A is only available to students with an HWAM of 65 or over. HWAM is a weighted average based on all 2000, 3000 and 4000 level units completed prior to enrolment in this unit. Prospective students in Honours Thesis A are expected to have consulted with supervisors and selected a topic of interest at the end of third year, guided by the advertised list of suggested thesis topics and supervisors. Availability of topics is limited and students should undertake to speak with prospective supervisors as soon as possible. Students who are unable to secure a supervisor and topic will be allocated a supervisor by the unit coordinator. Alternatively, students may do a thesis with a supervisor in industry or in another university department. In this case, the student must also find a second supervisor within the School of AMME.

The fourth year honours thesis aims to provide students with the opportunity to carry out a defined piece of independent research in a setting and in a manner that fosters the development of engineering research skills. These skills include the capacity to define a research question, showing how it relates to existing knowledge, identifying the tools needed to investigate the question, carrying out the research in a systematic way, analysing the results obtained and presenting the outcomes in a report that is clear, coherent and logically structured. Honours thesis is undertaken across two semesters of enrolment, in two successive Units of Study of 6 credits points each. Honours Thesis A covers first steps of thesis research starting with development of research proposal. Thesis B covers the second of stage writing up and presenting the research results.

Students are asked to write a thesis based on a research project, which is very often related to some aspect of a staff member's research interests. Some projects will be experimental in nature, others may involve computer-based simulation, feasibility studies or the design, construction and testing of equipment. Direction of thesis work may be determined by the supervisor or be of an original nature, but in either case the student is responsible for the execution of the practical work and the general layout and content of the thesis itself. The final thesis must be the student's individual work, although research is sometimes conducted in the framework of a group project shared with others. Students undertaking research on this basis will need to take care in ensuring the individual quality of their own research work and the final thesis submission. The thesis will be judged on the extent and quality of the student's original work and particularly how critical, perceptive and constructive he or she has been in assessing his/her work and that of others. Students will also be required to present the results of their findings to their peers and supervisors as part of a seminar program.

It is not expected that a thesis at this level will represent a significant contribution to new knowledge; nor is it expected that theses will resolve great intellectual problems. The timeframe available for the thesis is simply too short to permit students to tackle complex or difficult problems. Indeed, a key aim of the thesis is to specify a research topic that arouses sufficient intellectual curiosity, and presents an appropriate range and diversity of technical and conceptual challenges, while remaining manageable and allowing achievable outcomes within the time and resources available. It is important that the topic be of sufficient scope and complexity to allow a student to learn their craft and demonstrate their research skills. Equally imperative is that the task not be so demanding as to elude completion.

CHNG4811
Honours Thesis A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Meeting 1 hr/week; Project Work - own time 5 hrs/week. **Prerequisites:** CHNG3801, CHNG3802, CHNG3803, CHNG3805, CHNG3806, CHNG3807. **Prohibitions:** CHNG4814, CHNG4813 **Assumed knowledge:** Enrolment in this unit of study assumes that all (six) core chemical engineering UoS in third year have been successfully completed. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: This unit is available to only those students who have gained an entry to the Honours degree. School permission required for enrolment in semester 2.

The ability to plan, systematically conduct and report on a major research project is an important skill for professional engineers. This unit of study builds on technical competencies introduced in previous years, as well as making use of the report writing and communications skills the students have developed. The research activity is spread over two units (Chemical Engineering Thesis A and B) run in first and second semester. In this unit of study, students are required to plan and begin work on a major research project, which is very often some aspect of a staff member`s research interests. Some of the projects will be experimental in nature, while others may involve computer-based simulation, design or literature surveys. In this unit, students will learn how to examine published and experimental data, set objectives, organize a program of work and devise an experimental or developmental program. The progress at the end of Thesis A will be evaluated based on a seminar presentation and a progress report. The skills acquired will be invaluable to students undertaking engineering work. Students are expected to take the initiative when pursuing their research projects. The supervisor will be available for discussion - typically 1 hour per week.

ELEC4712
Honours Thesis A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Project Work - own time 12 hrs/week. **Prerequisites:** 36 credits of 3rd year units of study **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: Note that students require permission from the HOS to do both A and B units in the same Semester, and will have an accelerated assessment schedule. Note also that entry to Honours Thesis is by permission.

Students will work individually or in groups on an assigned project for the Semester. The concepts covered depend on the nature of the project, but broadly cover research and inquiry, and information literacy. While recognising that some projects can be interdisciplinary in nature, it is the normal expectation that the students would do the project in their chosen area of specialisation, i.e. Power Engineering, Telecommunications Engineering, Computer Engineering, and Software Engineering students would do projects in the general area of Power, Telecommunications, Computer, and Software respectively.

These units are normally taken in Semester 1.

Select 6 cp from:

AMME4112
Honours Thesis B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research 10 hrs/week. **Prerequisites:** 36 credits of 3rd year units of study and WAM 65 or over **Prohibitions:** AMME4010, AMME4122, AMME4121 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: HWAM of 65 or greater required for enrolment. HWAM is the weighted average of all 2000, 3000 and 4000 level units completed prior to enrolment in this unit.

The fourth year honours thesis aims to provide students with the opportunity to carry out a defined piece of independent research or design work in a setting and in a manner that fosters the development of engineering skills in research or design. These skills include the capacity to define a research or design question, showing how it relates to existing knowledge, identifying the tools needed to investigate the question, carrying out the research or design in a systematic way, analysing the results obtained and presenting the outcomes in a report that is clear, coherent and logically structured. Honours thesis is undertaken across two semesters of enrolment, in two successive Units of Study of 6 credits points each. Honours Thesis A covers first steps of thesis research starting with development of research proposal. Thesis B covers the second of stage writing up and presenting the research results.

Students are asked to write a thesis based on a research or major design project, which is very often related to some aspect of a staff member's research interests. Some projects will be experimental in nature, others may involve computer-based simulation, feasibility studies or the design, construction and testing of equipment. Direction of thesis work may be determined by the supervisor or be of an original nature, but in either case the student is responsible for the execution of the practical work and the general layout and content of the thesis itself. The final thesis must be the student's individual work, although research is sometimes conducted in the framework of a group project shared with others. Students undertaking research on this basis will need to take care in ensuring the individual quality of their own research work and the final thesis submission. The thesis will be judged on the extent and quality of the student's original work and particularly how critical, perceptive and constructive he or she has been in assessing his/her work and that of others. Students will also be required to present the results of their findings to their peers and supervisors as part of a seminar program.

It is not expected that a thesis at this level will represent a significant contribution to new knowledge; nor is it expected that theses will resolve great intellectual problems. The time frame available for the thesis is simply too short to permit students to tackle complex or difficult problems. Indeed, a key aim of the thesis is to specify a research or design topic that arouses sufficient intellectual curiosity, and presents an appropriate range and diversity of technical and conceptual challenges, while remaining manageable and allowing achievable outcomes within the time and resources available. It is important that the topic be of sufficient scope and complexity to allow a student to learn their craft and demonstrate their research or design skills. Equally imperative is that the task not be so demanding as to elude completion.

CHNG4812
Honours Thesis B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Meeting 1 hr/week; Project Work - own time 5 hrs/week. **Corequisites:** CHNG4811 **Prohibitions:** CHNG4814, CHNG4813 **Assumed knowledge:** Enrolment in this unit of study assumes that Honours Thesis A and all (six) core chemical engineering units of study in third year have been successfully completed. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: This unit is available to only those students who have gained an entry to the Honours degree. School permission required for enrolment in the semester 1.

The ability to plan, systematically conduct and report on a major research project is an important skill for professional engineers. This unit of study builds on technical competencies introduced in previous years, as well as making use of the report writing and communications skills the students have developed. The research activity is spread over two units (Honours Thesis A and B) run in first and second semester. In this unit of study, the primary emphasis is on the execution of a comprehensive and systemic series of investigations, and the reporting of the study in a major thesis document and an oral presentation. Students will acquire skills in developing a plan for a series of studies to illuminate an area of research, in evaluating alternatives at the conceptual level with a view to creating a `short-list` worthy of more detailed technical investigation, and in searching the literature for guidance of the studies. Further, communication skills will be developed, such as the ability to clearly present the background and results in a written format and in an oral presentation to a general engineering audience. This UoS is part of an integrated (two semester) fourth year program involving a chemical engineering research project and thesis. It has the overarching aim of completing the `vertical integration` of knowledge - one of the pillars on which this degree program is based. Students who have successfully completed CHNG4203 Major Industrial Project may apply for exemption from this unit of study and replace it with an advanced level chemical engineering elective unit of study.Students are expected to take the initiative when pursuing their research projects. The supervisor will be available for discussion - typically 1 hour per week.

ELEC4713
Honours Thesis B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Project Work - own time 12 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: Note that students require permission from the HOS to do both A and B units in the same Semester, and will have an accelerated assessment schedule. Note also that entry to Honours Thesis is by permission.

Students will work individually or in groups on an assigned project for the Semester. The concepts covered depend on the nature of the project, but broadly cover research and inquiry, and information literacy.

These units are normally taken in semester 2

Acceptable alternative units of study

Most units of study offered by the Faculty of Science shown in the tables can be replaced by an equivalent advanced level unit, subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing advanced options should seek advice from their department before enrolling.Students undertaking Study Abroad in a particular year of their degree must enrol in the appropriate International Exchange Program units of study as an alternative to a semester's standard units.

Requirements for a major

Completion of the Bachelor of Engineering(Biomedical) as a stand alone degree requires that a major sequence of units be completed in order to meet total degree requirements. The available majors are: (1) Mechanical Engineering(2) Electrical Engineering(3) Chemical and Biomolecular Engineering(4) Information Technology(5)

Mechatronic EngineeringThe sequence of units required to complete a major in one of these areas is shown in the following tables.

Mechanical Engineering Major

ENGG1802
Engineering Mechanics

Credit points: 6 **Session:** Semester 2, Summer Main **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit aims to provide students with an understanding of and competence in solving statics and introductory dynamics problems in engineering. Tutorial sessions will help students to improve their group work and problem solving skills, and gain competency in extracting a simplified version of a problem from a complex situation. Emphasis is placed on the ability to work in 3D as well as 2D, including the 2D and 3D visualization of structures and structural components, and the vectorial 2D and 3D representations of spatial points, forces and moments. Introduction to kinematics and dynamics topics includes position, velocity and acceleration of a point; relative motion, force and acceleration, momentum, collisions and energy methods.

AMME2500
Engineering Dynamics

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs **Prerequisites:** ENGG1802 and (MATH1001 or MATH1901) and (MATH1002 or MATH1902) **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to teach: Dynamics of Rigid Bodies: Analysis of Planar mechanisms; Kinematics of rigid bodies; Kinetics of rigid bodies. Students will also develop their skills in: how to model and analyse dynamic systems and the application of theory to real systems through practical/laboratory sessions.

At the end of this unit students will have developed skills in modelling and analysing planar mechanisms and rigid body dynamic systems.

Course content will include planar mechanisms, linkages, mobility; instant centres of rotation, Kennedy's theorem; velocity and acceleration polygons; kinematics of rigid bodies, frames of reference, velocity and acceleration, rotating frame of reference, relative velocity and acceleration, gyroscopic acceleration; kinetics of rigid bodies, linear momentum and Euler's first law; angular momentum and Euler's second law; centre of mass; moments of inertia, parallel axis and parallel plane theorems, principal axes and principal moments of inertia, rotation about an axis; impulse and momentum; work and energy, kinetic and potential energies; applications to orbital and gyroscopic motion; introduction to Lagrangian methods.

AMME2301
Mechanics of Solids

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** ENGG1802, MATH1001, MATH1002, MATH1003 **Assessment:** Through semester assessment (35%) Final Exam (65%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Equilibrium of deformable structures; basic concept of deformation compatibility; stress and strain in bars, beams and their structures subjected to tension, compression, bending, torsion and combined loading; statically determinate and indeterminate structures; energy methods for bar and beam structures; simple buckling; simple vibration; deformation of simple frames and cell box beams; simple two-dimensional stress and Morh's circle; problem-based applications in aerospace, mechanical and biomedical engineering.

MECH3261
Fluid Mechanics 2

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs. **Prerequisites:** AMME2200 OR AMME2261. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to provide students with a detailed understanding of the theory and practice of fluid mechanics in the context of mechanical engineering. Students will gain skills in problem solving in areas of pipe, pump and channel flow; lift and drag on immersed bodies; boundary layer theory and gas dynamics.

At the end of this unit students will have the ability to critically assess and solve problems commonly found in fluid mechanics practice, such as sizing pumps and piping systems, designing channels, and determing the lift and drag characteristics of submerged bodies. Additionally, they will develop a structured and systematic approach to problem solving.

AMME3500
System Dynamics and Control

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week. **Prerequisites:** ((MATH2061 or MATH2961) and (MATH2065 or MATH2965)) or MATH2067 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to allow students to develop an understanding of methods for modeling and controlling linear, time-invariant systems. Techniques examined will include the use of differential equations and frequency domain approaches to modeling of systems. This will allow students to examine the response of a system to changing inputs and to examine the influence of external stimuli such as disturbances on system behaviour. Students will also gain an understanding of how the responses of these mechanical systems can be altered to meet desired specifications and why this is important in many engineering problem domains.

The study of control systems engineering is of fundamental importance to most engineering disciplines, including Electrical, Mechanical, Mechatronic and Aerospace Engineering. Control systems are found in a broad range of applications within these disciplines, from aircraft and spacecraft to robots, automobiles, computers and process control systems. The concepts taught in this course introduce students to the mathematical foundations behind the modelling and control of linear, time-invariant dynamic systems. In particular, topics addressed in this course will include:

1. Techniques for modelling mechanical systems and understanding their response to control inputs and disturbances. This will include the use of differential equations and frequency domain methods as well as tools such as Root Locus and Bode plots.

2. Representation of systems in a feedback control system as well as techniques for determining what desired system performance specifications are achievable, practical and important when the system is under control

3. Theoretical and practical techniques that help engineers in designing control systems, and an examination of which technique is best in solving a given problem.

MECH2400
Mechanical Design 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 1 hr/week. **Assumed knowledge:** ENGG1801 and ENGG1802, HSC Maths and Physics **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Aim: For students to experience a realistic the design process and to develop good engineering skills.

Course Objectives: To develop an understanding of:

1. the need for and use of standard drawings in the communication and definition of parts and assemblies,

2. Efficient use of a CAD package

3. creativity,

4. the design process from initial idea to finished product

5. Methods used to analyse designs

6. standard components.

MECH3361
Mechanics of Solids 2

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 6 hrs. **Prerequisites:** AMME2301 and AMME2302 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The UoS aims to: teach the fundamentals of analysing stress and deformation in a solid under complex loading associated with the elemental structures/components in aerospace, mechanical and biomedical engineering; develop the following attributes: understand the fundamental principles of solid mechanics and basic methods for stress and deformation analysis of a solid structure/element in the above mentioned engineering areas; gain the ability to analyse problems in terms of strength and deformation in relation to the design, manufacturing and maintenance of machines, structures, devices and elements in the above mentioned engineering areas.

At the end of this unit students will have a good understanding of the following: applicability of the theories and why so; how and why to do stress analysis; why we need equations of motion/equilibrium; how and why to do strain analysis; why we need compatibility equations; why Hooke`s law, why plasticity and how to do elastic and plastic analysis; how and why to do mechanics modelling; how to describe boundary conditions for complex engineering problems; why and how to solve a mechanics model based on a practical problem; why and how to use energy methods for stress and deformation analysis; why and how to do stress concentration analysis and its relation to fracture and service life of a component/structure; how and why to do fundamental plastic deformation analysis; how and why the finite element method is introduced and used for stress and deformation analysis.

The students are expected to develop the ability of solving engineering problems by comprehensively using the skills attained above. The students will get familiar with finite element analysis as a research and analysis tool for various real-life problems.

MECH3362
Materials 2

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory, Independent Study **Prerequisites:** AMME2301 and AMME2302 **Assumed knowledge:** This subject requires you to have two important skills to bring in: (1) A good understanding of basic knowledge and principles of material science and engineering from AMME2302 (MECH2300) Materials I and mechanics of solids for simple structural elements (in tension, bending, torsion) from AMME2301 (AERO2300); (2) Reasonable mathematical skills in calculation of stresses and strains in simple structural elements. **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims for students to understand the relationship between properties of materials and their microstructures and to improve mechanical design based on knowledge of mechanics and properties of materials.

At the end of this unit students should have the capability to select proper materials for simple engineering design.

Course content will include: short-term and long-term mechanical properties; introductory fracture and fatigue mechanics, dislocations; polymers and polymer composite materials; ceramics and glasses; structure-property relationships; selection of materials in mechanical design.

Electrical Engineering Major

ELEC1601
Foundations of Computer Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** HSC Mathematics extension 1 or 2 **Assessment:** Through semester assessment (61%) Final Exam (39%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study introduces the fundamental digital concepts upon which the design and operation of modern digital computers are based. A prime aim of the unit is to develop a professional view of, and a capacity for inquiry into, the field of computing.

Topics covered include: data representation, basic computer organisation, the CPU, elementary gates and logic, peripheral devices, software organisation, machine language, assembly language, operating systems, data communications and computer networks.

PHYS1001
Physics 1 (Regular)

Credit points: 6 **Session:** Semester 1 **Classes:** Three 1-hour lectures, one 3-hour laboratory per week for 9 weeks and one 1-hour tutorial per week. **Prerequisites:** HSC Physics with a minimum mark of 65 **Prohibitions:** PHYS1002, EDUH1017, PHYS1901 **Assumed knowledge:** HSC Physics **Assessment:** 3 hour exam plus laboratories, assignments and mid-semester tests (100%). **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for students who gained 65 marks or better in HSC Physics or equivalent.The lecture series contains three modules on the topics of mechanics, thermal physics, and oscillations and waves.

Textbooks

Young & Freedman. University Physics. 13th edition, with Mastering Physics, Addison-Wesley. 2012. Course lab manual.

PHYS1003
Physics 1 (Technological)

Credit points: 6 **Session:** Semester 2 **Classes:** Three 1-hour lectures, one 3-hour laboratory per week for 10 weeks, one 1-hour tutorial per week. **Prohibitions:** PHYS1902, PHYS1004 **Assumed knowledge:** HSC Physics or PHYS1001 or PHYS1002 or PHYS1901 or equivalent. **Assessment:** 3 hour exam plus laboratories, tutorials, and assignments (100%). **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: It is recommended that PHYS1001 or PHYS1002 or PHYS1901 be completed before this unit

This unit of study is designed for students majoring in physical and engineering sciences and emphasis is placed on applications of physical principles to the technological world. The lecture series contains modules on the topics of fluids, electromagnetism, and quantum physics.

Textbooks

Young & Freedman. University Physics. 13th edition, with Mastering Physics. Addison-Wesley. Course lab manual.

ELEC2602
Digital Logic

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week; Laboratory pre-work 2 hrs/week. **Assumed knowledge:** ELEC1601. This unit of study assumes some knowledge of digital data representation and basic computer organisation **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The purpose of this unit is to equip the students with the skills to design simple digital logic circuits which comprise modules of larger digital systems.

The following topics are covered: logic operations, theorems and Boolean algebra, number operations (binary, hex, integer and floating point), combinational logic analysis and synthesis, sequential logic, registers, counters, bus systems, state machines, simple CAD tools for logic design, and the design of a simple computer.

ELEC3803
Bioelectronics

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; LaboratoryTutorial 2 hrs/week. **Prerequisites:** ELEC2104 OR ELEC2602. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Familiarity with transistor operations, basic electrical circuits, embedded programming is required.

This unit will cover recent advances in bioelectronics circuits and systems including electronic medical devices, implanted devices, lab on a chip devices, biomedical signal processing and neuromorphic engineering. Regulatory aspects of bioelectronic system design will be addressed including the IEC standards and TGA approval processes. The unit will have a strong practical design focus with laboratories focused on dealing with real life bioelectronic signals and subject-device interfaces. Industry, clinical and research guest lecturers will introduce current topics and design needs.

Select 18 cp from the following block of units,

ELEC3304
Control

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs. **Prerequisites:** MATH2061 and ELEC2302 **Prohibitions:** AMME3500 **Assumed knowledge:** Specifically the following concepts are assumed knowledge for this unit: familiarity with basic Algebra, Differential and Integral Calculus, Physics; solution of linear differential equations, Matrix Theory, eigenvalues and eigenvectors; linear electrical circuits, ideal op-amps; continuous linear time-invariant systems and their time and frequency domain representations, Laplace transform, Fourier transform. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit is mainly concerned with the application of feedback control to continuous-time, linear time-invariant systems. It aims to give the students an appreciation of the possibilities in the design of control and automation in a range of application areas. The concepts learnt in this unit will be made use of heavily in many units of study in the areas of communication, control, electronics, and signal processing.

The following specific topics are covered: Modelling of physical systems using state space, differential equations, and transfer functions, dynamic response of linear time invariant systems and the role of system poles and zeros on it, simplification of complex systems, stability of feedback systems and their steady state performance, Routh-Hurwitz stability criterion, sketching of root locus and controller design using the root locus, Proportional, integral and derivative control, lead and lag compensators, frequency response techniques, Nyquist stability criterion, gain and phase margins, compensator design in the frequency domain, state space design for single input single-output systems, pole placement state variable feedback control and observer design.

ELEC3305
Digital Signal Processing

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs; Laboratory 2 hrs; Project Work - own time 1 hr. **Prerequisites:** ELEC2302 **Assumed knowledge:** Specifically the following concepts are assumed knowledge for this unit: familiarity with basic Algebra, Differential and Integral Calculus, continuous linear time-invariant systems and their time and frequency domain representations, Fourier transform, sampling of continuous time signals. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to teach how signals are processed by computers. It describes the key concepts of digital signal processing, including details of various transforms and filter design. Students are expected to implement and test some of these ideas on a digital signal processor (DSP). Completion of the unit will facilitate progression to advanced study in the area and to work in the industrial use of DSP.

The following topics are covered. Review of analog and digital signals. Analog to digital and digital to analog conversion. Some useful digital signals. Difference equations and filtering. Impulse and step response of filters. Convolution representation of filters. The Z-transform. Transfer functions and stability. Discrete time Fourier transform (DTFT) and frequency response of filters. Finite impulse response (FIR) filter design: windowing method. Infinite impulse response (IIR) filter design: Butterworth filters, Chebyshev filters, Elliptic filters and impulse invariant design. Discrete Fourier Transform (DFT): windowing effects. Fast Fourier Transform (FFT): decimation in time algorithm. DSP hardware.

ELEC3404
Electronic Circuit Design

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/fortnight; Laboratory 3 hrs/fortnight. **Assumed knowledge:** A background in basic electronics and circuit theory is assumed. **Assessment:** Through semester assessment (70%) Final Exam (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to teach students analysis and design techniques for electronic systems such as signal amplifiers, differential amplifiers and power amplifiers. Completion of this unit will allow progression to advanced studies or to work in electronics and telecommunication engineering.

Topics covered are as follows. The BJT and MOSFET as an amplifier. Biasing in amplifier circuits. Small signal operation and models. Single stage amplifiers. Internal capacitances and high frequency models. The frequency response of the common-emitter amplifier. Current sources and current mirrors. Differential amplifiers. Output stages and power amplifiers:class A, class B and class AB.

ELEC3607
Embedded Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week. **Prerequisites:** ELEC1601 and ELEC2602 **Assumed knowledge:** ELEC1601 AND ELEC2602. Logic operations, theorems and Boolean algebra, data representation, number operations (binary, hex, integers and floating point), combinational logic analysis and synthesis, sequential logic, registers, counters, bus systems, state machines, simple CAD tools for logic design, basic computer organisation, the CPU, peripheral devices, software organisation, machine language, assembly language, operating systems, data communications and computer networks. **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Embedded systems have become pervasive in modern society. The aim of this unit of study is to teach students about embedded systems architecture, design methodology, interfacing and programming. Topics covered include peripheral devices, interrupts, direct memory access (DMA), assembly language, communications and data acquisition. A major design project is part of this course.

Chemical and Biomolecular Major

CHNG1103
Material & Energy Transformations Intro

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The students should develop an understanding of and competence in the formulation and solution of material and energy balance problems in engineering; develop competence in using basic flowsheet analysis and appropriate computational tools; improve their group work and problem solving skills; gain an ability to extract a simplified version of a problem from a complex situation.

Material Transformation related topics include: unit systems and unit conversions; properties of solids, fluids and gases; mass balance calculations on batch and flow systems; balances on multiple units processes, balances on reactive systems, recycle, bypass and purge calculations; equilibrium compositions of reacting systems; vapour pressure and humidity. Energy transformations include the following topics: apply the first law of thermodynamics to flow and batch systems in process industries; understand thermodynamic properties such as internal energy, enthalpy and heat capacity; conduct energy balances for sensible heat changes, phase transformations and reactive processes for practical industrial systems; understand the applications of psychrometry, refrigeration, heat of formation and combustion in industry.

CHNG2801
Conservation and Transport Processes

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs/week; Presentation 4 hrs. **Prerequisites:** (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 OR MATH1015 OR MATH1905) AND ENGG1801 AND CHNG1103 AND (CHEM1101 OR CHEM1901) AND (CHEM1102 OR CHEM1902) **Corequisites:** CHNG2802 AND CHNG2803. **Assumed knowledge:** Calculus, Computations (Matlab, Excel), Mass and Energy Balances. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

In the design and analysis of chemical processes, chemical engineers have to understand integrated concepts in conservation of mass and energy, properties of fluids, heat transfer and the mass transfer of chemical species through the processes. This is true not only in traditional chemical engineering areas such as petrochemicals, but also for emerging fields like micro-reactors and biotechnology. This course is an introduction to the fundamental concepts in transport phenomena necessary for subsequent courses ranging from unit operations to reactor design and reaction kinetics. The course builds on concepts from elementary physics and chemistry, as well as calculus and differential equations.

This module will provide students with working knowledge of conservation of mass and energy, momentum, mass and energy transfer, and non-reaction rate processes. These aspects are a first step to the understanding of transport phenomena. It considers the classification of fluids and their properties. The integral and differential forms of the fundamental equations - continuity, momentum and energy equations are studied. The concepts of transfer rates of momentum, heat and mass as functions of appropriate driving forces divided by appropriate resistances will be introduced. The way in which such resistances and driving forces are defined will be reviewed. An aim of this unit of study is to provide theoretical support for other core units of study, particularly CHNG2803 through being able to apply the principles of conservation and transport processes to any problem. This unit of study also uses techniques that will be taught in CHNG2802, particularly the techniques for predicting the flows in piping networks.

CHNG2804
Chemical & Biological Systems Behaviour

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 OR MATH1015 OR MATH1905) AND ENGG1801 AND CHNG1103 AND (CHEM1101 OR CHEM1901) AND (CHEM1102 OR CHEM1902) **Corequisites:** CHNG2805 AND CHNG2806. **Assumed knowledge:** Ability to conduct mass and energy balances, and the integration of these concepts to solve real chemical engineering problems. Ability to understand basic principles of physical chemistry, physics and mechanics. Ability to use mathematics of calculus (including vector calculus) and linear algebra, and to carry out computations with Matlab and MS-Excel. **Assessment:** Through semester assessment (70%) Final Exam (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is a core unit within the curriculum. Chemical Engineering requires an understanding of material and energy transformations and how these are driven by molecular interactions. The rate of such transformations is dependent on driving forces and resistances, and these need to be defined in terms of fundamental physical and chemical properties of systems. This course seeks to provide students with a sound basis of the thermodynamics of chemical and biological systems, and how these, in turn, define limits of behaviour for such real systems. The thermodynamic basis for rate processes is explored, and the role of energy transfer processes in these highlighted, along with criteria for equilibrium and stability. Emphasis is placed on the prediction of physical properties of chemical and biological systems in terms of state variables. The course delivery mechanism is problem-based, and examples from thermal, chemical and biological processes will be considered, covering molecular to macro-systems scale. The course builds naturally from the second year first semester course in conservation and transport processes, and prepares students fundamentally for the third year course in design of chemical and biological processes, which deals fundamentally with reaction/separation systems, and considers phase and chemical equilibria.

CHNG2805
Industrial Systems and Sustainability

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 OR MATH1015 OR MATH1905) AND ENGG1801 AND CHNG1103 AND (CHEM1101 OR CHEM1901) AND (CHEM1102 OR CHEM1902) **Corequisites:** CHNG2804 AND CHNG2806. **Assumed knowledge:** Ability to conduct mass and energy balances, and the integration of these concepts to solve real chemical engineering problems. Ability to understand basic principles of physical chemistry, physics and mechanics. Ability to use mathematics of calculus (including vector calculus) and linear algebra, and carry out computations with MATLAB and MS EXCEL. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course involves the study of the various concepts which underpin sustainable development, including technical and economic efficiency, stewardship of the bio-physical environment, and social acceptability. The course examines the material economy from the perspective of open and closed thermodynamic systems, and the implications of this for resource and energy consumption, and waste generation. A number of governing sustainability frameworks are examined to determine their suitability within the context of chemical engineering. A range of approaches and tools for determining industries environmental performance are introduced as part of a sustainability framework. Energy production and use, and product design are investigated from a sustainability perspective. Green Engineering principles are highlighted as a potential method for transforming industry.

CHNG2806
Materials Purification and Recovery

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorials/Practicals 3 hrs/week. **Prerequisites:** (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 OR MATH1015 OR MATH1905) AND ENGG1801 AND CHNG1103 AND (CHEM1101 OR CHEM1901) AND (CHEM1102 OR CHEM1902) **Corequisites:** CHNG2804 AND CHNG2805. **Assumed knowledge:** Ability to conduct mass and energy balances, and the integration of these concepts to solve real chemical engineering problems. Ability to understand basic principles of physical chemistry, physics and mechanics. Ability to use mathematics of calculus (including vector calculus) and linear algebra, and carry out computations with MATLAB and MS EXCEL. Ability to read widely outside of the technical literature, and to synthesise arguments based on such literature. Ability to write coherent reports and essays based on qualitative and quantitative information **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

To recognise that chemical engineers are involved in creation of products and processes, in manipulating complex systems, and in managing technical operations. To develop an appreciation of the practical application of concepts and tools to real design problems in the process, products and service sectors in which chemical engineers are engaged. To consider this through three project-driven case studies covering a range of integrated analysis scenarios, from the domain of energy and fluid systems. This course is a concurrent requirement for the concept and enabling technology courses running in parallel in the same semester.

CHNG3801
Process Design

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** CHNG2801; CHNG2802; CHNG2803; CHNG2804; CHNG2805; CHNG2806 **Corequisites:** CHNG3803, CHNG3802 **Assumed knowledge:** Enrolment in this unit of study assumes that all (six) core chemical engineering UoS in second year have been successfully completed. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study consists of two strands: (1) vapour-liquid equilibrium and distillation and (2) heat transfer and heat exchangers. The central aim is to show how these unit operations interact in the design and operation of process equipment. The first strand focuses on the following; numerical methods for predicting vapour-liquid equilibrium; binary and multi-component distillation; deviations from ideal behaviour. The second strand of this unit of study focuses on the understanding of the differences between various conventional heat exchanger types and their strengths and weaknesses. Students will understand and be able to design a range of conventional heat exchangers using a systematic approach, and will focus on design and heat transfer calculations. The two strands make extensive use of computer software: Excel and Matlab for data manipulation and equation solving; commercial flowsheeting software (Hysys) for solving engineering design problems. This unit of study runs concurrently with another enabling technology unit of study CHNG3802. These two units together provide students with the tools and know-how to tackle real-life engineering problems encountered in the concurrent project-based unit of study, CHNG3803. This integrated course structure is designed to help students become familiar with the multi-disciplinary nature of chemical engineering today.

CHNG3802
Control and Reaction Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** CHNG2801; CHNG2802; CHNG2803; CHNG2804; CHNG2805; CHNG2806 **Corequisites:** CHNG3801; CHNG3803 **Assumed knowledge:** Enrolment in this unit of study assumes that all (six) core chemical engineering UoS in second year have been successfully completed. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Aims and Objectives: This Unit of study has two strands: the first is reaction engineering while the second is concerned with process modelling and process control. The first strand of this unit of study focuses on the understanding of the key concepts of reaction engineering in process design. It covers reaction kinetics, stoichiometry, reactor design, multiple reaction systems, catalysis and using reaction data to estimate rate laws. All industrial processes require some process monitoring and control for satisfactory operation. The first strand commences with process data management before moving on to empirical modelling. The second strand will concentrate on the role of process control covering: the development of linear models, control system analysis, the design and performance of feedback control systems, and the use of control related software. This UoS demonstrates that: process control is an integral concept for any modern plant; a unified approach allows a diversity of application fields to be readily handled via a consistent approach from data analysis, though process control to process optimisation. The UoS will allow each student to achieve and demonstrate competency through a range of individual and group-based activities. By the end of this UoS a student should achieve competence in the following: process data management skills relevant to engineering (data-based modelling and data reconciliation techniques); appreciation of the role of process control in modern manufacturing; designing an appropriate feedback control system and analysing its performance for a range of process applications using both traditional and software-based techniques; appreciation of the limitations of feedback control and be able to design a range of common enhancements; appreciate the limitations that exist whenever mathematical models are used as the basis for process control; appreciate the 'vertical integration' that exists from modelling, through control, to optimisation. This UoS is part of an integrated third-year program in chemical engineering. Completion of this body of work is required before a student will be permitted to move into the final-year with its emphasis on detailed design work, thesis based research and advanced engineering options.

CHNG3804
Biochemical Engineering

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Project Work - in class 2 hrs/week; Laboratory 4 hrs; Independent Study, **Prerequisites:** CHEM1101 and CHEM1102 and CHNG1103 and CHNG2801 and CHNG2802 and CHNG2803 and CHNG2804 and CHNG2805 and CHNG2806 and MATH1001 and MATH1002 and MATH1003 and MATH1005 **Assumed knowledge:** Enrolment in this unit of study assumes that all (six) core chemical engineering units of study in second year have been successfully completed. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Biochemical engineering is increasingly playing an important role in technology to modern society. The engineers with knowledge of various aspects of biochemical processes are tremendously valuable. The course will examine cutting edge examples of biochemical technologies across a broad range of applications relevant to chemical engineering. The specific objectives of this course are to understand the history and scope of the biotechnology industry; examine the role of biochemical engineering in the industrial application of biotechnology and its development. We will provide an understanding of the major fundamental aspects of biochemical engineering and implementing the knowledge acquired to some selected industrial applications.

At the completion of this unit of study students should have developed an appreciation of the underlying principles of biochemical engineering and the ability to apply these skills to new and novel situations. The students will be able to critically analyse different types of biochemical engineering processes and to improve these processes consistent with the principles of biochemical engineering.

Students are encouraged to engage in an interactive environment for exchange of information and develop problem-solving skills for successfully handling challenging engineering situations. This course will be assessed by quizzes, assignments and exams.

Information Technology Major

INFO1105
Data Structures

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1003 or INFO1103 or INFO1903 or INFS1000 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will teach some powerful ideas that are central to quality software: data abstraction and recursion. It will also show how one can analyse the scalability of algorithms using mathematical tools of asymptotic notation. Contents include: both external "interface" view, and internal "implementation" details, for commonly used data structures, including lists, stacks, queues, priority queues, search trees, hash tables, and graphs; asymptotic analysis of algorithm scalability, including use of recurrence relations to analyse recursive code. This unit covers the way information is represented in each structure, algorithms for manipulating the structure, and analysis of asymptotic complexity of the operations. Outcomes include: ability to write code that recursively performs an operation on a data structure; experience designing an algorithmic solution to a problem using appropriate data structures, coding the solution, and analysing its complexity.

INFO2120
Database Systems 1

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week; Project Work - own time 3 hrs/week. **Prerequisites:** INFO1003 OR INFO1103 OR INFO1903 OR INFS1000 OR DECO1012. **Prohibitions:** INFO2820, INFO2905, COMP5138 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The ubiquitous use of information technology leaves us facing a tsunami of data produced by users, IT systems and mobile devices. The proper management of data is hence essential for all applications and for effective decision making within organizations.

This unit of study will introduce the basic concepts of database designs at the conceptual, logical and physical levels. We will place particular emphasis on introducing integrity constraints and the concept of data normalization which prevents data from being corrupted or duplicated in different parts of the database. This in turn helps in the data remaining consistent during its lifetime. Once a database design is in place, the emphasis shifts towards querying the data in order to extract useful information. The unit will introduce different query languages with a particular emphasis on SQL, which is industry standard. Other topics covered will include the important concept of transaction management, application development with a backend database, an overview of data warehousing and OLAP, and the use of XML as a data integration language.

COMP2129
Operating Systems and Machine Principles

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1103. **Assumed knowledge:** INFO1105 OR INFO1905. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

In this unit of study elementary methods for developing robust, efficient, and re-usable software will be covered. The unit is taught in C, in a Unix environment. Specific coding topics include memory management, the pragmatic aspects of implementing data structures such as lists and hash tables and managing concurrent threads. Debugging tools and techniques are discussed and common programming errors are considered along with defensive programming techniques to avoid such errors. Emphasis is placed on using common Unix tools to manage aspects of the software construction process, such as version control and regression testing. The subject is taught from a practical viewpoint and it includes a considerable amount of programming practice.

COMP2007
Algorithms and Complexity

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** INFO1105 OR INFO1905. **Assumed knowledge:** MATH1004 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides an introduction to the design and analysis of algorithms. The main aims are (i) to learn how to develop algorithmic solutions to computational problem and (ii) to develop understanding of algorithm efficiency and the notion of computational hardness.

INFO2110
Systems Analysis and Modelling

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Experience with a data model as in INFO1003 or INFO1103 or INFS1000 **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides a comprehensive introduction to the analysis of complex systems. Key topics are the determination and expression of system requirements (both functional and on-functional), and the representation of structural and behavioural models of the system in UML notations. Students will be expected to evaluate requirements documents and models as well as producing them. This unit covers essential topics from the ACM/IEEE SE2004 curriculum, especially from MAA Software Modelling and Analysis.

Select 18 cp from the following block of units

COMP3308
Introduction to Artificial Intelligence

Credit points: 6 **Session:** Semester 1 **Classes:** Tutorial 1 hr/week; Lecture 2 hrs/week. **Prohibitions:** COMP3608 **Assumed knowledge:** COMP2007. Programing skills (e.g. Java, Python, C, C++, Matlab) **Assessment:** Through semester assessment (55%) Final Exam (45%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Artificial Intelligence (AI) is all about programming computers to perform tasks normally associated with intelligent behaviour. Classical AI programs have played games, proved theorems, discovered patterns in data, planned complex assembly sequences and so on. This unit of study will introduce representations, techniques and architectures used to build intelligent systems. It will explore selected topics such as heuristic search, game playing, machine learning, and knowledge representation. Students who complete it will have an understanding of some of the fundamental methods and algorithms of AI, and an appreciation of how they can be applied to interesting problems. The unit will involve a practical component in which some simple problems are solved using AI techniques.

COMP3419
Graphics and Multimedia

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** (COMP2007 or COMP 2907), and 6 credit points of Junior Math **Assessment:** Through semester assessment (35%) Final Exam (65%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides a broad introduction to the field of graphics and multimedia to meet the diverse requirements of application areas such as entertainment, industrial design, virtual reality, intelligent media management, medical imaging and remote sensing. It covers both the underpinning theories and the practices of computing and manipulating digital media including graphics / image, audio, animation, and video. Emphasis is placed on principles and cutting-edge techniques for multimedia data processing, content analysis, media retouching, media coding and compression.

INFO3220
Object Oriented Design

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Project Work - own time 2 hrs. **Prerequisites:** INFO2110 and COMP2129 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit covers essential design methods and language mechanisms for successful object-oriented design and programming. C++ is used as the implementation language and a special emphasis is placed on those features of C++ that are important for solving real-world problems. Advanced software engineering features, including exceptions and name spaces are thoroughly covered.

COMP3456
Computational Methods for Life Sciences

Credit points: 6 **Session:** Semester 2 **Classes:** (Lec 2hrs & Prac 2hrs) per week **Prerequisites:** (INFO1105 or INFO1905) and (COMP2007 or INFO2120) and 6 credit points from BIOL or MBLG **Assessment:** Assignment (20%), quizzes(10%) and final exam (70%). **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces the algorithmic principles driving advances in the life sciences. It discusses biological and algorithmic ideas together, linking issues in computer science and biology and thus is suitable for students in both disciplines. Students will learn algorithm design and analysis techniques to solve practical problems in biology.

INFO3315
Human-Computer Interaction

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Assumed knowledge:** Background in programming and operating systems that is sufficient for the student to independently learn new programming tools from standard online technical materials. Ability to conduct a literature search. Ability to write reports of work done. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is a course in HCI, Human Computer Interaction, with a focus on web-based Computing. It introduces the key aspects of HCI and web-based system design.

INFO3404
Database Systems 2

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Practical assignment on database tuning. 6 hrs. **Prohibitions:** INFO3504 **Assumed knowledge:** This unit of study assumes that students have previous knowledge of database concepts including (1) ER modelling, (2) the relational data model and (3) SQL. The prerequisite material is covered in INFO 2120/2820. Familiarity with a programming language (e.g. Java or C) is also expected. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study provides a comprehensive overview of the internal mechanisms and algorithms of Database Management Systems (DBMS) and other systems that manage large data collections. These skills are needed for successful performance tuning and to understand the scalability challenges faced by the information age. This unit builds upon the second- year INFO2120 - 'Database Systems 1' and correspondingly assumes a sound understanding of SQL, schema design and transactional programs.

The first part of this subject focuses on mechanisms for large-scale data management. It provides a deep understanding of the internal components of a database engine. Topics include: physical data organization and disk-based index structures, query processing and optimisation, locking and logging, and database tuning.

The second part focuses on the large-scale management of textual data such as by an information retrieval system or with web search engines. Topics include: distributed and replicated databases, information retrieval, document management, text index structures, and web-scale data processing.

The unit will be of interest to students seeking an introduction to database tuning, disk-based data structures and algorithms, and information retrieval. It will be valuable to those pursuing such careers as Software Engineers, Database Experts, Database Administrators, and e-Business Consultants.

COMP3615
Software Development Project

Credit points: 6 **Session:** Semester 2 **Classes:** Project Work - in class 2 hrs/week; Site Visit 1 hr/week; Project Work - own time 8 hrs/week; Meeting 1 hr/week. **Prerequisites:** INFO3402 AND COMP2129 AND (COMP2007 OR COMP2907 OR COMP2121) **Prohibitions:** INFO3600 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will provide students an opportunity to apply the knowledge and practise the skills acquired in the prerequisite and qualifying units, in the context of designing and building a substantial software development system in diverse application domains including life sciences. Working in groups for an external client combined with academic supervision, students will need to carry out the full range of activities including requirements capture, analysis and design, coding, testing and documentation. Students will use the XP methodology and make use of professional tools for the management of their project.

Mechatronic Engineering Major

MTRX1702
Mechatronics 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 1 hr/week; Digital Systems Laboratory/Tutorial 2 hrs/week; Tutorial 2 hrs/week. **Prohibitions:** COSC1002, COSC1902, ELEC1101, ELEC2602 **Assumed knowledge:** MTRX1701 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to provide an introduction to the analysis and design of digital logic circuits and to provide a foundation for the study of systems and embedded programming for the degree in Mechatronic Engineering.

Introductory Digital Systems (3 CR): Number systems and codes; Logic gates and Boolean algebra, universal (NAND) logic gates; Digital arithmetic: operations and circuits, Two`s complement addition and subtraction, overflow; Combinational logic circuits; Flip-flops and related devices; Counters and registers, shift register applications; sequential circuits, designs of synchronous, cascadable counters (BCD and binary). Integrated circuit logic families and interfacing; practical issues including, fan out, pull-up/down, grounds, power supplies and decoupling; timing issues, race conditions. Tri-state signals and buses; MSI logic circuits, multiplexers, demultiplexers, decoders, magnitude comparators; Introduction to programmable logic devices. The unit of study will include a practical component where students design and implement logic circuits. Purchase of a basic laboratory tool kit as described in classes will be required.

Introductory Software Engineering (3 CR): This unit of study provides an introduction to software design, implementation, debugging and testing in the context of C programming language. Problem definition and decomposition; the design process; designing for testing and defensive coding methods; modular code structure and abstract data types; best practice in programming. Preprocessor, tokens, storage classes and types. Arithmetic, relational and bit manipulation operators. Constructs for control flow: if, switch, for, do and while. Arrays. Pointers and character strings. Dynamic memory. Functions and parameter passing. Derived storage classes: structures and unions. File I/O.

ENGG1802
Engineering Mechanics

Credit points: 6 **Session:** Semester 2, Summer Main **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit aims to provide students with an understanding of and competence in solving statics and introductory dynamics problems in engineering. Tutorial sessions will help students to improve their group work and problem solving skills, and gain competency in extracting a simplified version of a problem from a complex situation. Emphasis is placed on the ability to work in 3D as well as 2D, including the 2D and 3D visualization of structures and structural components, and the vectorial 2D and 3D representations of spatial points, forces and moments. Introduction to kinematics and dynamics topics includes position, velocity and acceleration of a point; relative motion, force and acceleration, momentum, collisions and energy methods.

AMME2500
Engineering Dynamics

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs **Prerequisites:** ENGG1802 and (MATH1001 or MATH1901) and (MATH1002 or MATH1902) **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to teach: Dynamics of Rigid Bodies: Analysis of Planar mechanisms; Kinematics of rigid bodies; Kinetics of rigid bodies. Students will also develop their skills in: how to model and analyse dynamic systems and the application of theory to real systems through practical/laboratory sessions.

At the end of this unit students will have developed skills in modelling and analysing planar mechanisms and rigid body dynamic systems.

Course content will include planar mechanisms, linkages, mobility; instant centres of rotation, Kennedy's theorem; velocity and acceleration polygons; kinematics of rigid bodies, frames of reference, velocity and acceleration, rotating frame of reference, relative velocity and acceleration, gyroscopic acceleration; kinetics of rigid bodies, linear momentum and Euler's first law; angular momentum and Euler's second law; centre of mass; moments of inertia, parallel axis and parallel plane theorems, principal axes and principal moments of inertia, rotation about an axis; impulse and momentum; work and energy, kinetic and potential energies; applications to orbital and gyroscopic motion; introduction to Lagrangian methods.

MTRX2700
Mechatronics 2

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2.5 hrs/week; Laboratory 3 hrs/week. **Prerequisites:** MTRX1702 **Prohibitions:** ELEC2601, ELEC3607 **Assumed knowledge:** MTRX1701. Students are assumed to know how to program using the 'C' programming language. Additionally, students should understand the basic concepts behind simple digital logic circuits. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The aim of the unit is to introduce students to microprocessor and microcomputer systems, emphasizing assembly language programming and building on the digital logic foundations from first year. In particular, the following subjects are addressed:

Introduction to microprocessors, stored-program computer architecture, instruction codes and addressing modes, instruction execution cycle; Memory devices. Computer architecture and assembly language programming. Microprocessor and microcontroller systems, memory and IO interfacing, interrupts and interrupt handling. Serial and parallel communications. System design, documentation, implementation, debugging and testing.

MTRX2700 is the introductory course in the basics of real Mechatronic systems. This course builds on knowledge obtained in the courses ENGG1801, MTRX1701, ELEC1103 and MTRX1702. This course extends this knowledge by introducing students to their first practical applications in Mechatronic Engineering. By passing this subject, the student will have obtained the necessary skills to undertake Mechatronics 3 (MTRX3700).

AMME2301
Mechanics of Solids

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** ENGG1802, MATH1001, MATH1002, MATH1003 **Assessment:** Through semester assessment (35%) Final Exam (65%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Equilibrium of deformable structures; basic concept of deformation compatibility; stress and strain in bars, beams and their structures subjected to tension, compression, bending, torsion and combined loading; statically determinate and indeterminate structures; energy methods for bar and beam structures; simple buckling; simple vibration; deformation of simple frames and cell box beams; simple two-dimensional stress and Morh's circle; problem-based applications in aerospace, mechanical and biomedical engineering.

AMME3500
System Dynamics and Control

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week. **Prerequisites:** ((MATH2061 or MATH2961) and (MATH2065 or MATH2965)) or MATH2067 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to allow students to develop an understanding of methods for modeling and controlling linear, time-invariant systems. Techniques examined will include the use of differential equations and frequency domain approaches to modeling of systems. This will allow students to examine the response of a system to changing inputs and to examine the influence of external stimuli such as disturbances on system behaviour. Students will also gain an understanding of how the responses of these mechanical systems can be altered to meet desired specifications and why this is important in many engineering problem domains.

The study of control systems engineering is of fundamental importance to most engineering disciplines, including Electrical, Mechanical, Mechatronic and Aerospace Engineering. Control systems are found in a broad range of applications within these disciplines, from aircraft and spacecraft to robots, automobiles, computers and process control systems. The concepts taught in this course introduce students to the mathematical foundations behind the modelling and control of linear, time-invariant dynamic systems. In particular, topics addressed in this course will include:

1. Techniques for modelling mechanical systems and understanding their response to control inputs and disturbances. This will include the use of differential equations and frequency domain methods as well as tools such as Root Locus and Bode plots.

2. Representation of systems in a feedback control system as well as techniques for determining what desired system performance specifications are achievable, practical and important when the system is under control

3. Theoretical and practical techniques that help engineers in designing control systems, and an examination of which technique is best in solving a given problem.

ELEC3404
Electronic Circuit Design

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/fortnight; Laboratory 3 hrs/fortnight. **Assumed knowledge:** A background in basic electronics and circuit theory is assumed. **Assessment:** Through semester assessment (70%) Final Exam (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to teach students analysis and design techniques for electronic systems such as signal amplifiers, differential amplifiers and power amplifiers. Completion of this unit will allow progression to advanced studies or to work in electronics and telecommunication engineering.

Topics covered are as follows. The BJT and MOSFET as an amplifier. Biasing in amplifier circuits. Small signal operation and models. Single stage amplifiers. Internal capacitances and high frequency models. The frequency response of the common-emitter amplifier. Current sources and current mirrors. Differential amplifiers. Output stages and power amplifiers:class A, class B and class AB.

MTRX3700
Mechatronics 3

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2.5 hrs/week; Laboratory 3 hrs/week. **Prerequisites:** MTRX2700 **Prohibitions:** MECH4710 **Assumed knowledge:** Completion of a first course in microprocessor systems, including assembly and C language programming, interfacing, introductory digital and analogue electronics. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to provide experience, confidence and competence in the design and implementation of microprocessor-based products and instruments; to impart a detailed knowledge of the software and hardware architecture of a typical modern microcontroller, and an understanding of the use of these resources in product design; and to provide experience of working in a project team to prototype a realistic product to meet a specification.

At the end of this unit students will understand microprocessor system organization, and the organization of multiple and distributed processor systems, special purpose architectures (DSPs etc.) and their application. The student will have a detailed knowledge of the software and hardware architecture of a modern microcontroller. This knowledge will include an in-depth understanding of the relationship between assembly language, high-level language, and the hardware, of the utilisation and interfacing of microcontroller hardware resources, and of the design and development of software comprised of multiple interrupt-driven processes. The student will have the competence to develop prototype microprocessor-based products.

Course content will include single processor systems, multiple and distributed processing systems, special purpose architectures (DSPs etc) and their application; standard interfacing of sensor and actuation systems; ADC/DAC, SSI, parallel, CAN bus etc.; specific requirements for microprocessor-based products; problem definition and system design; tools for design, development and testing of prototype systems; the unit of study will include a project, where groups of students design, develop and commission a microprocessor-based product.

Resolutions of the Faculty of Engineering and Information Technologies relating to this table:

BE (Biomedical) Engineering

A minimum of 192 credit points is required to be eligible for the award of the degree of BE(Biomedical). 144 cp are selected from the core and recommended unit tables and 48 cp are selected from a table of major units.

BE(Biomedical)/BSc or BCom or BMedSci or BPM or BA or LLB

In addition to gaining credit for the units of study set out in the above tables, candidates are required to complete sufficient Biomedical Engineering electives so as to bring their total of eligible engineering credit points to at least 144. Further to this they are required to complete at least 96 credit points of units of study given by the Faculty of Science for the BE/BSc and BMedSci, or the School of Business for the BE/BCom or from the core units table for BPM. In the case of the BE/BA, they are required to complete at least 84 credit points of units of study given by the Faculty of Arts and Social Sciences, and the remaining 12 credit points will be Biomedical Engineering electives from the table above.A minimum of 240 credit points is required to be eligible for the combined degrees BE/BSc, BMedSci, BE/BCom and BE/BA.In the case of the BE/LLB, they are required to complete 96 credit points of compulsory Law units of study and a further 48 credit points of elective Law units of study.A minimum of 288 credit points is required to be eligible for the combined degree BE/LLB. Candidates should refer to the joint resolutions of the faculty in which they are undertaking the second degree.

For a standard enrolment plan for Biomedical Engineering visit http://cusp.sydney.edu.au/students/view-degree-page/name/BE(Biomed)

School of Chemical and Biomolecular Engineering

Chemical and biomolecular engineering is a broad field that combines the key disciplines of chemistry, physics and biology. Drawing on an extensive knowledge of areas including nanotechnology, molecular biology, environmental science and information technology, chemical and biomolecular engineers design valuable products and processes that address a wide range of societal and environmental challenges.

The School of Chemical and Biomolecular Engineering offers an exciting range of chemical and biomolecular engineering programs. Areas of study include chemical engineering, biochemical engineering and biotechnology, energy and environment, green product and process design, minerals processing, process systems engineering and sustainability.

The school also offers a unique industrial placement scholarship program, where our top final year undergraduate students can spend six months undertaking high-level investigative projects with one of our industry partners whilst receiving financial support.

Career opportunities for chemical and biomolecular engineers are diverse, including in the fields of oil, gas, and renewable resources, health, water, biotechnology and environmental management.

The School of Chemical and Biomolecular Engineering offers the following Bachelor of Engineering Honours degree specialisations:

- Chemical and Biomolecular Engineering
- Combined degrees with Science, Commerce, Arts, Medical Science and Law.

Bachelor of Engineering Honours (Chemical and Biomolecular)

Course Overview

Chemical and biomolecular engineering is a broad field that combines the key disciplines of chemistry, physics and biology.

Drawing on an extensive knowledge of areas including nanotechnology, molecular biology, environmental science and information technology, chemical and biomolecular engineers design valuable products and processes that address a wide range of societal and environmental challenges.

Chemical engineers are agents in the drive to ensure a sustainable society. Throughout the Bachelor of Engineering Honours (Chemical and Biomolecular) practical applications are used in teaching and learning and there is a strong interaction with industry through work experience and study projects.

The School of Chemical and Biomolecular Engineering offers the following Bachelor of Engineering Honours degree specialisations:

- Chemical and Biomolecular Engineering
- Combined degrees with Science, Commerce, Arts, Medical Science and Law.

Course Requirements

To qualify for the award of the degree, a candidate must successfully complete 192 credit points, comprising:

1. core and elective units of study relating to the specialist stream, as prescribed by the table of units of study for the stream; and
2. any additional free electives units

For a standard enrolment plan for Chemical and Biomolecular Engineering visit cusp.sydney.edu.au/students/view-degree-page/name/BE(CBE)

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Bachelor of Engineering Honours (Chemical and Biomolecular)			
Chemical and Biomolecular Engineering is a broad area that seeks to use a detailed knowledge of chemistry, mathematics and biology to convert raw materials into valuable products as economically and safely as possible. Our undergraduate program trains students so that on graduation they can analyse, design and operate a wide variety of processes and to solve industrially relevant problems. Candidates for the degree of Bachelor of Engineering in Chemical and Biomolecular Engineering are required to gain credit for the core units of study set out below. Any additional credit necessary shall be gained by completing additional credit points of elective units of study, as recommended by the school, as may be necessary to gain credit for a total of not less than 192 credit points.			
Core units of study			
First year			
MATH1001 **Differential Calculus**	3	**A** HSC Mathematics Extension 1 **N** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001	Semester 1 Summer Main
MATH1002 **Linear Algebra**	3	**A** HSC Mathematics or MATH1111 **N** MATH1902, MATH1012, MATH1014	Semester 1 Summer Main
MATH1003 **Integral Calculus and Modelling**	3	**A** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **N** MATH1013, MATH1903, MATH1907	Semester 2 Summer Main
MATH1005 **Statistics**	3	**A** HSC Mathematics **N** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021	Semester 2 Summer Main Winter Main
CHEM1101 **Chemistry 1A**	6	**A** HSC Chemistry and Mathematics **N** CHEM1905, CHEM1906, CHEM1903, CHEM1001, CHEM1909, CHEM1109, CHEM1901	Semester 1 Semester 2 Summer Main
CHEM1102 **Chemistry 1B**	6	**P** CHEM1101 or CHEM1901 or a Distinction in CHEM1001 or equivalent **N** CHEM1904, CHEM1907, CHEM1902, CHEM1108, CHEM1908, CHEM1002	Semester 1 Semester 2 Summer Main
CHNG1103 **Material & Energy Transformations Intro**	6		Semester 2
ENGG1800 **Engineering Disciplines (Intro) Stream A**	6		Semester 1
ENGG1801 **Engineering Computing**	6		Semester 1 Summer Late
ENGG1803 **Professional Engineering 1**	6	**N** ENGG1061	Semester 1 Semester 2
Second year			
CHEM2403 **Chemistry of Biological Molecules**	6	**P** 12 credit points of Junior Chemistry, 6 credit points of Junior Mathematics. **N** CHEM2301, CHEM2903, CHEM2913, CHEM2101, CHEM2901, CHEM2311, CHEM2502, CHEM2001 *To enrol in Senior Chemistry, students are required to have completed (CHEM2401 or CHEM2911 or CHEM2915) and (CHEM2402 or CHEM2912 or CHEM2916). Students are advised that combinations of Intermediate Chemistry units that do not meet this requirement will generally not allow progression to Senior Chemistry.*	Semester 2
Students can choose instead to enrol in CHEM2402 Chemical Structure and Stability. Students with a credit average or greater can choose to enrol in CHEM2912 Chemical Structure and Stability Advanced.			
CHEM2404 **Forensic and Environmental Chemistry**	6	**P** (CHEM1101 or CHEM1901 or CHEM1903) and (CHEM1102 or CHEM1902 or CHEM1904), 6 credit points of Junior Mathematics **N** CHEM3197, CHEM3107, AGCH3033 *To enrol in Senior Chemistry students are required to have completed (CHEM2401 or CHEM2911 or CHEM2915) and (CHEM2402 or CHEM2912 or CHEM2916). Students are advised that combinations of Intermediate Chemistry units that do not meet this requirement will generally not allow progression to Senior Chemistry.*	Semester 1
Students can choose instead to enrol in CHEM2401 Molecular Reactivity & Spectroscopy. Students with a credit average or greater can choose to enrol in CHEM2911 Molecular Reactivity & Spectroscopy Advanced.			
CHNG2801 **Conservation and Transport Processes**	6	**A** Calculus, Computations (Matlab, Excel), Mass and Energy Balances. **P** (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 OR MATH1015 OR MATH1905) AND ENGG1801 AND CHNG1103 AND (CHEM1101 OR CHEM1901) AND (CHEM1102 OR CHEM1902) **C** CHNG2802 AND CHNG2803.	Semester 1
CHNG2802 **Applied Maths for Chemical Engineers**	6	**A** Enrolment in this unit of study assumes that all core science and engineering UoS in first-year have been successfully completed. **P** (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 OR MATH1015 OR MATH1905) AND ENGG1801 AND CHNG1103 AND (CHEM1101 OR CHEM1901) AND (CHEM1102 OR CHEM1902) **C** CHNG2801 AND CHNG2803.	Semester 1

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
CHNG2803 **Energy and Fluid Systems Practice**	6	**A** Ability to conduct mass and energy balances, and the integration of these concepts to solve real chemical engineering problems Ability to understand basic principles of physical chemistry, physics and mechanics. Ability to use mathematics of calculus (including vector calculus) and linear algebra, and carry out computations with MATLAB and MS EXCEL. Ability to read widely outside of the technical literature, and to synthesise arguments based on such literature. Ability to write coherent reports and essays based on qualitative and quantitative information. **P** (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 OR MATH1015 OR MATH1905) AND ENGG1801 AND CHNG1103 AND (CHEM1101 OR CHEM1901) AND (CHEM1102 OR CHEM1902) **C** CHNG2801 AND CHNG2802	Semester 1
CHNG2804 **Chemical & Biological Systems Behaviour**	6	**A** Ability to conduct mass and energy balances, and the integration of these concepts to solve real chemical engineering problems. Ability to understand basic principles of physical chemistry, physics and mechanics. Ability to use mathematics of calculus (including vector calculus) and linear algebra, and to carry out computations with Matlab and MS-Excel. **P** (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 OR MATH1015 OR MATH1905) AND ENGG1801 AND CHNG1103 AND (CHEM1101 OR CHEM1901) AND (CHEM1102 OR CHEM1902) **C** CHNG2805 AND CHNG2806.	Semester 2
CHNG2805 **Industrial Systems and Sustainability**	6	**A** Ability to conduct mass and energy balances, and the integration of these concepts to solve real chemical engineering problems. Ability to understand basic principles of physical chemistry, physics and mechanics. Ability to use mathematics of calculus (including vector calculus) and linear algebra, and carry out computations with MATLAB and MS EXCEL. **P** (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 OR MATH1015 OR MATH1905) AND ENGG1801 AND CHNG1103 AND (CHEM1101 OR CHEM1901) AND (CHEM1102 OR CHEM1902) **C** CHNG2804 AND CHNG2806.	Semester 2
CHNG2806 **Materials Purification and Recovery**	6	**A** Ability to conduct mass and energy balances, and the integration of these concepts to solve real chemical engineering problems. Ability to understand basic principles of physical chemistry, physics and mechanics. Ability to use mathematics of calculus (including vector calculus) and linear algebra, and carry out computations with MATLAB and MS EXCEL. Ability to read widely outside of the technical literature, and to synthesise arguments based on such literature. Ability to write coherent reports and essays based on qualitative and quantitative information **P** (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 OR MATH1015 OR MATH1905) AND ENGG1801 AND CHNG1103 AND (CHEM1101 OR CHEM1901) AND (CHEM1102 OR CHEM1902) **C** CHNG2804 AND CHNG2805.	Semester 2
Third year			
CHNG3801 **Process Design**	6	**A** Enrolment in this unit of study assumes that all (six) core chemical engineering UoS in second year have been successfully completed. **P** CHNG2801; CHNG2802; CHNG2803; CHNG2804; CHNG2805; CHNG2806 **C** CHNG3803, CHNG3802	Semester 1
CHNG3802 **Control and Reaction Engineering**	6	**A** Enrolment in this unit of study assumes that all (six) core chemical engineering UoS in second year have been successfully completed. **P** CHNG2801; CHNG2802; CHNG2803; CHNG2804; CHNG2805; CHNG2806 **C** CHNG3801; CHNG3803	Semester 1
CHNG3803 **Chemical/Biological Process Design**	6	**A** Ability to conduct mass and energy balances, and the integration of these concepts to solve real chemical engineering problems. Ability to understand basic principles of physical chemistry, physics and mechanics. Ability to use mathematics of calculus (including vector calculus) and linear algebra, and carry out computations with MATLAB and MS EXCEL. Ability to read widely outside of the technical literature, and to synthesise arguments based on such literature. Ability to write coherent reports and essays based on qualitative and quantitative information. **P** CHNG2801; CHNG2802; CHNG2803; CHNG2804; CHNG2805; CHNG2806 **C** CHNG3801 and CHNG3802	Semester 1
CHNG3805 **Product Formulation and Design**	6	**A** Mass and Energy Balances Conservation and Transport Phenomena Applied Mathematics (for Chemical Engineering) Process Design Concepts Process Control and Optimisation Concepts **P** CHNG2801; CHNG2802; CHNG2803; CHNG2804; CHNG2805; CHNG2806 **C** CHNG3806; CHNG3807	Semester 2
CHNG3806 **Management of Industrial Systems**	6	**A** Ability to conduct mass and energy balances, and the integration of these concepts to solve real chemical engineering problems. Ability to understand basic principles of physical chemistry, physics and mechanics. Ability to use mathematics of calculus (including vector calculus) and linear algebra, and carry out computations with MATLAB and MS EXCEL. Ability to read widely outside of the technical literature, and to synthesise arguments based on such literature. Ability to write coherent reports and essays based on qualitative information. **P** CHNG2801; CHNG2802; CHNG2803; CHNG2804; CHNG2805; CHNG2806 **C** CHNG3805; CHNG3807	Semester 2
CHNG3807 **Products and Value Chains**	6	**A** Ability to conduct mass and energy balances, and the integration of these concepts to solve real chemical engineering problems. Ability to understand basic principles of physical chemistry, physics and mechanics. Ability to use mathematics of calculus (including vector calculus) and linear algebra, and carry out computations with MATLAB and MS EXCEL. Ability to read widely outside of the technical literature, and to synthesise arguments based on such literature. Ability to write coherent reports and essays based on qualitative and quantitative information. **P** CHNG2801; CHNG2802; CHNG2803; CHNG2804; CHNG2805; CHNG2806 **C** CHNG3805; CHNG3806	Semester 2
Fourth year			
CHNG4802 **Chemical Engineering Design A**	6	**A** Enrolment in this unit of study assumes that all (six) core chemical engineering unit of study in third year have been successfully completed. **P** CHNG3801,CHNG3802, CHNG3803, CHNG3805, CHNG3806, CHNG3807 **N** CHNG4203 *Note: Department permission required for enrolment* *School permission required for enrolment insession 2*	Semester 1 Semester 2
CHNG4806 **Chemical Engineering Design B**	6	**A** Enrolment in this unit of study assumes that all core chemical engineering units of study in third-year have been successfully completed, as well as the related first semester UoS CHNG4802 or CHNG4203 **P** CHNG4802 or CHNG4203 *Note: Department permission required for enrolment* *Department permission required for enrollment in session 1*	Semester 1 Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Students must enrol in 12 credit points of Thesis units.			
CHNG4811 **Honours Thesis A**	6	**A** Enrolment in this unit of study assumes that all (six) core chemical engineering UoS in third year have been successfully completed. **P** CHNG3801, CHNG3802, CHNG3803, CHNG3805, CHNG3806, CHNG3807. **N** CHNG4814, CHNG4813 *Note: Department permission required for enrolment* *This unit is available to only those students who have gained an entry to the Honours degree. School permission required for enrolment in semester 2.*	Semester 1 Semester 2
CHNG4812 **Honours Thesis B**	6	**A** Enrolment in this unit of study assumes that Honours Thesis A and all (six) core chemical engineering units of study in third year have been successfully completed. **C** CHNG4811 **N** CHNG4814, CHNG4813 *Note: Department permission required for enrolment* *This unit is available to only those students who have gained an entry to the Honours degree. School permission required for enrolment in the semester 1.*	Semester 1 Semester 2

Notes

2. For core units of study offered by other than the Faculty of Engineering, any assumed knowledge and/or prerequisite requirements will be as prescribed by that Faculty.

3. Students doing any of the combined degree options BEHons/BA, BE/BCom, BE/BPM, BE/BSc, BE/BMedSc and BE/LLB will be exempt from a First Year core unit of study and from Second Year Chemistry.

4. Students undertaking study overseas as part of an exchange program will enrol in CHNG3041,CHNG3042 in place of 3rd year core or CHNG4041,CHNG4042 in place of 4th year core.

Resolutions of the Faculty of Engineering relating to Chemical and Biomolecular Engineering

Bachelor of Engineering Honours (Chemical and Biomolecular)

Candidates for this degree are required to complete all the core units of study (total 156 credit points). They are also required to gain at least 24 credit points from the Third and Fourth Year electives listed in the table of recommended elective units of study for BE (Chem & Biomolec) as shown below.

BEHons (Chemical & Biomolecular) combined with a BA or BSc

Candidates in these combined degree options are required to complete all the core units of study except where specific exemptions are noted. They are also required to gain at least 12 credit points from the Fourth Year electives listed in the table of recommended elective units of study for BEHons (Chemical & Biomolecular) as shown below. This total of 144 credit points is only sufficient to be awarded a Bachelor of Engineering Honours (Chemical and Biomolecular) as part of these combined degree programs.

BEHons (Chemical & Biomolecular) combined with a BCom or BPM

Candidates in these combined degree options are required to complete all the core units of study except where specific exemptions are noted. They are also required to gain at least 6 credit points from the Fourth Year electives listed in the table of recommended elective units of study for BEHons (Chemical & Biomolecular) as shown below. This total of 144 credit points is only sufficient to be awarded a Bachelor of Engineering Honours (Chemical and Biomolecular) as part of this combined degree program.

Acceptable alternative units of study

Most Mathematics, Chemistry, Physics and Computer Science units of study offered by the Faculty of Science can be replaced by an equivalent Advanced level unit of study subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing Advanced options should seek advice from their Department before enrolling.

Recommended elective units of study

Third year

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
CHNG3804 **Biochemical Engineering**	6	**A** Enrolment in this unit of study assumes that all (six) core chemical engineering units of study in second year have been successfully completed. **P** CHEM1101 and CHEM1102 and CHNG1103 and CHNG2801 and CHNG2802 and CHNG2803 and CHNG2804 and CHNG2805 and CHNG2806 and MATH1001 and MATH1002 and MATH1003 and MATH1005	Semester 2
CHNG3808 **Polymer Engineering**	6	**A** CHNG3801 Process Design (including Reaction Engineering, Heat and Mass Transfer) or equivalent is an absolute Co-Requisite requirement. **P** CHNG2801; CHNG2802; CHNG2803; CHNG2804; CHNG2805; CHNG2806; CHEM1101; CHEM1102; CHNG1103; ENGG1800; ENGG1801; ENGG1803; MATH1001; MATH1002; MATH1003; MATH1005; MATH2061 **C** CHNG3801; CHNG3802	Semester 1
CHNG3809 **Laboratory and Industrial Practice**	6	**P** CHNG1103, CHNG2801, CHNG2802, CHNG2803, CHNG2804, CHNG2805 AND CHNG2806 **C** CHNG3801, CHNG3802, CHNG3803 *Note: Department permission required for enrolment*	Semester 1 Semester 2

Fourth year

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
CHNG4203 **Major Industrial Project**	24	**A** Passed at least 144 credit points. Students wishing to do this unit of study are required to discuss the matter with the Head of School prior to enrolment. **P** 144 CP prior study with >65% WAM *Note: Department permission required for enrolment* *Enrollment by permission only. The candidate will be selected by interview and at the discretion of the Head of School.*	Semester 1
CHNG5001 **Process Systems Engineering**	6	**A** First year undergraduate physics and mathematics (differential equations). Use of mathematical and/or computer-based modelling tools and techniques. Feedback control concepts and principles as taught in CHNG3802/CHNG5802 or similar courses. Students who are unsure about meeting these requirements should contact the unit coordinator for advice. *This unit of study is for Masters students and can be selected as an elective by 4th year students.*	Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
CHNG5003 **Green Engineering**	6	**A** CHNG3801 AND CHNG3802 AND CHNG3803 AND CHNG3805 AND CHNG3806 AND CHNG3807. All core third year chemical engineering.	Semester 2
CHNG5004 **Particles and Surfaces**	6	**A** Enrolment in this unit of study assumes that all (six) core chemical engineering UoS in third year or their equivalent have been successfully completed. *Note: Department permission required for enrolment*	Semester 1
CHNG5005 **Wastewater Engineering**	6	**A** Ability to conduct mass and energy balances, and the integration of these concepts to solve 'real' chemical engineering problems. Ability to understand basic principles of physical chemistry, physics and mechanics. Ability to use basic calculus and linear algebra, and carry out such computations using Matlab and MS Excel. Ability to read widely outside of the technical literature and to synthesise arguments based on such literature. Ability to write coherent reports and essays based on information from diverse sources.	Semester 1
CHNG5006 **Advanced Wastewater Engineering**	6	**A** CHNG5005 OR CHNG3804.	Semester 2
CHNG5008 **Nanotechnology in Chemical Engineering**	6	**P** CHNG3801 AND CHNG3802 AND CHNG3805 AND CHNG3806 *Note: Department permission required for enrolment* *Note: School permission required for enrollment.*	Semester 2
CHNG5601 **Membrane Science**	6		Semester 1
CHNG5602 **Cellular Biophysics**	6	*Note: Department permission required for enrolment*	Semester 1
CHNG5603 **Analysis, Modelling, Control: BioPhy Sys**	6	**A** It is assumed that students have a general knowledge of: MATH 1001 Differential Calculus MATH 1003 Integral Calculus and Modeling *This course is for Master degree students and also is offered as an elective course for fourth year students. Some lectures my be given by a guest lecturer. this*	Semester 1
CHNG5604 **Membrane Engineering Laboratory**	6	**A** CHNG5601	Semester 2
CHNG5605 **Bio-Products: Laboratory to Marketplace**	6	*This course is for Master degree students and also is offered as an elective course for fourth year students. .*	Semester 2

For a standard enrolment plan for Chemical and Biomolecular Engineering visit cusp.sydney.edu.au/students/view-degree-page/name/BE(CBE)

Unit of Study Descriptions

Bachelor of Engineering Honours (Chemical and Biomolecular)

Chemical and Biomolecular Engineering is a broad area that seeks to use a detailed knowledge of chemistry, mathematics and biology to convert raw materials into valuable products as economically and safely as possible. Our undergraduate program trains students so that on graduation they can analyse, design and operate a wide variety of processes and to solve industrially relevant problems. Candidates for the degree of Bachelor of Engineering in Chemical and Biomolecular Engineering are required to gain credit for the core units of study set out below. Any additional credit necessary shall be gained by completing additional credit points of elective units of study, as recommended by the school, as may be necessary to gain credit for a total of not less than 192 credit points.

Core units of study

First year

MATH1001
Differential Calculus

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001 **Assumed knowledge:** HSC Mathematics Extension 1 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1001 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study looks at complex numbers, functions of a single variable, limits and continuity, vector functions and functions of two variables. Differential calculus is extended to functions of two variables. Taylor's theorem as a higher order mean value theorem.

Textbooks
As set out in the Junior Mathematics Handbook.

MATH1002
Linear Algebra

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1902, MATH1012, MATH1014 **Assumed knowledge:** HSC Mathematics or MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1002 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study introduces vectors and vector algebra, linear algebra including solutions of linear systems, matrices, determinants, eigenvalues and eigenvectors.

Textbooks
As set out in the Junior Mathematics Handbook

MATH1003
Integral Calculus and Modelling

Credit points: 3 **Session:** Semester 2, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1013, MATH1903, MATH1907 **Assumed knowledge:** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1003 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.This unit of study first develops the idea of the definite integral from Riemann sums, leading to the Fundamental Theorem of Calculus. Various techniques of integration are considered, such as integration by parts.The second part is an introduction to the use of first and second order differential equations to model a variety of scientific phenomena.

Textbooks
As set out in the Junior Mathematics Handbook

MATH1005
Statistics

Credit points: 3 **Session:** Semester 2, Summer Main, Winter Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021 **Assumed knowledge:** HSC Mathematics **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1005 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit offers a comprehensive introduction to data analysis, probability, sampling, and inference including t-tests, confidence intervals and chi-squared goodness of fit tests.

Textbooks
As set out in the Junior Mathematics Handbook

CHEM1101
Chemistry 1A

Credit points: 6 **Session:** Semester 1, Semester 2, Summer Main **Classes:** Three 1 hour lectures and one 1 hour tutorial per week; one 3 hour practical per week for 9 weeks. **Prohibitions:** CHEM1905, CHEM1906, CHEM1903, CHEM1001, CHEM1909, CHEM1109, CHEM1901 **Assumed knowledge:** HSC Chemistry and Mathematics **Assessment:** Theory examination (60%), laboratory work (15%), online assignment (10%) and continuous assessment quizzes (15%) **Practical field work:** A series of 9 three-hour laboratory sessions, one per week for 9 weeks of the semester. **Mode of delivery:** Normal (lecture/lab/tutorial) day

Chemistry 1A is built on a satisfactory prior knowledge of the HSC Chemistry course. Chemistry 1A covers chemical theory and physical chemistry. Lectures: A series of 39 lectures, three per week throughout the semester.

Textbooks
A booklist is available from the First Year Chemistry website. http://sydney.edu.au/science/chemistry/firstyear

CHEM1102
Chemistry 1B

Credit points: 6 **Session:** Semester 1, Semester 2, Summer Main **Classes:** One 3 hour lecture and 1 hour tutorial per week; one 3 hour practical per week for 9 weeks. **Prerequisites:** CHEM1101 or CHEM1901 or a Distinction in CHEM1001 or equivalent **Prohibitions:** CHEM1904, CHEM1907, CHEM1902, CHEM1108, CHEM1908, CHEM1002 **Assessment:** Theory examination (60%), laboratory work (15%), online assignment (10%) and continuous assessment quizzes (15%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Chemistry 1B is built on a satisfactory prior knowledge of Chemistry 1A and covers inorganic and organic chemistry. Successful completion of Chemistry 1B is an acceptable prerequisite for entry into

Intermediate Chemistry units of study. Lectures: A series of 39 lectures, three per week throughout the semester.

Textbooks

A booklist is available from the First Year Chemistry website. http://sydney.edu.au/science/chemistry/firstyear

CHNG1103
Material & Energy Transformations Intro

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The students should develop an understanding of and competence in the formulation and solution of material and energy balance problems in engineering; develop competence in using basic flowsheet analysis and appropriate computational tools; improve their group work and problem solving skills; gain an ability to extract a simplified version of a problem from a complex situation.

Material Transformation related topics include: unit systems and unit conversions; properties of solids, fluids and gases; mass balance calculations on batch and flow systems; balances on multiple units processes, balances on reactive systems, recycle, bypass and purge calculations; equilibrium compositions of reacting systems; vapour pressure and humidity. Energy transformations include the following topics: apply the first law of thermodynamics to flow and batch systems in process industries; understand thermodynamic properties such as internal energy, enthalpy and heat capacity; conduct energy balances for sensible heat changes, phase transformations and reactive processes for practical industrial systems; understand the applications of psychrometry, refrigeration, heat of formation and combustion in industry.

ENGG1800
Engineering Disciplines (Intro) Stream A

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 1 hr/week; Laboratory 3 hrs/week. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces students to specialisations in the Engineering discipline areas of Aeronautical, Biomedical Chemical, Civil, Mechanical and Mechatronic Engineering, and Project Engineering and Management. By providing first-year students with an experience of these various engineering streams, the unit aims to develop the students' professional identity as an engineer and thus provide a suitable basis on which students can choose their discipline for further study.

Introductory sessions in the School of Aerospace,

Mechanical and Mechatronic Engineering

-4 weeks-

An overview of the degree requirements in each stream. The roles of the engineer in each stream (employments, skills, etc). How each of the subjects taught relate to the skills/knowledge and applications required of the engineers. Basically make sure students fully understand what engineers are in the discipline areas and why the students do the subjects they do. In each stream, one engineering technical topic will be taught as a problem solving exercise, and this topic will be the focus of the laboratory.

School of Civil Engineering

-4 weeks-

Introductory lectures in Engineering Economics and Construction Planning, Foundation Engineering, Structural Engineering, Materials, Environmental Engineering. Each student will be involved in the erection and dismantling of an 8 metre high steel and timber tower in the Civil Engineering Courtyard. Preliminary lectures related to the tower will include safety issues, loading, statical analysis, foundation calculations, construction management, engineering drawings and detailing, geometric calculations, and survey measurements. Exercises related to these issues will be performed before assembly and disassembly of the tower.

School of Chemical and Biomolecular Engineering

-4 weeks-

This course will enable students to gain an appreciation of: the methods and materials of construction of items of process equipment; the role of this equipment in building an entire chemical processing plant: its operation and maintenance and safety requirements and procedures. Students will dismantle, disassemble and operate items of process equipment. They will present written answers to questions, supplemented by drawings of process flowsheets, diagrams of dismantled equipment, and discussions of heat and mass balances and of process parameters.

ENGG1801
Engineering Computing

Credit points: 6 **Session:** Semester 1, Summer Late **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will introduce students to fundamental principles of programming. The language used will be Matlab but the principles taught are readily portable to other languages like C and Java. The unit material will be presented in a manner which will help students to draw a connection between programming constructs and real engineering applications. The unit will use engineering inspired case-studies : especially from Civil, Chemical, Aerospace and Mechanical streams, to motivate new material. There will be a major project which uses programming to solve a real world engineering problem. The extensive Matlab library for visualization will also be introduced. Matlab will cover two-thirds of the unit. The remaining one-third will be devoted to the use of Excel in engineering scenarios. Furthermore, cross integration between Matlab and Excel will also be highlighted.

ENGG1803
Professional Engineering 1

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prohibitions:** ENGG1061 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Professional Engineering 1 is an introductory Unit of Study within the Faculty of Engineering. The semester 1 course is aimed at students from the School of Aerospace, Mechanical and Mechatronic Engineering. It seeks to introduce newly admitted undergraduates to general principles of professional engineering practice, a range of contemporary professional engineering issues, plus outline skills related to academic study within an engineering environment. The subject is structured around a team based design and build project, in which students apply the professional engineering concepts they are learning to an engineering project. Professional engineering topics to be covered include: accessing information, teamwork, creativity, leadership, written and oral communication, project management, problem solving, ethics, liability, work health and safety and environmental issues.

Second year

CHEM2403
Chemistry of Biological Molecules

Credit points: 6 **Teacher/Coordinator:** A/Prof Richard Payne **Session:** Semester 2 **Classes:** Three 1-hour lectures per week, six 1-hour tutorials per semester, five 4-hour practical sessions per semester. **Prerequisites:** 12 credit points of Junior Chemistry, 6 credit points of Junior Mathematics. **Prohibitions:** CHEM2301, CHEM2903, CHEM2913, CHEM2101, CHEM2901, CHEM2311, CHEM2502, CHEM2001 **Assessment:** One 3-hour examination, quizzes, lab reports (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: To enrol in Senior Chemistry, students are required to have completed (CHEM2401 or CHEM2911 or CHEM2915) and (CHEM2402 or CHEM2912 or CHEM2916). Students are advised that combinations of Intermediate Chemistry units that do not meet this requirement will generally not allow progression to Senior Chemistry.

Life is chemistry, and this unit of study examines the key chemical processes that underlie all living systems. Lectures cover the chemistry of carbohydrates, lipids and DNA, the mechanisms of organic and biochemical reactions that occur in biological systems, chemical analysis of biological systems, the inorganic chemistry of metalloproteins, biomineralisation, biopolymers and biocolloids, and the application of spectroscopic techniques to biological systems. The practical course includes the chemical characterisation of biopolymers, experimental investigations of iron binding proteins, organic and inorganic chemical analysis, and the characterisation of anti-inflammatory drugs.

Students can choose instead to enrol in CHEM2402 Chemical Structure and Stability. Students with a credit average or greater can choose to enrol in CHEM2912 Chemical Structure and Stability Advanced.

CHEM2404
Forensic and Environmental Chemistry

Credit points: 6 **Teacher/Coordinator:** A/Prof Richard Payne **Session:** Semester 1 **Classes:** Three 1-hour lectures per week, six 1-hour tutorials and five 4-hour practical sessions per semester. **Prerequisites:** (CHEM1101 or CHEM1901 or CHEM1903) and (CHEM1102 or CHEM1902 or CHEM1904), 6 credit points of Junior Mathematics **Prohibitions:** CHEM3197, CHEM3107, AGCH3033 **Assessment:** One 3-hour examination, quizzes, lab reports (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: To enrol in Senior Chemistry students are required to have completed (CHEM2401 or CHEM2911 or CHEM2915) and (CHEM2402 or CHEM2912 or CHEM2916). Students are advised that combinations of Intermediate Chemistry units that do not meet this requirement will generally not allow progression to Senior Chemistry.

The identification of chemical species and quantitative determination of how much of each species is present are the essential first steps in solving all chemical puzzles. In this course students learn analytical techniques and chemical problem solving in the context of forensic and environmental chemistry. The lectures on environmental chemistry cover atmospheric chemistry (including air pollution, global warming and ozone depletion), and water/soil chemistry (including bio-geochemical cycling, chemical speciation, catalysis and green chemistry). The forensic component of the course examines the gathering and analysis of evidence, using a variety of chemical techniques, and the development of specialised forensic techniques in the analysis of trace evidence. Students will also study forensic analyses of inorganic, organic and biological materials (dust, soil, inks, paints, documents, etc) in police, customs and insurance investigations and learn how a wide range of techniques are used to examine forensic evidence.

Students can choose instead to enrol in CHEM2401 Molecular Reactivity & Spectroscopy. Students with a credit average or greater can choose to enrol in CHEM2911 Molecular Reactivity & Spectroscopy Advanced.

CHNG2801
Conservation and Transport Processes

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs/week; Presentation 4 hrs. **Prerequisites:** (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 OR MATH1015 OR MATH1905) AND ENGG1801 AND CHNG1103 AND (CHEM1101 OR CHEM1901) AND (CHEM1102 OR CHEM1902) **Corequisites:** CHNG2802 AND CHNG2803. **Assumed knowledge:** Calculus, Computations (Matlab, Excel), Mass and Energy Balances. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

In the design and analysis of chemical processes, chemical engineers have to understand integrated concepts in conservation of mass and energy, properties of fluids, heat transfer and the mass transfer of chemical species through the processes. This is true not only in traditional chemical engineering areas such as petrochemicals, but also for emerging fields like micro-reactors and biotechnology. This course is an introduction to the fundamental concepts in transport phenomena necessary for subsequent courses ranging from unit operations to reactor design and reaction kinetics. The course builds on concepts from elementary physics and chemistry, as well as calculus and differential equations.

This module will provide students with working knowledge of conservation of mass and energy, momentum, mass and energy transfer, and non-reaction rate processes. These aspects are a first step to the understanding of transport phenomena. It considers the classification of fluids and their properties. The integral and differential forms of the fundamental equations - continuity, momentum and energy equations are studied. The concepts of transfer rates of momentum, heat and mass as functions of appropriate driving forces divided by appropriate resistances will be introduced. The way in which such resistances and driving forces are defined will be reviewed. An aim of this unit of study is to provide theoretical support for other core units of study, particularly CHNG2803 through being able to apply the principles of conservation and transport processes to any problem. This unit of study also uses techniques that will be taught in CHNG2802, particularly the techniques for predicting the flows in piping networks.

CHNG2802
Applied Maths for Chemical Engineers

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 OR MATH1015 OR MATH1905) AND ENGG1801 AND CHNG1103 AND (CHEM1101 OR CHEM1901) AND (CHEM1102 OR CHEM1902) **Corequisites:** CHNG2801 AND CHNG2803. **Assumed knowledge:** Enrolment in this unit of study assumes that all core science and engineering UoS in first-year have been successfully completed. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit consists of two core modules: MODULE A: Applied Statistics for Chemical Engineers and MODULE B: Applied Numerical Methods for Chemical Engineers. These modules aim at furthering your education by extending your skills in statistical analysis and Chemical Engineering computations. This unit will also enable you to develop a systematic approach to solving mathematically oriented Chemical Engineering problems, helping you to make sound engineering decisions. The modules will provide sufficient theoretical knowledge and computational training to progress in subsequent engineering analyses including Process Dynamics and Control and Chemical Engineering Design. This unit will provide students with the tools and know-how to tackle real-life multi-disciplinary chemical engineering problems.

CHNG2803
Energy and Fluid Systems Practice

Credit points: 6 **Session:** Semester 1 **Classes:** Project Work - in class 6 hrs/week; Project Work - own time 6 hrs/week. **Prerequisites:** (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 OR MATH1015 OR MATH1905) AND ENGG1801 AND CHNG1103 AND (CHEM1101 OR CHEM1901) AND (CHEM1102 OR CHEM1902) **Corequisites:** CHNG2801 AND CHNG2802 **Assumed knowledge:** Ability to conduct mass and energy balances, and the integration of these concepts to solve real chemical engineering problems Ability to understand basic principles of physical chemistry, physics and mechanics. Ability to use mathematics of calculus (including vector calculus) and linear algebra, and carry out computations with MATLAB and MS EXCEL. Ability to read widely outside of the technical literature, and to synthesise arguments based on such literature. Ability to write coherent reports and essays based on qualitative and quantitative information. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

CHNG2803 is a practically and theoretically-based course, where students will be introduced to types of problems that the modern chemical engineer may be asked to solve. The material is contemporary in nature, and the projects link with the key concepts taught in CHNG2801and CHNG2802 and across the curriculum.

The objectives in this unit are to provide an interesting, enjoyable, and challenging introduction to fundamental aspects of chemical engineering, particularly conservation and transport processes involving fluids and energy, as well as to the application of mathematical techniques in typical engineering problems.

In this course there is one overall project. The overall goal of the project work throughout this semester is to build a small cooling tower. This cooling tower may be used to cool water from processes that make the water hot, to humidify air that is cold and dry (as in a Sydney winter) or to dehumidify warm wet air (as in a Sydney summer).

The overall project will be split into two sub-projects i.Fluid mechanics: 4 weeks

ii.Heat and mass transfer: 8 weeks

The project in CHNG2803 addresses transport processes, including the movement of momentum (fluid mechanics), thermal energy (heat transfer) and components with mass. The projects are underpinned by a critical and constructive analysis and best practice in learning and teaching. In addition to the basic knowledge and skills required to pass this unit, the development of an understanding sufficient to enable you to tackle new and unfamiliar problems will be emphasized. You will learn to work in largely unsupervised groups and to be responsible for managing your individual and group performance.

Completion of this unit of study is a minimum requirement of your undergraduate degree program.

CHNG2804
Chemical & Biological Systems Behaviour

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 OR MATH1015 OR MATH1905) AND ENGG1801 AND CHNG1103 AND (CHEM1101 OR CHEM1901) AND (CHEM1102 OR CHEM1902) **Corequisites:** CHNG2805 AND CHNG2806. **Assumed knowledge:** Ability to conduct mass and energy balances, and the integration of these concepts to solve real chemical engineering problems. Ability to understand basic principles of physical chemistry, physics and mechanics. Ability to use mathematics of calculus (including vector calculus) and linear algebra, and to carry out computations with Matlab and MS-Excel. **Assessment:** Through semester assessment (70%) Final Exam (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is a core unit within the curriculum. Chemical Engineering requires an understanding of material and energy transformations and how these are driven by molecular interactions. The rate of such transformations is dependent on driving forces and resistances, and these need to be defined in terms of fundamental physical and chemical properties of systems. This course seeks to provide students with a sound basis of the thermodynamics of chemical and biological systems, and how these, in turn, define limits of behaviour for such real systems. The thermodynamic basis for rate processes is explored, and the role of energy transfer processes in these highlighted, along with criteria for equilibrium and stability. Emphasis is placed on the prediction of physical properties of chemical and biological systems in terms of state variables. The course delivery mechanism is problem-based, and examples from thermal, chemical and biological processes will be considered, covering molecular to macro-systems scale. The course builds naturally from the second year first semester course in conservation and transport processes, and prepares students fundamentally for the third year course in design of chemical and biological processes, which deals fundamentally with reaction/separation systems, and considers phase and chemical equilibria.

CHNG2805
Industrial Systems and Sustainability

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 OR MATH1015 OR MATH1905) AND ENGG1801 AND CHNG1103 AND (CHEM1101 OR CHEM1901) AND (CHEM1102 OR CHEM1902) **Corequisites:** CHNG2804 AND CHNG2806. **Assumed knowledge:** Ability to conduct mass and energy balances, and the integration of these concepts to solve real chemical engineering problems. Ability to understand basic principles of physical chemistry, physics and mechanics. Ability to use mathematics of calculus (including vector calculus) and linear algebra, and carry out computations with MATLAB and MS EXCEL. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course involves the study of the various concepts which underpin sustainable development, including technical and economic efficiency, stewardship of the bio-physical environment, and social acceptability. The course examines the material economy from the perspective of open and closed thermodynamic systems, and the implications of this for resource and energy consumption, and waste generation. A number of governing sustainability frameworks are examined to determine their suitability within the context of chemical engineering. A range of approaches and tools for determining industries environmental performance are introduced as part of a sustainability framework. Energy production and use, and product design are investigated from a sustainability perspective. Green Engineering principles are highlighted as a potential method for transforming industry.

CHNG2806
Materials Purification and Recovery

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorials/Practicals 3 hrs/week. **Prerequisites:** (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 OR MATH1015 OR MATH1905) AND ENGG1801 AND CHNG1103 AND (CHEM1101 OR CHEM1901) AND (CHEM1102 OR CHEM1902) **Corequisites:** CHNG2804 AND CHNG2805. **Assumed knowledge:** Ability to conduct mass and energy balances, and the integration of these concepts to solve real chemical engineering problems. Ability to understand basic principles of physical chemistry, physics and mechanics. Ability to use mathematics of calculus (including vector calculus) and linear algebra, and carry out computations with MATLAB and MS EXCEL. Ability to read widely outside of the technical literature, and to synthesise arguments based on such literature. Ability to write coherent reports and essays based on qualitative and quantitative information **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

To recognise that chemical engineers are involved in creation of products and processes, in manipulating complex systems, and in managing technical operations. To develop an appreciation of the practical application of concepts and tools to real design problems in the process, products and service sectors in which chemical engineers are engaged. To consider this through three project-driven case studies covering a range of integrated analysis scenarios, from the domain of energy and fluid systems. This course is a concurrent requirement for the concept and enabling technology courses running in parallel in the same semester.

Third year

CHNG3801
Process Design

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** CHNG2801; CHNG2802; CHNG2803; CHNG2804; CHNG2805; CHNG2806 **Corequisites:** CHNG3803, CHNG3802 **Assumed knowledge:** Enrolment in this unit of study assumes that all (six) core chemical engineering UoS in second year have been successfully completed. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study consists of two strands: (1) vapour-liquid equilibrium and distillation and (2) heat transfer and heat exchangers. The central aim is to show how these unit operations interact in the design and operation of process equipment. The first strand focuses on the following; numerical methods for predicting vapour-liquid equilibrium; binary and multi-component distillation; deviations from ideal behaviour. The second strand of this unit of study focuses on the understanding of the differences between various conventional heat exchanger types and their strengths and weaknesses. Students will understand and be able to design a range of conventional heat exchangers using a systematic approach, and will focus on design and heat transfer calculations. The two strands make extensive use of computer software: Excel and Matlab for data manipulation and equation solving; commercial flowsheeting software (Hysys) for solving engineering design problems. This unit of study runs concurrently with another enabling technology unit of study CHNG3802. These two units together provide students with the tools and know-how to tackle real-life engineering problems encountered in the concurrent project-based unit of study, CHNG3803. This integrated course structure is designed to help students become familiar with the multi-disciplinary nature of chemical engineering today.

CHNG3802
Control and Reaction Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** CHNG2801; CHNG2802; CHNG2803; CHNG2804; CHNG2805; CHNG2806 **Corequisites:** CHNG3801; CHNG3803 **Assumed knowledge:** Enrolment in this unit of study assumes that all (six) core chemical engineering UoS in second year have been successfully completed. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Aims and Objectives: This Unit of study has two strands: the first is reaction engineering while the second is concerned with process modelling and process control. The first strand of this unit of study focuses on the understanding of the key concepts of reaction engineering in process design. It covers reaction kinetics, stoichiometry, reactor design, multiple reaction systems, catalysis and using reaction data to estimate rate laws. All industrial processes require some process monitoring and control for satisfactory operation. The first strand commences with process data management before moving on to empirical modelling. The second strand will concentrate on the role of process control covering: the development of linear models, control system analysis, the design and performance of feedback control systems, and the use of control related software. This UoS demonstrates that: process control is an integral concept for any modern plant; a unified approach allows a diversity of application fields to be readily handled via a consistent approach from data analysis, though process control to process optimisation. The UoS will allow each student to achieve and demonstrate competency through a range of individual and group-based activities. By the end of this UoS a student should achieve competence in the following: process data management skills relevant to engineering (data-based modelling and data reconciliation techniques); appreciation of the role of process control in modern manufacturing; designing an appropriate feedback control system and analysing its performance for a range of process applications using both traditional and software-based techniques; appreciation of the limitations of feedback control and be able to design a range of common enhancements; appreciate the limitations that exist whenever mathematical models are used as the basis for process control; appreciate the 'vertical integration' that exists from modelling, through control, to optimisation. This UoS is part of an integrated third-year program in chemical engineering. Completion of this body of work is required before a student will be permitted to move into the final-year with its emphasis on detailed design work, thesis based research and advanced engineering options.

CHNG3803
Chemical/Biological Process Design

Credit points: 6 **Session:** Semester 1 **Classes:** Project Work - in class 4 hrs/week. **Prerequisites:** CHNG2801; CHNG2802; CHNG2803; CHNG2804; CHNG2805; CHNG2806 **Corequisites:** CHNG3801 and CHNG3802 **Assumed knowledge:** Ability to conduct mass and energy balances, and the integration of these concepts to solve real chemical engineering problems. Ability to understand basic principles of physical chemistry, physics and mechanics. Ability to use mathematics of calculus (including vector calculus) and linear algebra, and carry out computations with MATLAB and MS EXCEL. Ability to read widely outside of the technical literature, and to synthesise arguments based on such literature. Ability to write coherent reports and essays based on qualitative and quantitative information. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is a project based unit of study where students will work in small teams through three project-driven case studies covering a range of design scenarios, from the domain of chemical and biological processes. This course runs in parallel with CHNG3801 and CHNG3802, and the projects allow the students to demonstrate their kowledge of process modelling, the design of rate and equilibrium processes, the control of chemical processesand the practical and commercial aspects of design. Projects include designing equipment such as fermenters, reactors, distillation columns and heat exchangers, determining the optimal operating conditions for individual items of equipment, estimating the operating costs of processes, designing small flowsheets and designing simple control systems. By the end of this unit students will be proficient in estimating the feasibility of processes, desigining individual items of equipment and designing small flowsheets.

CHNG3805
Product Formulation and Design

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Project Work - own time, **Prerequisites:** CHNG2801; CHNG2802; CHNG2803; CHNG2804; CHNG2805; CHNG2806 **Corequisites:** CHNG3806; CHNG3807 **Assumed knowledge:** Mass and Energy Balances Conservation and Transport Phenomena Applied Mathematics (for Chemical Engineering) Process Design Concepts Process Control and Optimisation Concepts **Assessment:** Through semester assessment (55%) Final Exam (45%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Product design is one of the new frontiers of chemical and biomolecular engineering. Many products emerge from their processing not as a continuous stream, but as discrete entities. There are many examples of discrete systems in chemical and biomolecular engineering; these include particulate systems (e.g. powders or solid particles in fluids), as well as polymeric and biological systems (e.g. emulsions and cells, respectively). This unit of study is an introduction to the basic concepts in discrete systems necessary for a chemical engineer to be able to formulate and design discrete products with desired properties. In essence it is a course on product formulation and design.

The unit of study will provide students with a working knowledge of the types of discrete systems available, the ways in which particulate systems can be characterized and their applications in industry. These aspects will form the foundation for an introduction to the common techniques used to model discrete systems. By the end of the unit of study students should be proficient at understanding the types of discrete systems available, and the techniques used to characterise particulate systems, understanding the basic principles of particle-fluid systems, applying these principles and solving simple problems in product design and particulate engineering.

CHNG3806
Management of Industrial Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week; Independent Study, **Prerequisites:** CHNG2801; CHNG2802; CHNG2803; CHNG2804; CHNG2805; CHNG2806 **Corequisites:** CHNG3805; CHNG3807 **Assumed knowledge:** Ability to conduct mass and energy balances, and the integration of these concepts to solve real chemical engineering problems. Ability to understand basic principles of physical chemistry, physics and mechanics. Ability to use mathematics of calculus (including vector calculus) and linear algebra, and carry out computations with MATLAB and MS EXCEL. Ability to read widely outside of the technical literature, and to synthesise arguments based on such literature. Ability to write coherent reports and essays based on qualitative information. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Aims and Objectives: To develop an appreciation of management practice in process-led and product-driven industries; considering approaches to project management, economic evaluation of processes, risk assessment and decision making; to develop the requisite tools to support above; to consider approaches to innovation and entrepreneurship; to consider all this in the context of different scales of operation - from single process, to business unit, to enterprise, and across supply and value chains; to support this analysis through real-problem case studies and projects.

By the end of this unit of study a student should be competent in: preparing a resume for use in employment applications; developing project work plans in conjunction with project management schedules; performing economic evaluations of projects, plans and processes; performing qualitative risk assessments of projects, plans and processes; exploring optimisation of complex processes under risk and uncertainty, covering unit operations, business units, enterprises and value chains.

CHNG3807
Products and Value Chains

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 1 hr/week; Workgroup 1 hr/week; Project Work - in class 6 hrs/week; Project Work - own time 6 hrs. **Prerequisites:** CHNG2801; CHNG2802; CHNG2803; CHNG2804; CHNG2805; CHNG2806 **Corequisites:** CHNG3805; CHNG3806 **Assumed knowledge:** Ability to conduct mass and energy balances, and the integration of these concepts to solve real chemical engineering problems. Ability to understand basic principles of physical chemistry, physics and mechanics. Ability to use mathematics of calculus (including vector calculus) and linear algebra, and carry out computations with MATLAB and MS EXCEL. Ability to read widely outside of the technical literature, and to synthesise arguments based on such literature. Ability to write coherent reports and essays based on qualitative and quantitative information. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is designed to give students experience at solving complex, interesting, real world engineering problems, by applying theoretical and experimental principles learnt during their studies. During the unit of study students will be required to work on three project-driven case studies covering a range of design scenarios, from the domain of particulate products, entrepreneurial ventures (business "start ups", ethics and product value chains. This unit of study is a concurrent requirement for the concept and enabling technology courses running in parallel in the same semester. By the end of the unit of study students should be proficient at developing a strategy for taking a product development idea from concept to commercial artefact - with a comprehensive appreciation of economic arguments, underlying uncertainties (and how to mitigate these), and consideration of trade-offs inherent in this development. They should also be able to apply design and analysis tools for the synthesis of particulate products leading to the manufacture of a preferred product at pilot scale and be able to develop a strategy for the design and analysis of extended business enterprises. A key aspect of the unit of study is that students demonstrate these outcomes in project mode. The three projects in the unit of study address "issues of scale" of chemical and biomolecular engineering, from molecular to macro-systems levels.

Fourth year

CHNG4802
Chemical Engineering Design A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Site Visit, Independent Study, **Prerequisites:** CHNG3801,CHNG3802, CHNG3803, CHNG3805, CHNG3806, CHNG3807 **Prohibitions:** CHNG4203 **Assumed knowledge:** Enrolment in this unit of study assumes that all (six) core chemical engineering unit of study in third year have been successfully completed. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment. Note: School permission required for enrolment insession 2

In the overall design process, chemical engineers must clearly understand the (often complex) interactions and trade-offs that occur between technical, economic, social and environmental considerations. This units of study builds on concepts in each of these areas introduced in previous years but with an emphasis on their successful integration within a comprehensive design activity. This design activity is spread over two unit of study (Chemical Engineering Design A and B) run in first and second semester. The primary aim in the first unit of study is to consider the technical issues -with an emphasis on creating and evaluating a range of alternative options that exist at both the unit operation and complete flowsheet levels. The primary emphasis in the subsequent unit of study is on evaluating how non-technical considerations affect the final process design and its operation.

By the end of both units of study a student should be able to develop a wide range of alternative conceptual designs for a given product specification and market analysis, have an appreciation of how to evaluate process alternatives at the conceptual level with a view to creating a `short-list` worthy of more detailed technical investigation, be familiar with the use of process flowsheeting software to compare alternative designs , appreciate the fact that technical considerations are only one component in an overall successful design project and be able to clearly present the results from both individual and group work in oral/written formats.This unit of study is part of an integrated (two semester) fourth year program in chemical engineering design whose overarching aim is to complete the `vertical integration` of knowledge - one of the pillars on which this degree program is based.

CHNG4806
Chemical Engineering Design B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture, Project Work - own time, Project Work - in class, for an average of 3hrs per week **Prerequisites:** CHNG4802 or CHNG4203 **Assumed knowledge:** Enrolment in this unit of study assumes that all core chemical engineering units of study in third-year have been successfully completed, as well as the related first semester UoS CHNG4802 or CHNG4203 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

In the overall design process, chemical engineers must clearly understand the (often complex) interactions and trade-offs that occur between technical, economic, social and environmental considerations. This UoS builds on concepts in each of these areas introduced in previous years but with an emphasis on their successful integration within a comprehensive design activity.

This design activity is spread over two UoS (Chemical Engineering Design A and B) run in first and second semester. The primary aim in the first UoS is to consider the technical issues with an emphasis on creating and evaluating a range of alternative options that exist at both the unit operation and complete flowsheet levels. The primary emphasis in this UoS is on evaluating how non-technical considerations affect the final process design and its operation.

Students joining this course from the Major Industrial Placement Project (MIPPs CHNG 4203) or as overseas students (with approval) do the same assignment ut on a different schedule.

Students must enrol in 12 credit points of Thesis units.

CHNG4811
Honours Thesis A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Meeting 1 hr/week; Project Work - own time 5 hrs/week. **Prerequisites:** CHNG3801, CHNG3802, CHNG3803, CHNG3805, CHNG3806, CHNG3807. **Prohibitions:** CHNG4814, CHNG4813 **Assumed knowledge:** Enrolment in this unit of study assumes that all (six) core chemical engineering UoS in third year have been successfully completed. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: This unit is available to only those students who have gained an entry to the Honours degree. School permission required for enrolment in semester 2.

The ability to plan, systematically conduct and report on a major research project is an important skill for professional engineers. This unit of study builds on technical competencies introduced in previous years, as well as making use of the report writing and communications skills the students have developed. The research activity is spread over two units (Chemical Engineering Thesis A and B) run in first and second semester. In this unit of study, students are required to plan and begin work on a major research project, which is very often some aspect of a staff member`s research interests. Some of the projects will be experimental in nature, while others may involve computer-based simulation, design or literature surveys. In this unit, students will learn how to examine published and experimental data, set objectives, organize a program of work and devise an experimental or developmental program. The progress at the end of Thesis A will be evaluated based on a seminar presentation and a progress report. The skills acquired will be invaluable to students undertaking engineering work. Students are expected to take the initiative when pursuing their research projects. The supervisor will be available for discussion - typically 1 hour per week.

CHNG4812
Honours Thesis B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Meeting 1 hr/week; Project Work - own time 5 hrs/week. **Corequisites:** CHNG4811 **Prohibitions:** CHNG4814, CHNG4813 **Assumed knowledge:** Enrolment in this unit of study assumes that Honours Thesis A and all (six) core chemical engineering units of study in third year have been successfully completed. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: This unit is available to only those students who have gained an entry to the Honours degree. School permission required for enrolment in the semester 1.

The ability to plan, systematically conduct and report on a major research project is an important skill for professional engineers. This unit of study builds on technical competencies introduced in previous years, as well as making use of the report writing and communications skills the students have developed. The research activity is spread over two units (Honours Thesis A and B) run in first and second semester. In this unit of study, the primary emphasis is on the execution of a comprehensive and systemic series of investigations, and the reporting of the study in a major thesis document and an oral presentation. Students will acquire skills in developing a plan for a series of studies to illuminate an area of research, in evaluating alternatives at the conceptual level with a view to creating a `short-list` worthy of more detailed technical investigation, and in searching the literature for guidance of the studies. Further, communication skills will be developed, such as the ability to clearly present the background and results in a written format and in an oral presentation to a general engineering audience. This UoS is part of an integrated (two semester) fourth year program involving a chemical engineering research project and thesis. It has the overarching aim of completing the `vertical integration` of knowledge - one of the pillars on which this degree program is based. Students who have successfully completed CHNG4203 Major Industrial Project may apply for exemption from this unit of study and replace it with an advanced level chemical engineering elective unit of study.Students are expected to take the initiative when pursuing their research projects. The supervisor will be available for discussion - typically 1 hour per week.

Notes

2. For core units of study offered by other than the Faculty of Engineering, any assumed knowledge and/or prerequisite requirements will be as prescribed by that Faculty.3. Students doing any of the combined degree options BEHons/BA, BE/BCom, BE/BPM, BE/BSc, BE/BMedSc and BE/LLB will be exempt from a First Year core unit of study and from Second Year Chemistry.4. Students undertaking study overseas as part of an exchange program will enrol in CHNG3041,CHNG3042 in place of 3rd year core or CHNG4041,CHNG4042 in place of 4th year core.

Resolutions of the Faculty of Engineering relating to Chemical and Biomolecular Engineering

Bachelor of Engineering Honours (Chemical and Biomolecular)

Candidates for this degree are required to complete all the core units of study (total 156 credit points). They are also required to gain at least 24 credit points from the Third and Fourth Year electives listed in the table of recommended elective units of study for BE (Chem & Biomolec) as shown below.

BEHons (Chemical & Biomolecular) combined with a BA or BSc

Candidates in these combined degree options are required to complete all the core units of study except where specific exemptions are noted. They are also required to gain at least 12 credit points from the Fourth Year electives listed in the table of recommended elective units of study for BEHons (Chemical & Biomolecular) as shown below. This total of 144 credit points is only sufficient to be awarded a Bachelor of Engineering Honours (Chemical and Biomolecular) as part of these combined degree programs.

BEHons (Chemical & Biomolecular) combined with a BCom or BPM

Candidates in these combined degree options are required to complete all the core units of study except where specific exemptions are noted. They are also required to gain at least 6 credit points from the Fourth Year electives listed in the table of recommended elective units of study for BEHons (Chemical & Biomolecular) as shown below. This total of 144 credit points is only sufficient to be awarded a Bachelor of Engineering Honours (Chemical and Biomolecular) as part of this combined degree program.

Acceptable alternative units of study

Most Mathematics, Chemistry, Physics and Computer Science units of study offered by the Faculty of Science can be replaced by an equivalent Advanced level unit of study subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing Advanced options should seek advice from their Department before enrolling.

Recommended elective units of study

Third year

CHNG3804
Biochemical Engineering

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Project Work - in class 2 hrs/week; Laboratory 4 hrs; Independent Study, **Prerequisites:** CHEM1101 and CHEM1102 and CHNG1103 and CHNG2801 and CHNG2802 and CHNG2803 and CHNG2804 and CHNG2805 and CHNG2806 and MATH1001 and MATH1002 and MATH1003 and MATH1005 **Assumed knowledge:** Enrolment in this unit of study assumes that all (six) core chemical engineering units of study in second year have been successfully completed. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Biochemical engineering is increasingly playing an important role in technology to modern society. The engineers with knowledge of various aspects of biochemical processes are tremendously valuable. The course will examine cutting edge examples of biochemical technologies across a broad range of applications relevant to chemical engineering. The specific objectives of this course are to understand the history and scope of the biotechnology industry; examine the role of biochemical engineering in the industrial application of biotechnology and its development. We will provide an understanding of the major fundamental aspects of biochemical engineering and implementing the knowledge acquired to some selected industrial applications.

At the completion of this unit of study students should have developed an appreciation of the underlying principles of biochemical engineering and the ability to apply these skills to new and novel situations. The students will be able to critically analyse different types of biochemical engineering processes and to improve these processes consistent with the principles of biochemical engineering.

Students are encouraged to engage in an interactive environment for exchange of information and develop problem-solving skills for successfully handling challenging engineering situations. This course will be assessed by quizzes, assignments and exams.

CHNG3808
Polymer Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** CHNG2801; CHNG2802; CHNG2803; CHNG2804; CHNG2805; CHNG2806; CHEM1101; CHEM1102; CHNG1103; ENGG1800; ENGG1801; ENGG1803; MATH1001; MATH1002; MATH1003; MATH1005; MATH2061 **Corequisites:** CHNG3801; CHNG3802 **Assumed knowledge:** CHNG3801 Process Design (including Reaction Engineering, Heat and Mass Transfer) or equivalent is an absolute Co-Requisite requirement. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Polymers are ubiquitous and a significant number of scientists and engineers are employed by the Polymer Industry. This unit of study will facilitate engagement with a broad spectrum of engineering knowledge base that range from polymer synthesis to design of polymer products to developing sustainable technology in polymer synthesis and applications. The industrial applications range from biomedical to electronics and semiconductors to nanotechnology, in addition to usual consumer products. Technical knowledge relating to polymer chemistry, mathematics, fluid and solid mechanics, heat transfer, mass transfer and reaction engineering will be applied for the planned outcomes of this course.

The specific objectives are: To analyse molecular structures and their relations with material properties; To investigate the variety of thermal and thermo-mechanical properties relevant for probing polymer structure as well as understanding material behaviour in the context of applications; To engage with rheological characterization of polymers to probe polymer structural as well as to understand material behaviour in the context of applications; To understand the principles of polymer synthesis and to design polymerization reactors for producing polymer resins; To understand the principles of polymer processing in order to design polymeric products for consumer and specialty applications; To critically analyze production of polymeric goods from the sustainability point of view; To engage with examples of cutting-edge engineering product and process designs and applications that encompass biomedical, nanotechnology, electronics and other emerging technologies.

At the completion of this Unit of Study students should have developed: An appreciation of the underlying principles of polymer engineering; The ability to apply these skills to new and novel situations; The ability to critically analyse the methods of manufacture of different products and processes and to improve these processes; The development of an integrated suite of problem-solving skills needed to successfully handle new engineering applications; An ability to independently research and be critical of the findings; An ability to analyze experimental data; An ability to carry out process and product design through critical thinking; Interpersonal, group and teamwork skills including the ability to communicate clearly and concisely; Professionalism in terms of taking responsibility for the results of their calculations and recommendations; Lifetime or self-directed learning skills including the ability to critically assess one's own performance in a constructive manner.

CHNG3809
Laboratory and Industrial Practice

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 8 hrs/week; Project Work - in class 8 hrs/week; Tutorial 2 hrs/week; Report Writing 8 hrs. **Prerequisites:** CHNG1103, CHNG2801, CHNG2802, CHNG2803, CHNG2804, CHNG2805 AND CHNG2806 **Corequisites:** CHNG3801, CHNG3802, CHNG3803 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit of study provides an opportunity for students to gain experience in the operation of process plants and pilot plants. In particular students will have the opportunity to apply chemical and biomolecular engineering fundamentals to real world problems including distillation, heat transfer, fermentation, filtration, crystallisation and reverse osmosis. The UoS will give students experience with examples drawn from the petrochemical, minerals, biotech, pharmaceutical and water industries.

In addition the UoS will also give students an additional opportunity to apply the knowledge of experimental design, data analysis and statistics.

Fourth year

CHNG4203
Major Industrial Project

Credit points: 24 **Session:** Semester 1 **Classes:** Practical Experience, **Prerequisites:** 144 CP prior study with >65% WAM **Assumed knowledge:** Passed at least 144 credit points. Students wishing to do this unit of study are required to discuss the matter with the Head of School prior to enrolment. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: Enrollment by permission only. The candidate will be selected by interview and at the discretion of the Head of School.

This unit of study will give students a rich experience in carrying out a major project within an industrial environment, and in preparing and presenting detailed technical reports (both oral and written) on their work.

The project is carried out under joint University/industry supervision and extends over several months, with the student essentially being engaged fulltime on the project at the industrial site. Previous students have been placed with industries in areas including the mining industry, oil and gas processing, plastic and paint manufacture, food production, manufacturing and so on. Students will learn from this experience the following essential engineering skills : how to examine published and experimental data, set objectives, organise a program of work, and analyse results and evaluate these in relation to existing knowledge. Presentation skills will also be developed, which are highly relevant to many branches of engineering activity.WAM greater than credit average.

CHNG5001
Process Systems Engineering

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 1 hr/week; Project Work - in class 2 hrs/week; Project Work - own time 4 hrs/week. **Assumed knowledge:** First year undergraduate physics and mathematics (differential equations). Use of mathematical and/or computer-based modelling tools and techniques. Feedback control concepts and principles as taught in CHNG3802/CHNG5802 or similar courses. Students who are unsure about meeting these requirements should contact the unit coordinator for advice. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This unit of study is for Masters students and can be selected as an elective by 4th year students.

Whatever its purpose, any process requires some level of process monitoring and control to allow it to operate satisfactorily. Once a process is under control, the option exists to further improve performance via the implementation of some level of optimisation. This UoS will develop skills in integrating process modelling, simulation, design, optimisation and control concepts. The aims of this UoS are (i) to demonstrate that modelling, process control and optimisation are integral concepts in the overall consideration of industrial plants, (ii) to demonstrate that a unified approach allows a diversity of application fields to be readily handled, and (iii) to allow each student to achieve and demonstrate acceptable competency over the UoS material through a range of individual and group-based activities.

CHNG5003
Green Engineering

Credit points: 6 **Session:** Semester 2 **Classes:** Meeting 4 hrs/week. **Assumed knowledge:** CHNG3801 AND CHNG3802 AND CHNG3803 AND CHNG3805 AND CHNG3806 AND CHNG3807. All core third year chemical engineering. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Green engineering, eco-technology and sustainable technology are all interchangeable terms for the design of products and processes that maximise resource and energy efficiency, minimise (or preferably eliminate) waste and cause no harm to the environment. In modern society, engineers equipped with the skills to develop sustainable technologies are tremendously valuable. This unit of study will examine cutting edge examples of sustainable technologies across a broad range of applications relevant to chemical and biomolecular engineering. The delivery of teaching and learning material will be exclusively in project mode. Students will be expected to critically analyse modern engineering processes and improve them, from the ground up if necessary, so that they satisfy the criteria of eco-design. At the completion of this unit of study students should have developed an appreciation of the underlying principles of green engineering and be able to demonstrate they can apply these skills to new and novel situations. Students are expected to develop an integrated suite of problem-solving skills needed to successfully handle novel (and previously unseen) engineering situations, coupled with an ability to independently research new areas and be critical of what is found, and an ability to cope with experimental data, change and uncertainty through critical thinking.

CHNG5004
Particles and Surfaces

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Enrolment in this unit of study assumes that all (six) core chemical engineering UoS in third year or their equivalent have been successfully completed. **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

Particles and Surfaces: Mineral Processing. Aims and Objectives: Solid-solid and solid-liquid interactions are an important aspect in mineral processing. The aim of any mineral processing operation is the efficient extraction of the valuable metals or minerals (concentrate) from the waste materials in the ore (gangue). The goal of this course is to understand the various key steps and the corresponding principles required to achieve metal extraction from the ores.

Syllabus summary: This course will elucidate the principles in size reduction or comminution of the ore in liberating the valuable minerals, examine the microscopic details of solid-liquid, solid-gas and solid-solid interactions in mineral processing and their roles in macroscopic phenomena such as adhesion, wetting, adsorption, and mineral reactions such as reduction roasting and leaching. The general understanding of these factors will allow manipulation and improvement of performance in mineral beneficiation, dewatering of mineral slurries and extractive metallurgy.

By the end of this course students should develop a proficiency in characterisation of physical, surface and chemical properties of solids and metal aqueous streams; devising strategies to achieve extraction process objectives, within the constraints imposed by social, economic and physical environments, developing management strategies for treating liquid and solid effluents and becoming familiar with computer software packages in modelling aqueous and solid systems. This UoS is an advanced Chemical Engineering elective.

CHNG5005
Wastewater Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Group assignment 2 hrs/week; Site Visit 5 hrs/week. **Assumed knowledge:** Ability to conduct mass and energy balances, and the integration of these concepts to solve 'real' chemical engineering problems. Ability to understand basic principles of physical chemistry, physics and mechanics. Ability to use basic calculus and linear algebra, and carry out such computations using Matlab and MS Excel. Ability to read widely outside of the technical literature and to synthesise arguments based on such literature. Ability to write coherent reports and essays based on information from diverse sources. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit aims to acquaint students with the application of chemical engineering concepts and practice in an environmental context, the important example of wastewater treatment will be explored.

The key issues that will be considered are: Wastewater creation and characterisation; Wastewater treatment costs; Primary, secondary and tertiary treatment options; High-rate anaerobic and aerobic treatment options; Sludge management and water recovery/reuse options; Process integration considerations.

By the end of this UOS, a student should have gained an engineering-based appreciation of the technical, economic and social challenges posed by wastewater generation and its cost-effective treatment.

This UoS is an advanced elective in chemical engineering. The concepts and enabling technologies taught here are relevant to the real-world practice of chemical engineering across a broad range of industries.

CHNG5006
Advanced Wastewater Engineering

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Laboratory 1 hr/week. **Assumed knowledge:** CHNG5005 OR CHNG3804. **Assessment:** Through semester assessment (65%) Final Exam (35%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study addresses inter-related issues relevant to wastewater treatment including: (i) the diverse nature of wastewater and its characteristics; (ii) an overview of conventional wastewater treatment options; (iii) the use of commercial software in designing and evaluating a range of advanced wastewater treatment options including biological nutrient removal; (iv) the potential role of constructed wetlands in domestic and industrial wastewater treatment; (v) wastewater management in the food processing, resources, and coal seam gas production industries; (vi) researching advanced wastewater treatment options.

CHNG5008
Nanotechnology in Chemical Engineering

Credit points: 6 **Session:** Semester 2 **Classes:** Project Work - own time 8 hrs/week; Lecture 4 hrs/week. **Prerequisites:** CHNG3801 AND CHNG3802 AND CHNG3805 AND CHNG3806 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment. Note: Note: School permission required for enrollment.

This course will give students insights into advanced concepts in Chemical and Biomolecular Engineering, which are essential for the design of efficient processes and green products for the sustainable development and minimise or preferably eliminate waste for a clean world. This unit of study will examine cutting edge examples of nano-technology, renewable energy, bio-technology, and other advanced technologies across a broad range of applications relevant to chemical and biomolecular engineering. At the completion of this unit of study students should have developed an appreciation of the underlying concepts and be able to demonstrate they can apply these skills to new and novel situations. Students are expected to develop an integrated suite of problem-solving skills needed to successfully handle novel (and previously unseen) engineering situations, coupled with an ability to independently research new areas and be critical of what is found, and an ability to cope with experimental data, change and uncertainty through critical thinking.

CHNG5601
Membrane Science

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 4 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

"Membrane Science" provides background in the physics and electrochemistry of a variety of synthetic membranes used in industry as well as cellular membranes.

The course aims to provide students with an understand of:

membrane self-assembly and manufacture;

membrane separation processes such as filtration, desalination, ion exchange and water-splitting;

and techniques for membrane characterisation and monitoring.

CHNG5602
Cellular Biophysics

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 4 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

Students will be given a good background in the physics of biological processes. Students will understand the differences between thermodynamically closed and open systems and its relevance to cells and other biological systems. Students will be provided with an introduction to the thermodynamics of irreversible and evolutionary processes of relevance to biology. Students will be introduced to the statistical mechanics of self assembly and equilibrium structures and its relevance to biology at the molecular level.

CHNG5603
Analysis, Modelling, Control: BioPhy Sys

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Project Work - own time 2 hrs/week. **Assumed knowledge:** It is assumed that students have a general knowledge of: MATH 1001 Differential Calculus MATH 1003 Integral Calculus and Modeling **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This course is for Master degree students and also is offered as an elective course for fourth year students. Some lectures my be given by a guest lecturer. this

This course will give students an insight into the use of (computer-based) statistical techniques in extracting information from experimental data obtained from real life bio-physical systems. The issues and techniques required for mathematical modeling as well as monitoring and/or control scheme for bio-physical systems will be discussed and implemented in diverse range of bioprocesses, including biomaterials and fermentation products.

We will review statistical distribution; tests based on z, t, F variables; calculation of confidence intervals; hypothesis testing; linear and nonlinear regression; analysis of variance; principal component analysis; and use of computer-based statistical tools. The issues associated with dynamic response of bio-physical processes; inferred or estimated variables; control system design and implementation; introduction to model-based control; use of computer-based control system design and analysis tools will be elaborated.

When this course is successfully completed you will acquire knowledge to choose the appropriate statistical techniques within a computer based environment, such as Excel or MATLAB, for a given situation. The students will also obtain potential for monitoring/control scheme based on the key dynamic features of the process. Such information would be beneficial for any future career in Bio-manufacturing companies. Students are encouraged to promote an interactive environment for exchange of information.

CHNG5604
Membrane Engineering Laboratory

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 4 hrs/week. **Assumed knowledge:** CHNG5601 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This a practical unit of study where students apply the theoretical concepts of membrane science to engineering practice via a series of laboratory experiments. The students will gain practical insights into mass transport processes through various membranes. Students will understand the construction and functional properties of synthetic separation membranes and also will explore experimentally the various factors affecting the performance of membranes.

CHNG5605
Bio-Products: Laboratory to Marketplace

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Project Work - own time 6 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This course is for Master degree students and also is offered as an elective course for fourth year students. .

The objectives of the course are to provide students with an overview of biochemical and pharmaceutical industry. It will give students an insight into drug delivery systems and formulation; how therapeutic drugs work; and a general overview of biochemical and pharmaceutical marketing. The design and management of clinical trials, which are key factors for development of any new therapeutic agent will also be covered in the course. The challenges for commercialisation of innovative methods and/or biochemical and pharmaceutical products and aspects of intellectual property protection will be elaborated. Ultimately the aspects of Good Manufacturing Practice (GMP) and international legislation for marketing pharmaceutical products will be illuminated.

Lectures in this course will be delivered by both University of Sydney staff and by a number of visiting professional representatives from industry and government agencies. We will also arrange a site visit for a bio-manufacturing company as warranted.

When you successfully complete this course you acquire knowledge about drug formulation, pharmaceutical processing including physical processes, legislation governing the bio-manufacturing and commercialisation of biochemicals and pharmaceuticals. The information would be beneficial for your future career in pharmaceutical manufacturing companies.

Students are encouraged to engage in an interactive environment for exchange of information. This course will be assessed by quizzes, assignments, oral presentation and final report.This unit of study is offered as an advanced elective unit of study to final year undergraduate students. Students may be required to attend lectures off-campus.

For a standard enrolment plan for Chemical and Biomolecular Engineering visit cusp.sydney.edu.au/students/view-degree-page/name/BE(CBE)

School of Civil Engineering

Much of the physical infrastructure of our modern society is designed and built by civil engineers. The Bachelor of Engineering Honours (Civil) will teach you about planning, designing and testing structures within the built environment.

You will develop professional technical, managerial, organisational, financial, environmental and problem solving skills in the discipline. As a civil engineer, you will be concerned with all types of structures including dams, bridges, pipelines, roads, towers and buildings. You may become responsible for the design and construction of our transport systems, the design and management of our gas and water supply, sewerage systems, harbours, airports or railways.

Career paths for civil engineering graduates include construction and mining companies, engineering and infrastructure consultants, municipal councils, public works, airport and harbour authorities, environmental consultants, banks and project management consultants.

The School of Civil Engineering offers the following undergraduate degrees:

- Bachelor of Engineering Honours (Civil)
- Bachelor of Engineering Honours (Civil) and Design in Architecture
- Bachelor of Project Engineering and Management (Civil)

Please note that the Bachelor of Project Engineering and Management is no longer offered to new students. The information about this degree provided in this handbook is for continuing students only.

For a standard enrolment plan for Civil Engineering visit cusp.sydney.edu.au/students/view-degree-page/name/BE(Civil)

Bachelor of Engineering Honours (Civil)

Course Overview

Much of the physical infrastructure of our modern society is designed and built by civil engineers. The Bachelor of Engineering Honours (Civil) will teach you about planning, designing and testing structures within the built environment.

You will develop professional technical, managerial, organisational, financial, environmental and problem solving skills in the discipline. As a civil engineer, you will be concerned with all types of structures including dams, bridges, pipelines, roads, towers and buildings. You may become responsible for the design and construction of our transport systems, the design and management of our gas and water supply, sewerage systems, harbours, airports or railways.

Career paths for civil engineering graduates include construction and mining companies, engineering and infrastructure consultants, municipal councils, public works, airport and harbour authorities, environmental consultants, banks and project management consultants.

The Bachelor of Engineering Honours (Civil) is available in the following streams:

- Construction and Management
- Environmental
- Geotechnical
- Structures

Course Requirements

To meet requirements for the Bachelor of Engineering Honours(Civil), a candidate must successfully complete 192 credit points, comprising:

1. core and elective units of study relating to the specialist stream, as prescribed by the table of units of study for the stream; and
2. any additional free elective units of study as may be necessary to gain credit to complete the award.

For a standard enrolment plan for Civil Engineering visit cusp.sydney.edu.au/students/view-degree-page/name/BE(Civil)

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Bachelor of Engineering Honours (Civil)			
Candidates for the degree of Bachelor of Engineering Honours (Civil) are required to gain credit for the core units of study set out below. Any additional credit necessary to satisfy the degree requirement of not less than 192 credit points shall be gained by completing additional elective units of study, as recommended by the School (as set out below).			
Core units of study (all streams except Project Management)			
First year			
MATH1001 **Differential Calculus**	3	**A** HSC Mathematics Extension 1 **N** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001	Semester 1 Summer Main
MATH1002 **Linear Algebra**	3	**A** HSC Mathematics or MATH1111 **N** MATH1902, MATH1012, MATH1014	Semester 1 Summer Main
ENGG1800 **Engineering Disciplines (Intro) Stream A**	6		Semester 1
ENGG1801 **Engineering Computing**	6		Semester 1 Summer Late
PHYS1001 **Physics 1 (Regular)**	6	**A** HSC Physics **P** HSC Physics with a minimum mark of 65 **N** PHYS1002, EDUH1017, PHYS1901	Semester 1
MATH1003 **Integral Calculus and Modelling**	3	**A** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **N** MATH1013, MATH1903, MATH1907	Semester 2 Summer Main
MATH1005 **Statistics**	3	**A** HSC Mathematics **N** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021	Semester 2 Summer Main Winter Main
ENGG1802 **Engineering Mechanics**	6		Semester 2 Summer Main
ENGG1803 **Professional Engineering 1**	6	**N** ENGG1061	Semester 1 Semester 2
GEOL1501 **Engineering Geology 1**	6	**A** No previous knowledge of Geology assumed **N** GEOS1903, GEOL1902, GEOS1003, GEOL1002	Semester 2
Second year			
MATH2061 **Linear Mathematics and Vector Calculus**	6	**P** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **N** MATH2961, MATH2067, MATH2901, MATH2902, MATH2001, MATH2002	Semester 1 Summer Main
CIVL2110 **Materials**	6		Semester 1
CIVL2810 **Engineering Construction and Surveying**	6	**A** MATH1001, MATH1002, MATH1003, MATH1005 *In recent years - the course has included a 1.5 day camp at Webbs Creek (about 80km from Sydney). The camp is located in a bushland setting. It aims to provide valuable practice in practical field survey and has a secondary aim of providing a basis for social gathering (this aspect being requested in student feedback over recent years)*	Semester 1
CIVL2201 **Structural Mechanics**	6	**A** From ENGG1802 Engineering Mechanics, students should be competent in the following areas. 1. The concept of force and momentum equilibrium in two and three dimensions. 2. Drawing free body diagrams. 3. Establishing and solving the equations of equilibrium from the FBD. 4. Setting out solutions logically, clearly and neatly. Students should be competent incertain mathematical skills. 1. Solving algebraic equations. 2. Differentiation and integration (including double integrals). 3. Drawing graphs of polynomials (especially) and other mathematical function. 4. Trigonometry. **P** ENGG1802 **N** AMME2301	Semester 1
CIVL2230 **Intro to Structural Concepts and Design**	6	**A** CIVL2110 AND CIVL2201 AND ENGG1802. Structural mechanics, first year mathematics, but these are not prerequisites *Basic structural elements include beams, columns slabs and simple frames.*	Semester 2
CIVL2410 **Soil Mechanics**	6	**A** Knowledge: CIVL2201 AND GEOL1501. An understanding of simple statics, equilibrium, forces and bending moments, and of stress and strain and the relationship between them. This is covered by University of Sydney courses ENGG 1802 Engineering Mechanics, CIVL2201 Structural Mechanics. Familiarity with the use of spreadsheets (Excel, Mathcad) to obtain solutions to engineering problems, and with the graphical presentation of this data. Familiarity with word processing packages for report presentation. Some of this is covered in the University of Sydney course ENGG1801 Engineering Computing. Familiarity with partial differential equations, and their analytical and numerical solution.	Semester 2
CIVL2611 **Introductory Fluid Mechanics**	6	**A** CIVL2201 AND ENGG1802 AND MATH1001. Students are expected to have a strong understanding of fundamental physics, statics, equilibrium, forces, and dimensional analysis. Familiarity with simple calculus, partial differential equations, and the analytical and numerical solutions.	Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Third year			
CIVL3205 **Concrete Structures 1**	6	**A** CIVL2110 AND CIVL2201 AND CIVL2230. Basic concepts of solid mechanics and structural mechanics, including: compatability of strains; stress-strain relationships; equilibrium; flexure, shear and torsion; statically determinate load effects (reactions, bending moments, shear forces); elastic beam theory (strains, stresses and beam deflections).	Semester 1
CIVL3612 **Fluid Mechanics**	6	**A** CIVL2201 AND CIVL2611 AND ENGG1802 AND MATH2061. This unit of study follows on from Fluid Mechanics CIVL2611, which provides the essential fundamental fluid mechanics background and theory, and is assumed to be known and fully understood.	Semester 1
CIVL3010 **Sustainable Systems Engineering**	6	**A** ENGG1803	Semester 1
CIVL3812 **Project Appraisal**	6	**A** MATH1005 **N** ENGG2850	Semester 1
CIVL3206 **Steel Structures 1**	6	**A** CIVL2110 AND CIVL2201 AND CIVL2230 AND CIVL3235 *It is assumed that students are competent in the following areas: the methods of load transfer in structures - tension, compression, bending, shear, torsion, and bearing; an appreciation of stress and strain, and being able to determine stresses and strains in simple sections under axial force, bending moments, shear and torsion; calculating and understanding the physical significance of geometric section properties - centroid, Ix, Iy, Zx, Zy, Sx, Sy, rx, ry, J, Ag; knowledge of the basic elastic-plastic material properties of steel, E, G, fy, fu; and knowledge of loading of structures. A special "assumed knowledge" lecture will be given in Week 1 to refresh the knowledge of students.*	Semester 2
Fourth year			
CIVL4811 **Engineering Design and Construction**	6	**A** CIVL2810 *This unit aims to prepare students for employment in a broad range of engineering areas including design, planning and construction management.*	Semester 1
CIVL4903 **Civil Engineering Design**	6	**A** CIVL2410, CIVL3612, CIVL4811 **P** CIVL3205 and CIVL3206	Semester 2
ENGG4000 **Practical Experience**		**P** 36 Credit Points of Senior Units *Students should have completed three years of their BE program before enrolling in this unit.*	Semester 1 Semester 2
Students must enrol in 12cp of Thesis units.			
CIVL4022 **Honours Thesis A**	6	**P** 30 credits of 3rd year units of study and HWAM 65 or over. *Note: Department permission required for enrolment* *It is expected that the Thesis will be conducted over two consecutive semesters and that the majority of students will start in Semester 1. Commencement in Semester 2 requires permission of Thesis coordinator and School`s Director of Learning & Teaching and will only be allowed where there are good reasons for doing so. Students considering this option should discuss it with the Thesis coordinator at least one semester before they intend to start.*	Semester 1 Semester 2
CIVL4023 **Honours Thesis B**	6	**P** 30 credit points of 3rd year units of study *Note: Department permission required for enrolment*	Semester 1 Semester 2

Note

For core units of study offered by faculties other than the Faculty of Engineering and Information Technologies, any assumed knowledge, prerequisite and corequisite requirements will be as prescribed by the Faculty.

Resolutions of the Faculty of Engineering and Information Technologies relating to Civil Engineering (except Project Engineering Management)

Candidates for the degree of Bachelor of Engineering Honours (Civil) are expected to complete all the core units (144 credit points). They are also required to gain at least 18 credit points from the 3rd year Civil recommended elective units of study listed below, and 18 credit points from fourth year Civil recommended elective units of study listed below. The remaining 12 credit points can be obtained from any of the listed elective units or from units of study in other Faculties subject to approval from the Director of Learning and Teaching, Civil Engineering.

Single Degree Programs

To meet specialisation requirements for either Construction Engineering and Management, Structural Engineering, Environmental Engineering or Geotechnical Engineering, students must enrol in at least 3 electives from the relevant stream listed below, and undertake a thesis on a related topic. Students may enrol in a maximum of 4 electives from the Construction Engineering and Management stream. Students enrolled in a Bachelor of Engineering Honours (Civil) must follow note 2 below.

Construction Engineering and Management Stream: CIVL3805, CIVL3813, CIVL4810, CIVL4814, CIVL4815.

Structural Engineering Stream: CIVL3235, CIVL5266, CIVL5269, CIVL5458

Environmental Stream: CIVL3614, CIVL5351, CIVL5458, CIVL5668

Geotechnical Engineering Stream: CIVL3411, CIVL5351, CIVL5452, CIVL5458

Most Mathematics, Chemistry, Physics and Computer Science units of study offered by the Faculty of Science can be replaced by an equivalent advanced level units of study subject to prerequisite conditions (as required by the Faculty of Science) being met.

Combined Degree Programs

Candidates for one of the combined degree programs (that is, Bachelor of Engineering Honours (Civil) with either a Bachelor of Arts, Bachelor of Science, Bachelor of Medical Science, Bachelor of Laws, Bachelor of Project Management or Bachelor of Commerce) are required to complete all of the core units of study listed above (144 credit points). This total of 144 credit points (plus 12 credit points of electives from the list of electives below for combined degrees with Bachelor of Arts) is only sufficient to be awarded a Bachelor of Engineering Honours (Civil) as part of an approved combined degree program. The remaining credit points for the combined degree will be taken in the appropriate Faculty (Arts, Science, Law or Economics) or BPM core unit tables and candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies and the relevant faculty requirements.

Candidates taking a combined degree with Science or Medical Science may count the Science subjects in the Civil Engineering core to their 96 credits points of Science subjects. Electives from the list below should be taken to complete 144 credit points of Engineering subjects.

Candidates taking a combined degree with Design in Architecture please see the separate Table of core units of study.

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session

Advanced Options

Students considering doing advanced options should seek advice from the relevant department before enrolling.

Acceptable alternative units of study

The Faculty has prescribed the following acceptable alternatives to core units of study listed in the above specialisation requirements:

GEOL1501 Engineering Geology 1 (6cps), acceptable alternative: GEOL1001 and GEOL1002

Recommended elective units of study

Second year

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
CIVL2511 **Research Techniques**	6	**A** CIVL2201 AND ENGG1802. Basic understanding of Maths, Physics and Chemistry appropriate to student in 2nd year of study. Concepts of Force, Moment, Torque, Stress, Strain, Displacement, Velocity and Acceleration. These are covered in a range of courses but particularly CIVL2201 Structural Mechanics and ENGG1802 Engineering Mechanics	Semester 2
MATH2065 **Partial Differential Equations (Intro)**	6	**P** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **N** MATH2965, MATH2005, MATH2905, MATH2067	Semester 2 Summer Main

Third year

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
CIVL3235 **Structural Analysis**	6	**A** CIVL2110, CIVL2230 and MATH2061	Semester 2
CIVL3411 **Geotechnical Engineering**	6	**A** CIVL2410	Semester 2
CIVL3614 **Hydrology**	6	**A** ENGG1802 AND CIVL3612 AND MATH2061 **P** CIVL2611 *The unit of study builds on the theory and concepts learnt in CIVL2611 Introductory Fluid Mechanics and CIVL3612 Fluid Mechanics.*	Semester 2
CIVL3805 **Project Scope, Time and Cost Management**	6	**A** CIVL2810 **N** QBUS2350, ENGG1850	Semester 2

Fourth year

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
CIVL3813 **Contracts Formulation and Management**	6	**A** CIVL3805. Students are expected to have grasped the concepts of basic legal and management principles and the understanding of construction and engineering terminologies. As there is no any prerequisite courses for this UoS, without prior knowledge student can perform exceptionally well with regular attendance and participation in course activities. *?For students in the BE Civil degree (or combined degrees with BE Civil) this unit is a 4th year elective. Please take careful note: It DOES NOT count as a third year elective. ?For students in the BE Project Engineering and Management (Civil) degree this is a 3rd year core unit.*	Semester 2
CIVL4810 **Mgmnt of People, Quality and Risk in PE**	6	**A** CIVL3805. Students are expected to have understood and applied basic tools for project scope, cost and time management for projects as taught in (CIVL3805)or equivalent courses.	Semester 2
CIVL4814 **Project Procurement and Tendering**	6	**A** CIVL3805	Semester 2
CIVL4815 **Project Formulation**	6	**P** CIVL3805, CIVL3812	Semester 1
CIVL5266 **Steel Structures - Stability**	6	**A** There are no prerequisites for this unit of study but it is assumed that students are competent in the content covered in Structural Mechanics, Steel Structures, and Structural Analysis.	Semester 1
CIVL5269 **Concrete Structures - Strength & Service**	6	**P** CIVL3205 OR CIVL5507 OR CIVL9205	Semester 2
CIVL5351 **Geoenvironmental Engineering**	6		Semester 1
CIVL5453 **Geotechnical Hazards**	6	**A** CIVL2410 AND CIVL3411. Students are assumed to have a good knowledge of fundamental soil mechanics, which is covered in the courses of soil mechanics (settlement, water flow, soil strength) and foundation engineering (soil models, stability analyses; slope stability; retaining walls; foundation capacity).	Semester 2
CIVL5458 **Numerical Methods in Civil Engineering**	6		Semester 1
CIVL5668 **Wind Engineering for Design-Fundamentals**	6		Semester 1
CIVL5670 **Reservoir Stream & Coastal Eng**	6	**A** CIVL3612 and MATH2061.	Semester 1

Notes

1. Choice of electives as shown in the above table will depend upon subject availability, timetabling and prerequisite conditions.

2. For the BEHons (Civil) degree students must take at least 18 elective credit points of study from the recommended Civil Third Year level and 18 elective credit points from the recommended Civil Fourth Year electives. The remaining 12 credit points can be obtained from any of the listed elective units or from units of study in other Faculties subject to approval from the Director of the Learning and Teaching, Civil Engineering.

Exchange units of study

CIVL0011, CIVL0012, CIVL0013, CIVL0014, CIVL0015, CIVL0016, CIVL0017 AND CIVL0018 are available for exchange study programs.

For a standard enrolment plan for Civil Engineering visit cusp.sydney.edu.au/students/view-degree-page/name/BE(Civil)

Unit of Study Descriptions

Bachelor of Engineering Honours (Civil)

Candidates for the degree of Bachelor of Engineering Honours (Civil) are required to gain credit for the core units of study set out below. Any additional credit necessary to satisfy the degree requirement of not less than 192 credit points shall be gained by completing additional elective units of study, as recommended by the School (as set out below).

Core units of study (all streams except Project Management)

First year

MATH1001
Differential Calculus

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001 **Assumed knowledge:** HSC Mathematics Extension 1 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1001 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study looks at complex numbers, functions of a single variable, limits and continuity, vector functions and functions of two variables. Differential calculus is extended to functions of two variables. Taylor's theorem as a higher order mean value theorem.

Textbooks
As set out in the Junior Mathematics Handbook.

MATH1002
Linear Algebra

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1902, MATH1012, MATH1014 **Assumed knowledge:** HSC Mathematics or MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1002 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study introduces vectors and vector algebra, linear algebra including solutions of linear systems, matrices, determinants, eigenvalues and eigenvectors.

Textbooks
As set out in the Junior Mathematics Handbook

ENGG1800
Engineering Disciplines (Intro) Stream A

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 1 hr/week; Laboratory 3 hrs/week. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces students to specialisations in the Engineering discipline areas of Aeronautical, Biomedical Chemical, Civil, Mechanical and Mechatronic Engineering, and Project Engineering and Management. By providing first-year students with an experience of these various engineering streams, the unit aims to develop the students' professional identity as an engineer and thus provide a suitable basis on which students can choose their discipline for further study.

Introductory sessions in the School of Aerospace,

Mechanical and Mechatronic Engineering

-4 weeks-

An overview of the degree requirements in each stream. The roles of the engineer in each stream (employments, skills, etc). How each of the subjects taught relate to the skills/knowledge and applications required of the engineers. Basically make sure students fully understand what engineers are in the discipline areas and why the students do the subjects they do. In each stream, one engineering technical topic will be taught as a problem solving exercise, and this topic will be the focus of the laboratory.

School of Civil Engineering

-4 weeks-

Introductory lectures in Engineering Economics and Construction Planning, Foundation Engineering, Structural Engineering, Materials, Environmental Engineering. Each student will be involved in the erection and dismantling of an 8 metre high steel and timber tower in the Civil Engineering Courtyard. Preliminary lectures related to the tower will include safety issues, loading, statical analysis, foundation calculations, construction management, engineering drawings and detailing, geometric calculations, and survey measurements. Exercises related to these issues will be performed before assembly and disassembly of the tower.

School of Chemical and Biomolecular Engineering

-4 weeks-

This course will enable students to gain an appreciation of: the methods and materials of construction of items of process equipment; the role of this equipment in building an entire chemical processing plant: its operation and maintenance and safety requirements and procedures. Students will dismantle, disassemble and operate items of process equipment. They will present written answers to questions, supplemented by drawings of process flowsheets, diagrams of dismantled equipment, and discussions of heat and mass balances and of process parameters.

ENGG1801
Engineering Computing

Credit points: 6 **Session:** Semester 1, Summer Late **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will introduce students to fundamental principles of programming. The language used will be Matlab but the principles taught are readily portable to other languages like C and Java. The unit material will be presented in a manner which will help students to draw a connection between programming constructs and real engineering applications. The unit will use engineering inspired case-studies : especially from Civil, Chemical, Aerospace and Mechanical streams, to motivate new material. There will be a major project which uses programming to solve a real world engineering problem. The extensive Matlab library for visualization will also be introduced. Matlab will cover two-thirds of the unit. The remaining one-third will be devoted to the use of Excel in engineering scenarios. Furthermore, cross integration between Matlab and Excel will also be highlighted.

PHYS1001
Physics 1 (Regular)

Credit points: 6 **Session:** Semester 1 **Classes:** Three 1-hour lectures, one 3-hour laboratory per week for 9 weeks and one 1-hour tutorial per week. **Prerequisites:** HSC Physics with a minimum mark of 65 **Prohibitions:** PHYS1002, EDUH1017, PHYS1901 **Assumed knowledge:** HSC Physics **Assessment:** 3 hour exam plus laboratories, assignments and mid-semester tests (100%). **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for students who gained 65 marks or better in HSC Physics or equivalent. The lecture series contains three modules on the topics of mechanics, thermal physics, and oscillations and waves.

Textbooks
Young & Freedman. University Physics. 13th edition, with Mastering Physics, Addison-Wesley. 2012. Course lab manual.

MATH1003
Integral Calculus and Modelling

Credit points: 3 **Session:** Semester 2, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1013, MATH1903, MATH1907 **Assumed knowledge:** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1003 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.This unit of study first develops the idea of the definite integral from Riemann sums, leading to the Fundamental Theorem of Calculus. Various techniques of integration are considered, such as integration by parts.The second part is an introduction to the use of first and second order differential equations to model a variety of scientific phenomena.

Textbooks
As set out in the Junior Mathematics Handbook

MATH1005
Statistics

Credit points: 3 **Session:** Semester 2, Summer Main, Winter Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021 **Assumed knowledge:** HSC Mathematics **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1005 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit offers a comprehensive introduction to data analysis, probability, sampling, and inference including t-tests, confidence intervals and chi-squared goodness of fit tests.

Textbooks
As set out in the Junior Mathematics Handbook

ENGG1802
Engineering Mechanics

Credit points: 6 **Session:** Semester 2, Summer Main **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit aims to provide students with an understanding of and competence in solving statics and introductory dynamics problems in engineering. Tutorial sessions will help students to improve their group work and problem solving skills, and gain competency in extracting a simplified version of a problem from a complex situation. Emphasis is placed on the ability to work in 3D as well as 2D, including the 2D and 3D visualization of structures and structural components, and the vectorial 2D and 3D representations of spatial points, forces and moments. Introduction to kinematics and dynamics topics includes position, velocity and acceleration of a point; relative motion, force and acceleration, momentum, collisions and energy methods.

ENGG1803
Professional Engineering 1

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prohibitions:** ENGG1061 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Professional Engineering 1 is an introductory Unit of Study within the Faculty of Engineering. The semester 1 course is aimed at students from the School of Aerospace, Mechanical and Mechatronic Engineering. It seeks to introduce newly admitted undergraduates to general principles of professional engineering practice, a range of contemporary professional engineering issues, plus outline skills related to academic study within an engineering environment. The subject is structured around a team based design and build project, in which students apply the professional engineering concepts they are learning to an engineering project. Professional engineering topics to be covered include: accessing information, teamwork, creativity, leadership, written and oral communication, project management, problem solving, ethics, liability, work health and safety and environmental issues.

GEOL1501
Engineering Geology 1

Credit points: 6 **Teacher/Coordinator:** A/Prof Tom Hubble **Session:** Semester 2 **Classes:** Two 2 hour lectures per week and 24 hours laboratory classes. **Prohibitions:** GEOS1903, GEOL1902, GEOS1003, GEOL1002 **Assumed knowledge:** No previous knowledge of Geology assumed **Assessment:** Practical laboratory work, Assignments, Tests and Quizzes, and a combined theory and practical exam (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Course objectives: To introduce basic geology and the principles of site investigation to civil engineering students. Expected outcomes: Students should develop an appreciation of geologic processes and their influence civil engineering works, acquire knowledge of the most important rocks and minerals and be able to identify them, and interpret geological maps with an emphasis on making construction decisions. Syllabus summary: Geological concepts relevant to civil engineering and the building environment. Introduction to minerals; igneous, sedimentary and metamorphic rocks, their occurrence, formation and significance. General introduction to physical geology and geomorphology, structural geology, plate tectonics, hydrogeology, rock core logging site investigation techniques for construction. Associated laboratory work on minerals, rocks and mapping.

Textbooks
Portrait of A Planet by Stephen Marshak, Published by H.H. Norton and Company and readings provided via Blackboard

Second year

MATH2061
Linear Mathematics and Vector Calculus

Credit points: 6 **Session:** Semester 1, Summer Main **Classes:** Three 1 hour lectures, one 1 hour tutorial and one 1 hour practice class per week. **Prerequisites:** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **Prohibitions:** MATH2961, MATH2067, MATH2901, MATH2902, MATH2001, MATH2002 **Assessment:** One 2 hour exam, assignments, quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit starts with an investigation of linearity: linear functions, general principles relating to the solution sets of homogeneous and inhomogeneous linear equations (including differential equations), linear independence and the dimension of a linear space. The study of eigenvalues and eigenvectors, begun in junior level linear algebra, is extended and developed. The unit then moves on to topics from vector calculus, including vector-valued functions (parametrised curves and surfaces; vector fields; div, grad and curl; gradient fields and potential functions), line integrals (arc length; work; path-independent integrals and conservative fields; flux across a curve), iterated integrals (double and triple integrals; polar, cylindrical and spherical coordinates; areas, volumes and mass; Green's Theorem), flux integrals (flow through a surface; flux integrals through a surface defined by a function of two variables, though cylinders, spheres and parametrised surfaces), Gauss' Divergence Theorem and Stokes' Theorem.

CIVL2110
Materials

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Materials are an important part of the civil engineers' work. Indeed, civil engineers who are concerned with the design, construction, and maintenance of facilities need to understand the behaviour and performance of the materials used. And as it happens, mechanical properties - which are essential and basic for civil engineers - are highly dependent on the structure of materials at various scales. Therefore, it is important that a student in Civil Engineering possesses a fundamental knowledge in materials science.

This unit of study aims to provide students with the tools necessary to select the adequate material for a particular application and to assess its mechanical behaviour while in use. This course will focus mainly on materials for civil engineering and construction applications, i.e. metals, concrete and soils.

CIVL2810
Engineering Construction and Surveying

Credit points: 6 **Session:** Semester 1 **Classes:** Tutorial 2 hrs/week; Workgroup 3 hrs/week; Lecture 3 hrs/week. **Assumed knowledge:** MATH1001, MATH1002, MATH1003, MATH1005 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: In recent years - the course has included a 1.5 day camp at Webbs Creek (about 80km from Sydney). The camp is located in a bushland setting. It aims to provide valuable practice in practical field survey and has a secondary aim of providing a basis for social gathering (this aspect being requested in student feedback over recent years)

The objectives of this unit are to gain an understanding of the fundamentals of engineering construction including

- design, control, management, measurement and construction methods for excavation, embankments and other earthworks, hauling and associated operations.

- building construction fundamentals, including reinforced concrete, masonry, steel and timber.

- drilling and blasting

Engineering Survey topics aim (a) to provide basic analogue methods of distance, angle and height measurement and (b) to provide an understanding of three dimensional mapping using basic total station electronic field equipment with associated data capture ability and (c) to give an insight into future trends in the use of GPS and GIS systems.

At the end of this unit, students should develop basic competency in earthwork engineering and economic optimisation of related construction, including proposing and analysing systems and methods, estimation of probable output, unit cost and productivity evaluation. Students should have a basic knowledge of vertical construction in reinforced concrete, masonry, steel and timber. Students should also develop proficiency in the design and implementation of mapping systems in Civil Engineering, using analogue and electronic field equipment and associated software packages.

The syllabus comprises introduction to the framework under which construction projects are formulated and analysed; construction engineering fundamentals; construction systems related to excavation, hauling and embankment construction, including selection and evaluation of plant and methods as well as the expected output and cost; introduction to construction operations management. Introduction to engineering surveying, distance measurement, angle measurement, levelling, traversing, topographic surveys, electronic surveying equipment, future surveying technologies.

CIVL2201
Structural Mechanics

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** ENGG1802 **Prohibitions:** AMME2301 **Assumed knowledge:** From ENGG1802 Engineering Mechanics, students should be competent in the following areas. 1. The concept of force and momentum equilibrium in two and three dimensions. 2. Drawing free body diagrams. 3. Establishing and solving the equations of equilibrium from the FBD. 4. Setting out solutions logically, clearly and neatly. Students should be competent incertain mathematical skills. 1. Solving algebraic equations. 2. Differentiation and integration (including double integrals). 3. Drawing graphs of polynomials (especially) and other mathematical function. 4. Trigonometry. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The primary objective of this unit is to understand internal actions (forces and moments) in structures (deformable objects) under loads in three key areas: how structures resist external loads by internal actions; the distribution of internal actions within structures; and the deformations, stresses and strains associated with the internal actions. At the end of this unit, students should be able to understand the basic methods of load transfer in structures - tension, compression, bending, shear and torsion (internal actions); apply the equations of equilibrium to determine the distribution of internal actions in a simple structure by drawing BMDs, SFDs, AFDs, and TMDs; understand the significance and methods of calculation of the geometric properties of structural sections (I, Z, S, J etc); understand the effect of internal forces and deformations of bodies through the concept and calculation of strains and stresses; appreciate the behaviour of structures by analysing structures without numerical calculations; display a knowledge of basic material properties, combined stresses and failure criteria; and demonstrate their hands-on experience of the behaviour of structural members via experiments and the ability to prepare written reports on those experiments. Emphasis in the assessment scheme will be placed on understanding structural behaviour and solving problems, rather than remembering formulae or performing complex calculations. The course seeks to utilise and improve the generic skills of students, in areas such as problem solving, neat and logical setting out of solutions, report writing, and team work. The syllabus comprises introduction; equilibrium; internal actions: BMDs, SFDs, AFDs, and TMDs; elasticity, stress and strain, and basic material properties; axial forces: tension and compression; elastic bending of beams; shear force and shear stresses in beams; torsion; deflection of beams; pipes and pressure vessels; trusses; material properties, combined stresses and yield criteria; advanced bending; introduction to buckling and instability.

CIVL2230
Intro to Structural Concepts and Design

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1.5 hrs/week. **Assumed knowledge:** CIVL2110 AND CIVL2201 AND ENGG1802. Structural mechanics, first year mathematics, but these are not prerequisites **Assessment:** Through semester assessment (25%) Final Exam (75%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Basic structural elements include beams, columns slabs and simple frames.

The primary objective is to develop an understanding of design concepts and an introduction to the design of steel, concrete and composite structures. This involves calculation of loads on structures caused by gravity, wind and earthquake; and analysis and design of basic structural elements.

CIVL2410
Soil Mechanics

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 1 hr/week; Laboratory 2 hrs/week. **Assumed knowledge:** Knowledge: CIVL2201 AND GEOL1501. An understanding of simple statics, equilibrium, forces and bending moments, and of stress and strain and the relationship between them. This is covered by University of Sydney courses ENGG 1802 Engineering Mechanics, CIVL2201 Structural Mechanics. Familiarity with the use of spreadsheets (Excel, Mathcad) to obtain solutions to engineering problems, and with the graphical presentation of this data. Familiarity with word processing packages for report presentation. Some of this is covered in the University of Sydney course ENGG1801 Engineering Computing. Familiarity with partial differential equations, and their analytical and numerical solution. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course provides an elementary introduction to Geotechnical Engineering, and provides the basic mechanics necessary for the detailed study of Geotechnical Engineering. This course aims to provide an understanding of: the nature of soils as engineering materials; common soil classification schemes; the importance of water in the soil and the effects of water movement; methods of predicting soil settlements, the stress-strain-strength response of soils, and earth pressures.

CIVL2611
Introductory Fluid Mechanics

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 1 hr/week. **Assumed knowledge:** CIVL2201 AND ENGG1802 AND MATH1001. Students are expected to have a strong understanding of fundamental physics, statics, equilibrium, forces, and dimensional analysis. Familiarity with simple calculus, partial differential equations, and the analytical and numerical solutions. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The objective of this unit of study is to develop an understanding of basic fluid concepts for inviscid and incompressible fluids. Topics to be covered will include: basic fluid properties, hydrostatics, buoyancy, stability, pressure distribution in a fluid with rigid body motion, fluid dynamics, conservation of mass and momentum, dimensional analysis, open channel flow, and pipe flow.

This core unit of study together with CIVL3612 forms the basis for further studies in the applied areas of ocean, coastal and wind engineering and other elective fluid mechanics units which may be offered.

Third year

CIVL3205
Concrete Structures 1

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Project Work - in class 3 hrs/week; Laboratory 2 hrs/week. **Assumed knowledge:** CIVL2110 AND CIVL2201 AND CIVL2230. Basic concepts of solid mechanics and structural mechanics, including: compatability of strains; stress-strain relationships; equilibrium; flexure, shear and torsion; statically determinate load effects (reactions, bending moments, shear forces); elastic beam theory (strains, stresses and beam deflections). **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The objectives of this unit are to provide a basic understanding of the behaviour of reinforced concrete members and structures; to provide a basic understanding of standard methods of analysis and design of reinforced concrete structures (including an understanding of capabilities and limitations); and to provide basic design training in a simulated professional engineering environment. At the end of this unit students will gain proficiency in basic methods of reinforced concrete analysis and design.

The syllabus covers the behaviour of reinforced concrete members and structures, including: material properties, 'elastic' analysis (stresses/deformations/time-dependence), ultimate strength of beams (flexure), ultimate strength of columns (short and slender), behaviour or reinforced concrete slabs, the reinforced concrete truss analogy (shear/torsion/and detailing implications), the design of typical elements of a reinforced concrete building, structural modelling, analysis of load-effects (incl.earthquakes), design criteria (for durability, fire-resistance, serviceability and strength), design calculation procedures, reinforcement detailing and structural drawings.

CIVL3612
Fluid Mechanics

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 1.30 hrs/week. **Assumed knowledge:** CIVL2201 AND CIVL2611 AND ENGG1802 AND MATH2061. This unit of study follows on from Fluid Mechanics CIVL2611, which provides the essential fundamental fluid mechanics background and theory, and is assumed to be known and fully understood. **Assessment:** Through semester assessment (55%) Final Exam (45%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to provide an understanding of the conservation of mass and momentum in differential forms for viscous fluid flows. It provides the foundation for advanced study of turbulence, flow around immersed bodies, open channel flow, and turbo-machinery.

CIVL3010
Sustainable Systems Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Project Work - own time 2 hrs/week. **Assumed knowledge:** ENGG1803 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Engineering graduates apply their technical skills in a wide variety of legal, institutional, and environmental settings, acting as agents and managers of technology-driven social change. Engineering decision-making and problem-solving are made more complex by technical, economic, environmental, social and ethical constraints. In particular, environmental sustainability has given rise to a new framework of engineering analysis that is now an essential part of the work of engineers. The goals of this unit are to introduce students to major problems of environmental deterioration, especially climate change and energy, and to concepts of sustainability within a system dynamics framework, and engage students in active reflection on the role of civil engineers in addressing these issues; to develop the students skills at quantifying the impact of engineering decisions within the broader economic, environmental and socio-cultural contexts; to develop communication skills through participation in group discussions, oral presentations, and written report writing. Lectures, group discussions, case problems and projects are all used in teaching and learning in this unit of study.

At the end of the unit, students will be able to:

a. identify and analyse important ecological, social and ethical issues deriving from technology-driven change, including new paradigms of environmental sustainability within system dynamics framework, especially in relation to long-range air pollution and energy.

b. write environmental impact statements for engineering projects and identify and analyse the impacts of infrastructure projects on the social and natural environments.

c. use design and analysis tools such as the Life-Cycle Analysis and the BASIX system to develop better engineering design solutions.

d. understand the influence of organizational, ethical and legal factors on engineering practice.

The secondary objectives of the UoS are:

a. to improve students team-work ability.

b. to improve students communication skills, through verbal and written media.

c. to improve students skills in research and use of library resources.

The syllabus comprises role(s) of civil engineers, historical development of profession, air pollution and climate change, energy; a system dynamics approach to sustainability; definitions and practice of sustainability; BASIX design system; environmental impact statements; life-cycle analyses; ethics in engineering.

CIVL3812
Project Appraisal

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Online quizzes 2 hrs/week. **Prohibitions:** ENGG2850 **Assumed knowledge:** MATH1005 **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This UoS is a third-year core unit for students enrolled in any of the undergraduate streams in the School of Civil Engineering and elective for all other branches of engineering and other faculties. The objectives of this unit of study are to develop students' ability to critically analyse issues involved in project appraisal and to equip students with the concepts, tools and analytical processes to effectively carry out project appraisal tasks for businesses, non-profit organisations, and governments. At the end of this unit, students should be able to comprehend and relate to real-life examples the fundamental concepts in project appraisal (e.g. the meaning of time value for money, equivalence); calculate common financial indicators for a given project and explain the relevance of each to the appraisal of the project; rank projects by combining both financial and non-financial indicators (e.g. environmental and social); understand how risks and uncertainties affect evaluation outcomes and be able to deal with uncertainties and risks in analysis; apply techniques to account for the effects of inflation/deflation and exchange rates in analysis; understand the concept and mechanisms for depreciation and carry out pre-tax as well as post-tax analysis; understand the assumptions, pros and cons of each evaluation method and be able to explain why a particular method is appropriate/not appropriate for a given project. The syllabus comprises time value of money, cost of capital, simple/compound interest, nominal/effective interest, cost/benefit analysis of projects; equivalence, net present worth (value), future worth (value), annual worth (value), internal rate of return, external rate of return, payback period, cost-benefit analysis, cost-utility analysis, identifying and quantifying non-financial benefits/externalities, price changes and exchange rates, techniques for multi-criteria group decision-making, economic analysis of business investment projects, depreciation, capitalisation and valuation studies, replacement of assets, real option, project risk analysis, decision-tree analysis, binomial method, WACC, MARR, equity capital, debt.

CIVL3206
Steel Structures 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 3 hrs/week; Laboratory 2 hrs/week. **Assumed knowledge:** CIVL2110 AND CIVL2201 AND CIVL2230 AND CIVL3235 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: It is assumed that students are competent in the following areas: the methods of load transfer in structures - tension, compression, bending, shear, torsion, and bearing; an appreciation of stress and strain, and being able to determine stresses and strains in simple sections under axial force, bending moments, shear and torsion; calculating and understanding the physical significance of geometric section properties - centroid, Ix, Iy, Zx, Zy, Sx, Sy, rx, ry, J, Ag; knowledge of the basic elastic-plastic material properties of steel, E, G, fy, fu; and knowledge of loading of structures. A special "assumed knowledge" lecture will be given in Week 1 to refresh the knowledge of students.

This unit of study is concerned with the behaviour and design of steel structures. Statics provided the fundamentals of equilibrium upon which most structural engineering is based. Structural Concepts and Structural Analysis provided information on the loads (actions) on a structure and how structures resist these actions with a resulting distribution of internal actions (bending moments, shear forces, axial forces; BMDs, SFDs and AFDs). Structural Mechanics considered how these internal actions resulted in stresses and strains in members. Materials considered the microscopic and molecular structure of metals to determine its inherent mechanical properties such as yield stress. This unit of study will then combine the knowledge of stresses, material properties of steel, structural analysis, and loading, and consider new concepts and modes of failure, such as local and flexural torsional buckling, combined actions and second-order effects to understand the behaviour of steel members and frames, and how this behaviour is accounted for in the design standard AS 4100.

Both the units of study "Steel Structures 1" and "Concrete Structures 1" can be considered the culmination of the various elements of structural engineering begun in "Engineering Mechanics" in first year, and is further developed in "Civil Engineering Design" in final year. More advanced topics, such as plate behaviour, advanced buckling and connection design, are considered in the final year elective subject "Steel Structures 2".

It is recognised that not all students intend to become consulting structural engineers. The unit of study is designed so that students who make an effort to understand the concepts are most capable of passing. Students who are planning a career in the consulting structural engineering profession should be aiming at achieving a Distinction grade or higher.

Fourth year

CIVL4811
Engineering Design and Construction

Credit points: 6 **Session:** Semester 1 **Classes:** Workshop 3 hrs/week; Project Work - own time 1 hr/week; Presentation 2 hrs/week. **Assumed knowledge:** CIVL2810 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This unit aims to prepare students for employment in a broad range of engineering areas including design, planning and construction management.

The objectives of this unit are to develop an understanding of construction methods, strategies, equipment and machinery in a range of construction activities and an understanding of the principles involved in the design for those construction activities.

At the end of this unit, students will have developed a familiarity with a variety of construction methods, strategies, equipment and machinery in a range of construction activities such that they will be able, if and when the opportunity arises to participate as site engineers (or similar role) in the planning and execution of those construction activities, albeit with supervision and guidance from experienced professionals. Students will also have developed an understanding of the design principles and techniques involved in the planning for those construction activities such that they are able, if and when the opportunity arises, to participate as design engineers, in the planning and design for those construction activities, with supervision and guidance from experienced professionals. The range of topics covered in this course is such that the learning outcomes form a basis for later development of more detailed knowledge, dependent on the future career experiences of the student. The course does not prepare a student for immediate, unsupervised participation in construction and design work associated with the topics covered.

The construction topics covered in this course have not been previously addressed in CIVL2810 (Engineering Construction and Survey). The topics may vary dependent on current and planned projects in Sydney, NSW and Australia. At this stage the topics are hard rock tunnelling and general hard rock underground excavation; soft ground tunnelling; underground construction; micro tunnelling; cut and cover (cover and cut) tunnelling; earth retaining systems; piling; formwork and falsework (incl Tilt up, Ultrafloor, Sacrificial form); dewatering; pavement design and construction - rigid and flexible (incl and pavement construction materials); stormwater drainage design and construction; marine construction; civil construction in environmentally sensitive areas; contract administration for construction engineers; general engineering in remote localities (project based); construction methods in bridge engineering; QA documentation on a typical project; insurance in the construction industry occupational health and safety issues in the construction industry; timber engineeering; post-tensioned/prestressed concrete construction; civil engineering in a marine environment.

On day 1 of the course, a form based survey is taken to invite students to nominate specific areas of interest which may lead to adjustment in course content.

CIVL4903
Civil Engineering Design

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 1 hr/week; Tutorial 3 hrs/week. **Prerequisites:** CIVL3205 and CIVL3206 **Assumed knowledge:** CIVL2410, CIVL3612, CIVL4811 **Assessment:** Through semester assessment (75%) Final Exam (25%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is a fourth year core unit of study for the degree in Civil Engineering and fourth year elective for the degree in Project Engineering and Management (Civil).

The objective of this unit is to give students an appreciation of the role of the designer in the development of Civil Engineering projects. At the end of this unit, students will have developed an understanding of the design philosophy. They will gain this through their involvement in a number of exercises which cover the design sequence from concept to documentation.

The syllabus comprises: design sequence beginning with a 'brief' and including definition, value and criteria selection; generation of proposals; analysis of proposals; selection of design; development of details of a particular design selected; feasibility studies and examination of existing works; study of design projects by stages, including details of some aspects.

This unit is under the direction of an engineer in professional practice in cooperation with other professional practitioners and members of the academic staff. Lectures and exercises on the interaction between civil engineering and architectural design and practice are included in the unit.

ENGG4000

Practical Experience

Session: Semester 1, Semester 2 **Classes:** Practical Experience, **Prerequisites:** 36 Credit Points of Senior Units **Assessment:** Through semester assessment (100%) **Mode of delivery:** Professional practice

Note: Students should have completed three years of their BE program before enrolling in this unit.

The aim of this unit is to give students exposure to work in an engineering organisation and gain some professional experience; to enhance a student's abilities and experience in report writing; to encourage self-evaluation in the context of applying their theoretical knowledge to real industry practise. Students will gain a better appreciation of the role of engineers in the workplace. The assessment will enhance the student's ability to present structured observations and reflections in the mode of a formal written report.

Each student is required to gain exposure to professional engineering practice and environments and to submit a satisfactory written report of his or her work. The report will include the requirement of a detail logbook recording tasks given and timelines set for achieving these. Self-evaluation of a student's personal level of knowledge and its applicability to the workplace is a major component of the reporting. Normally 12 weeks (60 days) of practical work experience is required, though the Faculty may accept alternatives that are judged as equivalent. Students are strongly encouraged to undertake their work experience in the break between Year 3 and 4 and definitely prior to commencing their final semester of study, however any engineering work taken after completing 28 credit points of 3rd year units of study may be accepted for the requirements of this unit. The University Careers and Appointments Service is available to assist students to obtain suitable employment. This unit of study is a core unit of study in all BE programs and must be passed in order to graduate from those programs.

Students must enrol in 12cp of Thesis units.

CIVL4022

Honours Thesis A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Research 10 hrs/week; Meeting, **Prerequisites:** 30 credits of 3rd year units of study and HWAM 65 or over. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: It is expected that the Thesis will be conducted over two consecutive semesters and that the majority of students will start in Semester 1. Commencement in Semester 2 requires permission of Thesis coordinator and School`s Director of Learning & Teaching and will only be allowed where there are good reasons for doing so. Students considering this option should discuss it with the Thesis coordinator at least one semester before they intend to start.

Honours Thesis provides an opportunity for students to conduct original research. Students will generally work in groups, although planning and writing of the thesis will be done individually; i.e., a separate thesis must be submitted by each student. Only in exceptional circumstances and by approval of Thesis course coordinator and the relevant academic supervisor concerned will a student be permitted to undertake a project individually.

Honours Thesis is a major task and is to be conducted with work spread over most of the year, in two successive Units of Study of 6 credits points each, Honours Thesis A (CIVL4022) and Honours Thesis B (CIVL4023). This particular unit of study, which must precede CIVL4023 Honours Thesis B, should cover the first half of the work required for a complete "final year" thesis project. In particular, it should include almost all planning of a research or investigation project, a major proportion of the necessary literature review (unless the entire project is based on a literature review and critical analysis), and a significant proportion of the investigative work required of the project.

CIVL4023

Honours Thesis B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research 10 hrs/week; Meeting, **Prerequisites:** 30 credit points of 3rd year units of study **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment.

Honours Thesis provides an opportunity for students to conduct original research. Students will generally work in groups, although planning and writing of the thesis will be done individually; i.e., a separate thesis must be submitted by each student. Only in exceptional circumstances and by approval of Thesis course coordinator and the relevant academic supervisor concerned will a student be permitted to undertake a project individually.

Honours Thesis is a major task and is to be conducted with work spread over most of the year, in two successive Units of Study of 6 credits points each, Honours Thesis A (CIVL4022) and Honours Thesis B (CIVL4023). This particular unit of study, which must be preceded by or be conducted concurrently with CIVL4022 Honours Thesis A, should cover the second half of the work required for a complete "final year" thesis project. In particular, it should include completion of all components of the research or investigation project planned but not undertaken or completed in CIVL4022 Honours Thesis A.

Note

For core units of study offered by faculties other than the Faculty of Engineering and Information Technologies, any assumed knowledge, prerequisite and corequisite requirements will be as prescribed by the Faculty.

Resolutions of the Faculty of Engineering and Information Technologies relating to Civil Engineering (except Project Engineering Management)

Candidates for the degree of Bachelor of Engineering Honours (Civil) are expected to complete all the core units (144 credit points). They are also required to gain at least 18 credit points from the 3rd year Civil recommended elective units of study listed below, and 18 credit points from fourth year Civil recommended elective units of study listed below. The remaining 12 credit points can be obtained from any of the listed elective units or from units of study in other Faculties subject to approval from the Director of Learning and Teaching, Civil Engineering.

Single Degree Programs

To meet specialisation requirements for either Construction Engineering and Management, Structural Engineering, Environmental Engineering or Geotechnical Engineering, students must enrol in at least 3 electives from the relevant stream listed below, and undertake a thesis on a related topic. Students may enrol in a maximum of 4 electives from the Construction Engineering and Management stream. Students enrolled in a Bachelor of Engineering Honours (Civil) must follow note 2 below.Construction Engineering and Management Stream: CIVL3805, CIVL3813, CIVL4810, CIVL4814, CIVL4815.Structural Engineering Stream: CIVL3235, CIVL5266, CIVL5269, CIVL5458Environmental Stream: CIVL3614, CIVL5351, CIVL5458, CIVL5668Geotechnical Engineering Stream: CIVL3411, CIVL5351, CIVL5452, CIVL5458Most Mathematics, Chemistry, Physics and Computer Science units of study offered by the Faculty of Science can be replaced by an equivalent advanced level units of study subject to prerequisite conditions (as required by the Faculty of Science) being met.

Combined Degree Programs

Candidates for one of the combined degree programs (that is, Bachelor of Engineering Honours (Civil) with either a Bachelor of Arts, Bachelor of Science, Bachelor of Medical Science, Bachelor of Laws, Bachelor of Project Management or Bachelor of Commerce) are required to complete all of the core units of study listed above (144 credit points). This total of 144 credit points (plus 12 credit points of electives from the list of electives below for combined degrees with Bachelor of Arts) is only sufficient to be awarded a Bachelor of Engineering Honours (Civil) as part of an approved combined degree program. The remaining credit points for the combined degree will be taken in the appropriate Faculty (Arts, Science, Law or Economics) or BPM core unit tables and candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies and the relevant faculty requirements.Candidates taking a combined degree with Science or Medical Science may count the Science subjects in the Civil Engineering core to their 96 credits points of Science subjects. Electives from the list below should be taken to complete 144 credit points of Engineering subjects.Candidates taking a combined degree with Design in Architecture please see the separate Table of core units of study.

Advanced Options

Students considering doing advanced options should seek advice from the relevant department before enrolling.

Acceptable alternative units of study

The Faculty has prescribed the following acceptable alternatives to core units of study listed in the above specialisation requirements:GEOL1501 Engineering Geology 1 (6cps), acceptable alternative: GEOL1001 and GEOL1002

Recommended elective units of study

Second year

CIVL2511
Research Techniques

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/week; Project Work - in class 4 hrs/week; Site Visit 2 hrs/week; Presentation 0.33 hrs/week. **Assumed knowledge:** CIVL2201 AND ENGG1802. Basic understanding of Maths, Physics and Chemistry appropriate to student in 2nd year of study. Concepts of Force, Moment, Torque, Stress, Strain, Displacement, Velocity and Acceleration. These are covered in a range of courses but particularly CIVL2201 Structural Mechanics and ENGG1802 Engineering Mechanics **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The objectives of this unit are to introduce students to the philosophy and principles of measurement, and its uses in Civil Engineering practice and research. The instrumentation used in practice, the underlying physical principles and the basic electrical/electronic and signal processing issues. It will introduce students to issues in the planning and construction of experiments. Give experience working in groups and in producing reports.

At the end of this unit, students should gain an understanding of the importance of measurement, of the methods and application of measurement; ability to conduct experiments and interpret measurements. The course will reinforce key concepts in Structural Mechanics, Fluid Mechanics, Soil Mechanics and Surveying.

The syllabus comprises principles of measurement, presentation of data, error analysis, stress and strain, sensor types and technologies wave based techniques and wave analysis, photographic techniques, signal processing, electric circuit theory.

MATH2065
Partial Differential Equations (Intro)

Credit points: 6 **Session:** Semester 2, Summer Main **Classes:** Three 1 hour lectures, one 1 hour tutorial, one 1 hour example class per week. **Prerequisites:** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **Prohibitions:** MATH2965, MATH2005, MATH2905, MATH2067 **Assessment:** 2 hour exam, mid-semester test, assignments (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is an introductory course in the analytical solutions of PDEs (partial differential equations) and boundary value problems. The techniques covered include separation of variables, Fourier series, Fourier transforms and Laplace transforms.

Third year

CIVL3235
Structural Analysis

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 4 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** CIVL2110, CIVL2230 and MATH2061 **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The objectives of this unit are to provide an understanding of the principles of structural analysis by introducing the strain-displacement, stress-strain and equilibrium relationships for beam members; applying the relationships to the matrix displacement analysis of frame structures; and using computer software to conduct the linear-elastic and buckling analyses of frame structures.At the end of this unit, students will be able to deduce appropriate structural models for frame structures; and use computer methods and simple hand methods to obtain internal forces and displacements as well as buckling loads for frame structures. The syllabus comprises theoretical background (strain-displacement, stress-strain and equilibrium relationships), structural analysis software, matrix displacement method, beam theory, introduction to nonlinear analysis, buckling analysis.

CIVL3411
Geotechnical Engineering

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 4 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** CIVL2410 **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The objectives of this unit are to provide an understanding of the factors influencing soil strength, and to give practice in the application of this understanding by exploring the stability of slopes, retaining walls and foundations. At the end of this unit students will be able to: determine the strength parameters appropriate to a range of stability problems, and understand the difference between total and effective stress approaches; evaluate strength parameters from laboratory data; critically analyse foundation stability and slope stability problems; use spreadsheets to perform parametric studies and produce design charts for simple geotechnical design problems; and communicate the results of experiments and analyses using written methods appropriate for professional geotechnical engineers. The syllabus comprises; methods of analysis for gravity and sheet pile retaining walls; reinforced soil; slope stability, including modes of failure, analysis and computer methods; bearing capacity of shallow foundations under general loading, and axial and lateral capacities of deep pile foundations; the mechanical behaviour of sands and clays; and Critical State models.

CIVL3614
Hydrology

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Site Visit, Laboratory, **Prerequisites:** CIVL2611 **Assumed knowledge:** ENGG1802 AND CIVL3612 AND MATH2061 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: The unit of study builds on the theory and concepts learnt in CIVL2611 Introductory Fluid Mechanics and CIVL3612 Fluid Mechanics.

The overall objective of this unit of study is to give a general introduction to water resources, how these are linked the hydrological processes, and how engineering plays a role in the management of water resources. The aim of this unit is to provide a detailed understanding of: the hydrologic cycle of water as a whole and its specific components including: geophysical flows of water throughout the environment, dynamics of precipitation formations, transformations into runoff, reservoir and lake dynamics, stream flow discharge, surface runoff assessment, calculation of peak flows, the hydrograph theory, ground water flows, aquifers dynamics, concept of water quality and water treatment methods and units. The topics mentioned above will be covered in both qualitative and quantitative aspects. Use will be made of essential concepts of energy, mass and momentum conservation. An intermediate level of integral and differential calculus is required as well as knowledge and use of calculation software such as Excell and Matlab.

CIVL3805
Project Scope, Time and Cost Management

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Independent study and assessment work 3 hrs/week. **Prohibitions:** QBUS2350, ENGG1850 **Assumed knowledge:** CIVL2810 **Assessment:** Through semester assessment (65%) Final Exam (35%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is a core course for the Bachelor of Project Engineering & Management (Civil) and an elective for Civil Engineering degree and other branches of engineering and faculties. The general aim of this unit of study is to offer the student the opportunity to develop an understanding of the scope, time and cost management in project environments. Students will engage with some of the key concepts and various activities which underpin project scope, time and cost management. At the end of this unit, students will be able to: develop Work Breakdown Structure (WBS), develop network diagrams, and undertake Critical Path Analysis (CPA) and Earned Value Analysis (EVA) using the given project information; explain in depth why scope, time and cost management are important to project management; analyse a project situation that involves scope, time and cost management issues; and explain how the components of scope, time and cost management interrelate in project environments. The syllabus comprises the project planning cycle, working with the project sponsor, scope initiation and definition, project scope definition tools, WBS, network scheduling techniques, CPA, Just-in-Time philosophy, estimating and budgeting, cash flow management, EVA and application of project management software.

Fourth year

CIVL3813
Contracts Formulation and Management

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** CIVL3805. Students are expected to have grasped the concepts of basic legal and management principles and the understanding of construction and engineering terminologies. As there is no any prerequisite courses for this UoS, without prior knowledge student can perform exceptionally well with regular attendance and participation in course activities. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: ?For students in the BE Civil degree (or combined degrees with BE Civil) this unit is a 4th year elective. Please take careful note: It DOES NOT count as a third year elective. ?For students in the BE Project Engineering and Management (Civil) degree this is a 3rd year core unit.

The objectives of this unit are to give students a fundamental knowledge of the legal system and contract terms under which projects are generally conducted. Initially, emphasis will be on contract negotiations and understanding what negotiation is about and how to prepare for negotiations and also how to manage the negotiation so that a suitable outcome for both parties may be achieved. Also being able to deal with difficult opponents will be something that will be considered.

Emphasis will be on the principles of contract formulation, administration and finalisation, including prevention and/or settlement of disputes in projects. The syllabus comprises brief overview of the legal system in Australia and comparison with other legal systems introduction to project delivery systems and the running of a typical project, introduction to contract law and the formation of contracts, the principles of standard form contracts as well as bespoke drafting, an understanding of the risks undertaken by the different contracting parties, a detailed review of a standard contract promoting an understanding of major project issues such as time, variations and payment; implementation and administration; potential liabilities associated with project participation; contract conditions and specifications; understanding insurances and alternate dispute resolution procedures; notification requirements including time bar, understanding the commercial significance of issues such as latent conditions, subcontracting, bank guarantees and security of payment legislation.

CIVL4810
Mgmnt of People, Quality and Risk in PE

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Project Work - own time 4 hrs/week. **Assumed knowledge:** CIVL3805. Students are expected to have understood and applied basic tools for project scope, cost and time management for projects as taught in (CIVL3805)or equivalent courses. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is a fourth year core unit of study for the Bachelor of Project Engineering & Management. It is also an elective for other branches of engineering and faculties. The objective of this unit is to provide underpinning knowledge and skills in the application of tools to the project management environment for risk, quality and people management including leading and managing project teams. At the end of this unit, students will be able to understand and apply the tools of team building and project management leadership, as well as apply tools for design and implementation of integrated plans for risk, quality, human resource and procurement. The competency level achieved will enable application of integration tools to a range of simple generic projects as well as provide input to plans for more complex projects. The syllabus comprises team management, project leadership, modern quality management principles and techniques, quality assurance, preparation of quality plans; risk analysis, planning and risk management, as well as linking risk and quality management to human resourcing and procurement methodologies. The use of integrated planning software such as MS Project, Gantt Project and social media tools for project management will be explained and practised. The definitions and processes of Project Management will largely follow the US based Project Management Institutes, PMBOK as is used in the Australian Institution of Project Management Standards at the level of Certified Practising Project Manager,(CPPM). Other International standards such as ICPMA's, ICB3.0 standard will also be covered.

CIVL4814
Project Procurement and Tendering

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** CIVL3805 **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is a fourth year core unit of study for the Bachelor of Project Engineering and Management (Civil), elective for all other branches of engineering and other faculties. The general aim of this unit is to offer student the opportunity to develop an understanding of the procurement of built facilities and the methods of job allocation in project environments. Students will be engaged in a real construction case study project where key practical concepts which underpin procurement will be taught. At the end of this unit of study, students should be able to: evaluate a client's procurement situation and apply an appropriate procurement route; explain how and why a particular procurement route is chosen; undertake procurement assessment exercises; analyze a contractor's strategic responses in tendering (bidding) decision-making; discuss why a particular bidding strategy is chosen in different contexts; and evaluate a contractor's bidding performance using competitor analysis techniques. The syllabus comprises fundamentals of building procurement, assessment of procurement risks, competitive bidding, cost estimating, the competitive environment in the construction industry, contractors' competitive positioning, contractors' decision-making in bidding competition, bidding strategies and competitor analysis.

CIVL4815
Project Formulation

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 4 hrs/week. **Prerequisites:** CIVL3805, CIVL3812 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is a fourth-year core unit for PEM students and an elective for all other branches of engineering and other faculties. The assumed knowledge for this Unit includes Project Appraisal (CIVL3812) and Project Scope, Time and Cost Management (CIVL3805). The objective of this unit is, through the integration of areas of project management knowledge learned in various PEM subjects, to develop students' ability to develop project proposals through carrying out a feasibility study and developing a project definition plan for a real-life engineering project. This unit is relevant for students who intend to pursue a career related to project management. At the end of this unit, students should have developed understanding of the fundamentals of project conceptualisation, appraisal and planning plus the abilities to: model and analyse basic financing and cash flow requirements; develop risk management plan, marketing and sales plan, stakeholder management and communication plan, operations plan; and design professional documentation and presentation to a board of review. In addition, this unit also develops students' abilities in problem solving, working with other students, conducting independent research, communication in team environment, information need identification and collection, and understanding social and environmental issues. The syllabus comprises feasibility study, project appraisal, risk assessment and management, sensitivity analysis, project planning, project integration management, carbon-trading scheme, global warming, environmental impact assessment, investment capital, venture capital, due diligence, project planning, operational planning, revenue projection, community consultation, communication management, stakeholder management, political environment.

CIVL5266
Steel Structures - Stability

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** There are no prerequisites for this unit of study but it is assumed that students are competent in the content covered in Structural Mechanics, Steel Structures, and Structural Analysis. **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Objectives:

This Unit aims to:

- provide fundamental understanding at advanced level of the behaviour and design steel structural members, notably members undergoing cross-sectional and/or global buckling.

- provide fundamental understanding of the methods available for determining buckling loads of structural members and elements, and explain how classical solutions to buckling problems are incorporated in national design standards for steel structures, including AS4100 and AS/NZS4600.

Outcomes:

It is anticipated that at the end of this unit of study students will be familiar with the buckling behaviour of steel structures and will understand the methods available for determining buckling loads of structural members and cross-section. Students will have a good understanding of the stability design provisions for steel structures specified in the standards AS4100 and AS/NZS4600, and will be proficient in using software for calculating buckling loads.

Syllabus Summary:

Stability theory, Plate theory, Stability of plates and plate assemblies, Theory for thin-walled members in torsion and bi-axial bending, Stability of thin-walled members, Stability design to AS4100 and AS/NZS4600, Direct Strength Method.

CIVL5269
Concrete Structures - Strength & Service

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** CIVL3205 OR CIVL5507 OR CIVL9205 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This Unit reviews the fundamental concepts of 'elastic' behaviour of reinforced concrete structures and introduces models of behaviour and methods of analysis related to the time-dependent effects of creep and shrinkage (at service loads). This Unit also examines the non-linear (strain-softening) behaviour of reinforced concrete and the related effects concerning the strength of statically-indeterminate reinforced concrete structures. In particular, this Unit examines the concepts of ductility, moment-redistribution and plastic design (for beams and slabs). Strut-and-tie modelling of reinforced concrete members is also described. Design guidelines will reflect requirements of the Australian Standards and Eurocodes.

Outcomes:

This Unit will provide students with the following knowledge and skills:

- understanding of the fundamental concepts and theoretical models concerning the time-dependent structural effects of concrete creep and shrinkage;

- ability to carry out calculations to estimate 'elastic' load-effects (stresses/strains/deformations) for reinforced concrete structures (at service loads), accounting for the time-dependent effects of concrete creep and shrinkage;

- understanding of the fundamental concepts and theoretical models of the strain-softening behaviour of reinforced concrete (in flexure);

- understanding of the fundamental concepts and numerical models of ductility and moment redistribution for reinforced concrete beams;

- ability to quantitatively assess the ductility and moment-redistribution capacity of reinforced concrete beams;

- understanding of the fundamental concepts and numerical models of plastic behaviour and design for reinforced concrete beams and slabs (including yield-line analysis);

- ability to determine the ultimate plastic load-carrying capacity of statically-indeterminate reinforced-concrete beams and slabs;

- ability to use strut-and-tie models of reinforced concrete behaviour.

CIVL5351
Geoenvironmental Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Objectives: To develop an understanding of the geotechnical aspects of the design and management of industrial and domestic waste disposal systems.

Learning Outcomes: 1. Analyse flow regime in soil using Darcy equation; 2. Analyse contaminant migration in soil using coupled flow and reactive diffusion advection equations; 3. Design a single or double composite landfill liner satisfying groundwater quality requirements; 4. Predict the potential for methane production in a landfill and assess the feasibility of waste-to-energy conversion; 5. Conduct research on a geoenvironmental topic as part for group.

Syllabus Summary: introduction to geoenvironmental engineering; integrated waste management and life cycle assessment; soil composition and mineralogy; types and characteristics of contaminants; theory of water seepage in soil and hydraulic conductivity; theory of reactive contaminant transport in soil including molecular diffusion, mechanical dispersion and advective flow; analytical and numerical solutions of reactive diffusion advection equation; design of landfills; geosynthetics and geomembranes; defects and leakage rates; methane generation in landfills and landfill gas management.

CIVL5453
Geotechnical Hazards

Credit points: 6 **Teacher/Coordinator:** Pierre Rognon **Session:** Semester 2 **Classes:** Lecture: 3 hours per week; Tutorial: 1 hour per week. **Assumed knowledge:** CIVL2410 AND CIVL3411. Students are assumed to have a good knowledge of fundamental soil mechanics, which is covered in the courses of soil mechanics (settlement, water flow, soil strength) and foundation engineering (soil models, stability analyses; slope stability; retaining walls; foundation capacity). **Assessment:** Through semester assessment (50%), Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Geotechnical flows include landslides, rock falls and mud flows. They are triggered by soil failure due to natural or human causes. The objective of this Unit of Study is to develop the ability to assess and mitigate the risks associated to such events. Students will learn how to estimate when and where these events are likely to occur, how to define safety zones and how to design effective protection structures. The syllabus is comprised of (i) Landslide Risk Assessment and Management procedures (ii) post-faillure and out of equilibrium soil mechanics applied to prediction of rock fall, landslide and mud flow run-out distance and impact force on structures; (iii) design of geotechnical protection structures.

CIVL5458
Numerical Methods in Civil Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Objectives:

The objective of this unit is to provide students with fundamental knowledge of finite element analysis and how to apply this knowledge to the solution of civil engineering problems at intermediate and advanced levels.

At the end of this unit, students should acquire knowledge of methods of formulating finite element equations, basic element types, the use of finite element methods for solving problems in structural, geotechnical and continuum analysis and the use of finite element software packages. The syllabus comprises introduction to finite element theory, analysis of bars, beams and columns, and assemblages of these structural elements; analysis of elastic continua; problems of plane strain, plane stress and axial symmetry; use, testing and validation of finite element software packages; and extensions to apply this knowledge to problems encountered in engineering practice.

Outcomes:

On completion of this unit, students will have gained the following knowledge and skills:

1. Knowledge of methods of formulating finite element equations. This will provide students with an insight into the principles at the basis of the FE elements available in commercial FE software.

2. Knowledge of basic element types. Students will be able to evaluate the adequacy of different elements in providing accurate and reliable results.

3. Knowledge of the use of finite element methods for solving problems in structural and geotechnical engineering applications. Students will be exposed to some applications to enable them to gain familiarity with FE analyses.

4. Knowledge of the use of finite element programming and modeling.

5. Extended knowledge of the application of FE to solve civil engineering problems.

CIVL5668
Wind Engineering for Design-Fundamentals

Credit points: 6 **Session:** Semester 1 **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Objectives:

This unit of study will introduce the fundamentals of meteorology governing wind flow, details of extreme wind events, wind structure, statistical distribution of the wind, the effect of topography and terrain changes on wind profile, investigate the fluid flow around bluff bodies, and detail the design of civil engineering structures for wind loading.

Outcomes:

This Unit will provide students with the following knowledge and skills:

On completion of this course students will have an understanding of the governing principles of wind engineering, how to predict the extreme wind speed and analyse anemographs, predict the effect of terrain and topography on velocity and turbulence, understand flow patterns around bodies, how to predict the pressure distribution and wind loading on bodies and structures, dynamic response of structures, and how all the above relates to AS1170.2.

CIVL5670
Reservoir Stream & Coastal Eng

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures 2 hrs/week; Tutorials 2 hrs/week. **Assumed knowledge:** CIVL3612 and MATH2061. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The objectives of this Unit of Study are to develop an understanding of the processes occurring in lakes, reservoirs, streams and coastal seas, and an introduction to transport and mixing in inland waters, and to the design the design of marine structures. The unit will cover the mass and heat budget in stored water bodies, mixing, and the implications for water quality. In streams, simple transport models will be introduced, and simple models for dissolved oxygen transport discussed. The basic equations for linear and non linear wave theories in coastal seas will be introduced, and wave forces on structures and an introduction to design of offshore structures will be discussed.

(Students who have previously studied CIVL3613 will only be permitted to enrol in this unit by approval of the Director of Undergraduate Studies.)

Notes

1. Choice of electives as shown in the above table will depend upon subject availability, timetabling and prerequisite conditions.2. For the BEHons (Civil) degree students must take at least 18 elective credit points of study from the recommended Civil Third Year level and 18 elective credit points from the recommended Civil Fourth Year electives. The remaining 12 credit points can be obtained from any of the listed elective units or from units of study in other Faculties subject to approval from the Director of the Learning and Teaching, Civil Engineering.

Exchange units of study

CIVL0011, CIVL0012, CIVL0013, CIVL0014, CIVL0015, CIVL0016, CIVL0017 AND CIVL0018 are available for exchange study programs. For a standard enrolment plan for Civil Engineering visit cusp.sydney.edu.au/students/view-degree-page/name/BE(Civil)

Bachelor of Engineering Honours (Civil) and Bachelor of Design in Architecture

Course Overview

The Bachelor of Engineering Honours and Bachelor of Design in Architecture is a five year combined degree that caters for the emerging need for professionals who can work with both architectural and structural engineering design. There is an emphasis on the conceptual and aesthetical aspects of the design process in the architectural studies, while the engineering studies teach the analysis of forces within the structure, and how to proportion the structural skeleton to support these forces. The Bachelor of Design in Architecture can only be combined with the Bachelor of Engineering (Civil) award.

You will study conceptual and aesthetic aspects of the design process in architectural studies, while learning about planning, designing and testing structures within the built environment. This overarching course of study will provide you with a holistic approach to the design of our built environment and with skills that will encourage greater diversity and ingenuity in the design and construction of our buildings.

This combined degree offered at the University of Sydney is distinct from the "Architectural Engineering" degrees offered at other universities, nationally and internationally, in that graduates will receive Bachelor degrees in both Engineering and Design in Architecture. The combined degree, therefore, provides pathways to both professions.

Course Requirements

To qualify for the award of the combined degree, a candidate must successfully complete 240 credit points in accordance with the unit of study tables for the Civil Engineering combined with Design in Architecture degree.

For a standard enrolment plan for Civil Engineering combined with Design in Architecture visit http://cusp.sydney.edu.au/engineering

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Bachelor of Engineering Honours (Civil) and Bachelor of Design in Architecture			
Candidates for the degree of Bachelor of Engineering Honours (Civil) and Design in Architecture are required to gain credit for the core units of study set out below. To satisfy the degree requirement of the combined degree a candidate must study not less than 144 credit points of the core civil engineering units of study and 96 credit points of units of study of the core design in architecture units of study.			
Core units of study			
First year			
MATH1001 **Differential Calculus**	3	**A** HSC Mathematics Extension 1 **N** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001	Semester 1 Summer Main
MATH1002 **Linear Algebra**	3	**A** HSC Mathematics or MATH1111 **N** MATH1902, MATH1012, MATH1014	Semester 1 Summer Main
MATH1003 **Integral Calculus and Modelling**	3	**A** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **N** MATH1013, MATH1903, MATH1907	Semester 2 Summer Main
MATH1005 **Statistics**	3	**A** HSC Mathematics **N** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021	Semester 2 Summer Main Winter Main
BDES1010 **Architecture Studio 101**	6	**A** HSC Mathematics and HSC English Standard or equivalent **N** DESA1001	Semester 1
BDES1011 **Architectural History/Theory 1**	6	**A** HSC Mathematics and HSC English Standard or equivalent **N** DESA1102	Semester 1
BDES1012 **Architectural Communications 1**	6	**A** HSC Mathematics and HSC English Standard or equivalent **N** DESA1001	Semester 2
BDES1020 **Architecture Studio 102**	6	**P** BDES1010 or DESA1001 **N** DESA1002	Semester 2
BDES1023 **Architectural Technologies 1**	6	**N** DESA1102	Semester 2
BDES1024 **Art Workshop 1**	6		Semester 1
Second year			
ENGG1800 **Engineering Disciplines (Intro) Stream A**	6		Semester 1
ENGG1802 **Engineering Mechanics**	6		Semester 2 Summer Main
ENGG1803 **Professional Engineering 1**	6	**N** ENGG1061	Semester 1 Semester 2
INFO1003 **Foundations of Information Technology**	6	**N** INFO1000, ISYS1003, INFO1903, INFS1000	Semester 1 Semester 2
MATH2061 **Linear Mathematics and Vector Calculus**	6	**P** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **N** MATH2961, MATH2067, MATH2901, MATH2902, MATH2001, MATH2002	Semester 1 Summer Main
PHYS1001 **Physics 1 (Regular)**	6	**A** HSC Physics **P** HSC Physics with a minimum mark of 65 **N** PHYS1002, EDUH1017, PHYS1901	Semester 1
CIVL2201 **Structural Mechanics**	6	**A** From ENGG1802 Engineering Mechanics, students should be competent in the following areas. 1. The concept of force and momentum equilibrium in two and three dimensions. 2. Drawing free body diagrams. 3. Establishing and solving the equations of equilibrium from the FBD. 4. Setting out solutions logically, clearly and neatly. Students should be competent incertain mathematical skills. 1. Solving algebraic equations. 2. Differentiation and integration (including double integrals). 3. Drawing graphs of polynomials (especially) and other mathematical function. 4. Trigonometry. **P** ENGG1802 **N** AMME2301	Semester 1
GEOL1501 **Engineering Geology 1**	6	**A** No previous knowledge of Geology assumed **N** GEOS1903, GEOL1902, GEOS1003, GEOL1002	Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Third year			
CIVL2410 **Soil Mechanics**	6	**A** Knowledge: CIVL2201 AND GEOL1501. An understanding of simple statics, equilibrium, forces and bending moments, and of stress and strain and the relationship between them. This is covered by University of Sydney courses ENGG 1802 Engineering Mechanics, CIVL2201 Structural Mechanics. Familiarity with the use of spreadsheets (Excel, Mathcad) to obtain solutions to engineering problems, and with the graphical presentation of this data. Familiarity with word processing packages for report presentation. Some of this is covered in the University of Sydney course ENGG1801 Engineering Computing. Familiarity with partial differential equations, and their analytical and numerical solution.	Semester 2
CIVL2611 **Introductory Fluid Mechanics**	6	**A** CIVL2201 AND ENGG1802 AND MATH1001. Students are expected to have a strong understanding of fundamental physics, statics, equilibrium, forces, and dimensional analysis. Familiarity with simple calculus, partial differential equations, and the analytical and numerical solutions.	Semester 2
BDES2010 **Architecture Studio 201**	6	**P** BDES1020 or DESA1002 **C** BDES2012, BDES2013 **N** DESA2001	Semester 1
BDES2012 **Architectural Communications 2**	6	**P** BDES1012 **C** BDES2010, BDES2013 **N** DESA2001	Semester 1
BDES2013 **Architectural Technologies 2**	6	**P** BDES1023 **C** BDES2026 **N** DESA2111	Semester 1 Semester 2
BDES2020 **Architecture Studio 202**	6	**P** BDES2010 or DESA2001 **C** BDES2021 **N** DESA2002	Semester 2
BDES2021 **Architectural History/Theory 2**	6	**P** BDES1011 **C** BDES2020 **N** DESA2111	Semester 2
Fourth year			
CIVL2810 **Engineering Construction and Surveying**	6	**A** MATH1001, MATH1002, MATH1003, MATH1005 *In recent years - the course has included a 1.5 day camp at Webbs Creek (about 80km from Sydney). The camp is located in a bushland setting. It aims to provide valuable practice in practical field survey and has a secondary aim of providing a basis for social gathering (this aspect being requested in student feedback over recent years)*	Semester 1
CIVL3812 **Project Appraisal**	6	**A** MATH1005 **N** ENGG2850	Semester 1
CIVL3206 **Steel Structures 1**	6	**A** CIVL2110 AND CIVL2201 AND CIVL2230 AND CIVL3235 *It is assumed that students are competent in the following areas: the methods of load transfer in structures - tension, compression, bending, shear, torsion, and bearing; an appreciation of stress and strain, and being able to determine stresses and strains in simple sections under axial force, bending moments, shear and torsion; calculating and understanding the physical significance of geometric section properties - centroid, Ix, Iy, Zx, Zy, Sx, Sy, rx, ry, J, Ag; knowledge of the basic elastic-plastic material properties of steel, E, G, fy, fu; and knowledge of loading of structures. A special "assumed knowledge" lecture will be given in Week 1 to refresh the knowledge of students.*	Semester 2
CIVL3235 **Structural Analysis**	6	**A** CIVL2110, CIVL2230 and MATH2061	Semester 2
BDES3010 **Architecture Studio 301**	6	**P** BDES2020, or equivalents from DESA2002, DESA2111 **C** BDES3023 **N** DESA3001	Semester 1
BDES3012 **Architectural Communications 3**	6	**P** BDES2012 or DESA2002 **C** BDES3020 **N** DESA3001	Semester 2
BDES3020 **Architecture Studio 302**	6	**P** BDES3010 or DESA3001 **C** BDES3012 **N** DESA3002	Semester 2
BDES3023 **Architectural Technologies 3**	6	**P** BDES2013 or DESA2111 **C** BDES3010 and BDES3011 **N** DAAP3002	Semester 1
Fifth Year			
CIVL3205 **Concrete Structures 1**	6	**A** CIVL2110 AND CIVL2201 AND CIVL2230. Basic concepts of solid mechanics and structural mechanics, including: compatability of strains; stress-strain relationships; equilibrium; flexure, shear and torsion; statically determinate load effects (reactions, bending moments, shear forces); elastic beam theory (strains, stresses and beam deflections).	Semester 1
CIVL3612 **Fluid Mechanics**	6	**A** CIVL2201 AND CIVL2611 AND ENGG1802 AND MATH2061. This unit of study follows on from Fluid Mechanics CIVL2611, which provides the essential fundamental fluid mechanics background and theory, and is assumed to be known and fully understood.	Semester 1
CIVL4811 **Engineering Design and Construction**	6	**A** CIVL2810 *This unit aims to prepare students for employment in a broad range of engineering areas including design, planning and construction management.*	Semester 1
CIVL4860 **Architectural to Structural Design**	6	**P** CIVL3235 AND BDES3023 *This unit is restricted to students enrolled in the Bachelor of Engineering/Bachelor of Design in Architecture combined degree.*	Semester 2
CIVL4903 **Civil Engineering Design**	6	**A** CIVL2410, CIVL3612, CIVL4811 **P** CIVL3205 and CIVL3206	Semester 2
ENGG4000 **Practical Experience**		**P** 36 Credit Points of Senior Units *Students should have completed three years of their BE program before enrolling in this unit.*	Semester 1 Semester 2
BDES3025 **Architectural Professional Practice**	6		Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Students must select 12cp from the following block of units. Students must enrol in 12 credit points of Thesis units.			
CIVL4022 Honours Thesis A	6	**P** 30 credits of 3rd year units of study and HWAM 65 or over. *Note: Department permission required for enrolment* *It is expected that the Thesis will be conducted over two consecutive semesters and that the majority of students will start in Semester 1. Commencement in Semester 2 requires permission of Thesis coordinator and School`s Director of Learning & Teaching and will only be allowed where there are good reasons for doing so. Students considering this option should discuss it with the Thesis coordinator at least one semester before they intend to start.*	Semester 1 Semester 2
CIVL4023 Honours Thesis B	6	**P** 30 credit points of 3rd year units of study *Note: Department permission required for enrolment*	Semester 1 Semester 2

Resolutions of the Faculty of Engineering and Information Technology relating to the combined Bachelor of Engineering Honours (Civil)/Design in Architecture program.

1. Candidates for the degrees of Bachelor of Engineering Honours (Civil) and Bachelor of Design in Architecture must complete all the core units of the study as listed in the above table and complete a minimum of 240 credit points.

2. Most Mathematics, Chemistry, Physics and Computer Science units of study offered by the Faculty of Science can be replaced by an equivalent advanced level units of study subject to prerequisite conditions (as required by the Faculty of Science) being met.

3. Students considering doing Advanced Engineering options should seek advice from the relevant school advisor before enrolling.

For a standard enrolment plan for Civil Engineering combined with Design in Architecture visit http://cusp.sydney.edu.au/students/view-degree-page/degree_Civil/Architecture

Unit of Study Descriptions

Bachelor of Engineering Honours (Civil) and Bachelor of Design in Architecture

Candidates for the degree of Bachelor of Engineering Honours (Civil) and Design in Architecture are required to gain credit for the core units of study set out below. To satisfy the degree requirement of the combined degree a candidate must study not less than 144 credit points of the core civil engineering units of study and 96 credit points of units of study of the core design in architecture units of study.

Core units of study

First year

MATH1001
Differential Calculus

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001 **Assumed knowledge:** HSC Mathematics Extension 1 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1001 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study looks at complex numbers, functions of a single variable, limits and continuity, vector functions and functions of two variables. Differential calculus is extended to functions of two variables. Taylor's theorem as a higher order mean value theorem.

Textbooks
As set out in the Junior Mathematics Handbook.

MATH1002
Linear Algebra

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1902, MATH1012, MATH1014 **Assumed knowledge:** HSC Mathematics or MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1002 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study introduces vectors and vector algebra, linear algebra including solutions of linear systems, matrices, determinants, eigenvalues and eigenvectors.

Textbooks
As set out in the Junior Mathematics Handbook

MATH1003
Integral Calculus and Modelling

Credit points: 3 **Session:** Semester 2, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1013, MATH1903, MATH1907 **Assumed knowledge:** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1003 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.This unit of study first develops the idea of the definite integral from Riemann sums, leading to the Fundamental Theorem of Calculus. Various techniques of integration are considered, such as integration by parts.The second part is an introduction to the use of first and second order differential equations to model a variety of scientific phenomena.

Textbooks
As set out in the Junior Mathematics Handbook

MATH1005
Statistics

Credit points: 3 **Session:** Semester 2, Summer Main, Winter Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021 **Assumed knowledge:** HSC Mathematics **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1005 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit offers a comprehensive introduction to data analysis, probability, sampling, and inference including t-tests, confidence intervals and chi-squared goodness of fit tests.

Textbooks
As set out in the Junior Mathematics Handbook

BDES1010
Architecture Studio 101

Credit points: 6 **Teacher/Coordinator:** Dr Sean Anderson **Session:** Semester 1 **Classes:** Lecture and studio contact, plus self-directed preparation and assignments, for a minimum total student commitment averaging 9 hours per week. **Prohibitions:** DESA1001 **Assumed knowledge:** HSC Mathematics and HSC English Standard or equivalent **Assessment:** Minor Project (30%) Major Project (50%), Portfolio (20%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Architecture Studio 101 introduces students to the skills and knowledge required to produce creative, innovative and appropriate solutions to architectural problems. It seeks to develop the architectural imagination as a dialogue between poetic thought and pragmatic material circumstance, nurturing the capacity to move back and forth between conceptual, intuitive levels of reference and the precise skills required for credible technical resolution. It expands students' vocabulary of architecture through study of relevant precedents and examination of techniques for spatial organization. Students develop a preliminary understanding of contemporary architectural theory and deploy a range of architectural representation techniques.

BDES1011
Architectural History/Theory 1

Credit points: 6 **Teacher/Coordinator:** Dr Ross Anderson **Session:** Semester 1 **Classes:** Lecture and tutorial contact, plus self-directed preparation and assignments, for a minimum total student commitment averaging 9 hours per week. **Prohibitions:** DESA1102 **Assumed knowledge:** HSC Mathematics and HSC English Standard or equivalent **Assessment:** Participation and Written Reviews (50%), Research Reports (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Architectural History/Theory 1 introduces students to the discourse of architectural history and theory. It commences with a concise chronological survey of key periods of architectural history from antiquity to the mid-nineteenth century, providing an overview of the scope of the field and establishing initial points of reference. It then changes focus to investigate more closely the ways in which particular architectural themes and ideas traverse across history, coming to the fore in certain periods and receding in others. Students will interrogate these themes in small groups through intense study of a single significant building, which they will research, document and illustrate in a written report, and re-construct in a suite of finely crafted scale models. They will be introduced to fundamental principles and skills of scholarly research, including locating and evaluating sources, and constructing arguments.

BDES1012
Architectural Communications 1

Credit points: 6 **Teacher/Coordinator:** Dr Sean Anderson **Session:** Semester 2 **Classes:** Lecture, computer laboratory and studio contact, plus self-directed preparation and assignments, for a minimum total student commitment averaging 9 hours per week. **Prohibitions:** DESA1001 **Assumed knowledge:** HSC Mathematics and HSC English Standard or equivalent **Assessment:** Assignments (70%), Portfolio (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Architectural Communications 1 introduces students to fundamental modes of communication that are used to comprehend, conceive, explore, articulate and document architecture. It covers the domains of sketching, technical drawing, model making, verbal and written communication, diagramming and photography. It both familiarises students with necessary technical skills and encourages their creative deployment through practical experimentation.

BDES1020
Architecture Studio 102

Credit points: 6 **Teacher/Coordinator:** Dr Jennifer Ferng **Session:** Semester 2 **Classes:** Lecture and studio contact, plus self-directed preparation and assignments, for a minimum total student commitment averaging 9 hours per week. **Prerequisites:** BDES1010 or DESA1001 **Prohibitions:** DESA1002 **Assessment:** Project (30%); Major Project (50%); Portfolio (20%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Architecture Studio 102 further develops and applies the skills and knowledge gained in Architecture Studio 101 in response to increasingly concrete and complex programmatic and contextual issues. The design of a single building in a complex urban context is advanced through a series of iterations with an emphasis on practical experimentation at a range of scales and in a range of media. The work is drawn together into a final presentation comprising a finely crafted model and panels of drawings.

BDES1023
Architectural Technologies 1

Credit points: 6 **Teacher/Coordinator:** Dr Sean Anderson **Session:** Semester 2 **Classes:** Lecture and tutorial contact, plus self-directed preparation and assignments, for a minimum total student commitment averaging 9 hours per week. **Prohibitions:** DESA1102 **Assessment:** Assignments (60%), Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Architectural Technologies 1 introduces students to the roles that environmental considerations, structures and construction play in architecture. The fundamental concepts underpinning each of these key areas are presented and students demonstrate their developing knowledge of them via project-based assignments. These progressively complex tasks initiate students to the knowledge required to successfully analyse and synthesise construction and technical systems in basic buildings.

BDES1024
Art Workshop 1

Credit points: 6 **Teacher/Coordinator:** Chris Fox **Session:** Semester 1 **Classes:** Lecture and studio contact, plus self-directed preparation and assignments, for a minimum total student commitment averaging 9 hours per week. **Assessment:** Studio Work (50%); Research Journal and Gallery Review (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

In Art Workshop 1, first year architecture students begin to shape and communicate their ideas and experiences through various art practices. A range of studio-based modules within one semester seeks to foster technical, creative and conceptual skills with a particular emphasis on interdisciplinary process, tactility, interactions and critical thinking. A combination of specific disciplines in both contemporary art and the reworking of traditional art media, extend students' understanding of their own creative process and how art may contribute to their architectural study. A framework of lectures, gallery visits and readings asks students to consider the dynamic interchange between historical, cultural and environmental concerns and the field of contemporary art.

Second year

ENGG1800
Engineering Disciplines (Intro) Stream A

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 1 hr/week; Laboratory 3 hrs/week. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces students to specialisations in the Engineering discipline areas of Aeronautical, Biomedical Chemical, Civil, Mechanical and Mechatronic Engineering, and Project Engineering and Management. By providing first-year students with an experience of these various engineering streams, the unit aims to develop the students' professional identity as an engineer and thus provide a suitable basis on which students can choose their discipline for further study.

Introductory sessions in the School of Aerospace,

Mechanical and Mechatronic Engineering

-4 weeks-

An overview of the degree requirements in each stream. The roles of the engineer in each stream (employments, skills, etc). How each of the subjects taught relate to the skills/knowledge and applications required of the engineers. Basically make sure students fully understand what engineers are in the discipline areas and why the students do the subjects they do. In each stream, one engineering technical topic will be taught as a problem solving exercise, and this topic will be the focus of the laboratory.

School of Civil Engineering

-4 weeks-

Introductory lectures in Engineering Economics and Construction Planning, Foundation Engineering, Structural Engineering, Materials, Environmental Engineering. Each student will be involved in the erection and dismantling of an 8 metre high steel and timber tower in the Civil Engineering Courtyard. Preliminary lectures related to the tower will include safety issues, loading, statical analysis, foundation calculations, construction management, engineering drawings and detailing, geometric calculations, and survey measurements. Exercises related to these issues will be performed before assembly and disassembly of the tower.

School of Chemical and Biomolecular Engineering

-4 weeks-

This course will enable students to gain an appreciation of: the methods and materials of construction of items of process equipment; the role of this equipment in building an entire chemical processing plant: its operation and maintenance and safety requirements and procedures. Students will dismantle, disassemble and operate items of process equipment. They will present written answers to questions, supplemented by drawings of process flowsheets, diagrams of dismantled equipment, and discussions of heat and mass balances and of process parameters.

ENGG1802
Engineering Mechanics

Credit points: 6 **Session:** Semester 2, Summer Main **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit aims to provide students with an understanding of and competence in solving statics and introductory dynamics problems in engineering. Tutorial sessions will help students to improve their group work and problem solving skills, and gain competency in extracting a simplified version of a problem from a complex situation. Emphasis is placed on the ability to work in 3D as well as 2D, including the 2D and 3D visualization of structures and structural components, and the vectorial 2D and 3D representations of spatial points, forces and moments. Introduction to kinematics and dynamics topics includes position, velocity and acceleration of a point; relative motion, force and acceleration, momentum, collisions and energy methods.

ENGG1803
Professional Engineering 1

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prohibitions:** ENGG1061 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Professional Engineering 1 is an introductory Unit of Study within the Faculty of Engineering. The semester 1 course is aimed at students from the School of Aerospace, Mechanical and Mechatronic Engineering. It seeks to introduce newly admitted undergraduates to general principles of professional engineering practice, a range of contemporary professional engineering issues, plus outline skills related to academic study within an engineering environment. The subject is structured around a team based design and build project, in which students apply the professional engineering concepts they are learning to an engineering project. Professional engineering topics to be covered include: accessing information, teamwork, creativity, leadership, written and oral communication, project management, problem solving, ethics, liability, work health and safety and environmental issues.

INFO1003
Foundations of Information Technology

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 3 hrs/week; Laboratory 2 hrs/week. **Prohibitions:** INFO1000, ISYS1003, INFO1903, INFS1000 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Information technologies (IT) and systems have emerged as the primary platform to support communication, collaboration, research, decision making, and problem solving in contemporary organisations. The essential necessity for all university students to acquire the fundamental knowledge and skills for applying IT effectively for a wide range of tasks is widely recognised. It is an introductory unit of study which prepares students from any academic discipline to develop the necessary knowledge, skills and abilities to be competent in the use of information technology for solving a variety of problems. The main focus of this unit is on modelling and problem solving through the effective use of using IT. Students will learn how to navigate independently to solve their problems on their own, and to be capable of fully applying the power of IT tools in the service of their goals in their own domains while not losing sight of the fundamental concepts of computing.

Students are taught core skills related to general purpose computing involving a range of software tools such as spreadsheets, database management systems, internet search engine, HTML, and JavaScript. Students will undertake practical tasks including authoring an interactive website using HTML, JavaScript and AJAX and building a small scale application for managing information. In addition, the course will address the many social, ethical, and intellectual property issues arising from the wide-spread use of information technology in our society.

MATH2061
Linear Mathematics and Vector Calculus

Credit points: 6 **Session:** Semester 1, Summer Main **Classes:** Three 1 hour lectures, one 1 hour tutorial and one 1 hour practice class per week. **Prerequisites:** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **Prohibitions:** MATH2961, MATH2067, MATH2901, MATH2902, MATH2001, MATH2002 **Assessment:** One 2 hour exam, assignments, quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit starts with an investigation of linearity: linear functions, general principles relating to the solution sets of homogeneous and inhomogeneous linear equations (including differential equations), linear independence and the dimension of a linear space. The study of eigenvalues and eigenvectors, begun in junior level linear algebra, is extended and developed. The unit then moves on to topics from vector calculus, including vector-valued functions (parametrised curves and surfaces; vector fields; div, grad and curl; gradient fields and potential functions), line integrals (arc length; work; path-independent integrals and conservative fields; flux across a curve), iterated integrals (double and triple integrals; polar, cylindrical and spherical coordinates; areas, volumes and mass; Green's Theorem), flux integrals (flow through a surface; flux integrals through a surface defined by a function of two variables, though cylinders, spheres and parametrised surfaces), Gauss' Divergence Theorem and Stokes' Theorem.

PHYS1001
Physics 1 (Regular)

Credit points: 6 **Session:** Semester 1 **Classes:** Three 1-hour lectures, one 3-hour laboratory per week for 9 weeks and one 1-hour tutorial per week. **Prerequisites:** HSC Physics with a minimum mark of 65 **Prohibitions:** PHYS1002, EDUH1017, PHYS1901 **Assumed knowledge:** HSC Physics **Assessment:** 3 hour exam plus laboratories, assignments and mid-semester tests (100%). **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for students who gained 65 marks or better in HSC Physics or equivalent. The lecture series contains three modules on the topics of mechanics, thermal physics, and oscillations and waves.

Textbooks

Young & Freedman. University Physics. 13th edition, with Mastering Physics, Addison-Wesley. 2012. Course lab manual.

CIVL2201
Structural Mechanics

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** ENGG1802 **Prohibitions:** AMME2301 **Assumed knowledge:** From ENGG1802 Engineering Mechanics, students should be competent in the following areas. 1. The concept of force and momentum equilibrium in two and three dimensions. 2. Drawing free body diagrams. 3. Establishing and solving the equations of equilibrium from the FBD. 4. Setting out solutions logically, clearly and neatly. Students should be competent incertain mathematical skills. 1. Solving algebraic equations. 2. Differentiation and integration (including double integrals). 3. Drawing graphs of polynomials (especially) and other mathematical function. 4. Trigonometry. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The primary objective of this unit is to understand internal actions (forces and moments) in structures (deformable objects) under loads in three key areas: how structures resist external loads by internal actions; the distribution of internal actions within structures; and the deformations, stresses and strains associated with the internal actions. At the end of this unit, students should be able to understand the basic methods of load transfer in structures - tension, compression, bending, shear and torsion (internal actions); apply the equations of equilibrium to determine the distribution of internal actions in a simple structure by drawing BMDs, SFDs, AFDs, and TMDs; understand the significance and methods of calculation of the geometric properties of structural sections (I, Z, S, J etc); understand the effect of internal forces and deformations of bodies through the concept and calculation of strains and stresses; appreciate the behaviour of structures by analysing structures without numerical calculations; display a knowledge of basic material properties, combined stresses and failure criteria; and demonstrate their hands-on experience of the behaviour of structural members via experiments and the ability to prepare written reports on those experiments. Emphasis in the assessment scheme will be placed on understanding structural behaviour and solving problems, rather than remembering formulae or performing complex calculations. The course seeks to utilise and improve the generic skills of students, in areas such as problem solving, neat and logical setting out of solutions, report writing, and team work. The syllabus comprises introduction; equilibrium; internal actions: BMDs, SFDs, AFDs, and TMDs; elasticity, stress and strain, and basic material properties; axial forces: tension and compression; elastic bending of beams; shear force and shear stresses in beams; torsion; deflection of beams; pipes and pressure vessels; trusses; material properties, combined stresses and yield criteria; advanced bending; introduction to buckling and instability.

GEOL1501
Engineering Geology 1

Credit points: 6 **Teacher/Coordinator:** A/Prof Tom Hubble **Session:** Semester 2 **Classes:** Two 2 hour lectures per week and 24 hours laboratory classes. **Prohibitions:** GEOS1903, GEOL1902, GEOS1003, GEOL1002 **Assumed knowledge:** No previous knowledge of Geology assumed **Assessment:** Practical laboratory work, Assignments, Tests and Quizzes, and a combined theory and practical exam (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Course objectives: To introduce basic geology and the principles of site investigation to civil engineering students. Expected outcomes: Students should develop an appreciation of geologic processes and their influence civil engineering works, acquire knowledge of the most important rocks and minerals and be able to identify them, and interpret geological maps with an emphasis on making construction decisions. Syllabus summary: Geological concepts relevant to civil engineering and the building environment. Introduction to minerals; igneous, sedimentary and metamorphic rocks, their occurrence, formation and significance. General introduction to physical geology and geomorphology, structural geology, plate tectonics, hydrogeology, rock core logging site investigation techniques for construction. Associated laboratory work on minerals, rocks and mapping.

Textbooks

Portrait of A Planet by Stephen Marshak, Published by H.H. Norton and Company and readings provided via Blackboard

Third year

CIVL2410
Soil Mechanics

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 1 hr/week; Laboratory 2 hrs/week. **Assumed knowledge:** Knowledge: CIVL2201 AND GEOL1501. An understanding of simple statics, equilibrium, forces and bending moments, and of stress and strain and the relationship between them. This is covered by University of Sydney courses ENGG 1802 Engineering Mechanics, CIVL2201 Structural Mechanics. Familiarity with the use of spreadsheets (Excel, Mathcad) to obtain solutions to engineering problems, and with the graphical presentation of this data. Familiarity with word processing packages for report presentation. Some of this is covered in the University of Sydney course ENGG1801 Engineering Computing. Familiarity with partial differential equations, and their analytical and numerical solution. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course provides an elementary introduction to Geotechnical Engineering, and provides the basic mechanics necessary for the detailed study of Geotechnical Engineering. This course aims to provide an understanding of: the nature of soils as engineering materials; common soil classification schemes; the importance of water in the soil and the effects of water movement; methods of predicting soil settlements, the stress-strain-strength response of soils, and earth pressures.

CIVL2611
Introductory Fluid Mechanics

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 1 hr/week. **Assumed knowledge:** CIVL2201 AND ENGG1802 AND MATH1001. Students are expected to have a strong understanding of fundamental physics, statics, equilibrium, forces, and dimensional analysis. Familiarity with simple calculus, partial differential equations, and the analytical and numerical solutions. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The objective of this unit of study is to develop an understanding of basic fluid concepts for inviscid and incompressible fluids. Topics to be covered will include: basic fluid properties, hydrostatics, buoyancy, stability, pressure distribution in a fluid with rigid body motion, fluid dynamics, conservation of mass and momentum, dimensional analysis, open channel flow, and pipe flow.

This core unit of study together with CIVL3612 forms the basis for further studies in the applied areas of ocean, coastal and wind engineering and other elective fluid mechanics units which may be offered.

BDES2010
Architecture Studio 201

Credit points: 6 **Teacher/Coordinator:** Dr Sean Anderson **Session:** Semester 1 **Classes:** Lecture and studio contact, plus self-directed preparation and assignments, for a minimum total student commitment averaging 9 hours per week. **Prerequisites:** BDES1020 or DESA1002 **Corequisites:** BDES2012, BDES2013 **Prohibitions:** DESA2001 **Assessment:** Project 1 (25%), Project 2 (25%), Project 3 (40%), Portfolio (10%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Architecture Studio 201 introduces principles of urban landscape, including an understanding of urban ecological and socio-cultural processes as they impact and influence understandings of place and the siting and design of buildings in built topographies. Learning objectives in the first part of the semester include development of knowledge and skills in analysis and the conceptual configuration of contexts that may involve contested ideas and competing interests. In the second part of the semester approaches to the siting, spatial composition and design through urban landscape and architectural strategies that support social sustainability, and an awareness of the inter-connectedness between context and architecture, are explored.

BDES2012
Architectural Communications 2

Credit points: 6 **Teacher/Coordinator:** Dr Dagmar Reinhardt **Session:** Semester 1 **Classes:** Lecture, computer laboratory and studio contact, plus self-directed preparation and assignments, for a minimum total student commitment averaging 9 hours per week. **Prerequisites:** BDES1012 **Corequisites:** BDES2010, BDES2013 **Prohibitions:** DESA2001 **Assessment:** Assignments (70%), Portfolio (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Architectural Communications 2 particularly explores the roles that digital technology can play in contemporary architectural communication. It revisits graphic representation, modelling and verbal and written communication through the lens of computer-aided operations. This unit of study equips students with skills in digital drafting and modelling, texture mapping, lighting, rendering and digital fabrication, and encourages their creative deployment in an iterative design project for a simple specific building typology Students are asked to develop a clear understanding of their chosen typology and represent it through a range of media in order to create an archive of their own analysis of its concepts and expressions. Communications 2 is divided into both guided lab and studio sessions. The lab sessions deploy a variety of analogue techniques and move towards digital design in order to better understand the typology's experimental qualities including scale, proportion, texture and materiality.

BDES2013
Architectural Technologies 2

Credit points: 6 **Teacher/Coordinator:** Michael Muir **Session:** Semester 1, Semester 2 **Classes:** Lecture and tutorial contact, plus self-directed preparation and assignments, for a minimum total student commitment averaging 9 hours per week. **Prerequisites:** BDES1023 **Corequisites:** BDES2026 **Prohibitions:** DESA2111 **Assessment:** Assignments (60%), Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Architectural Technologies 2 explores the roles that environmental considerations, structures and construction play in moderately complex medium-scale buildings. Emphasis is placed on developing in students an active awareness of the impact that technical and constructional decisions have on architectural Architectural Technologies 2 explores the role that environmental, structural and constructional considerations play in moderately complex small-scale buildings. Attention is paid to the impact that choices of materials, detailing, structural systems and energy systems, whether passive or active, have on architectural design. Through project-based learning, students develop an active awareness of the important role that appropriate technical and constructional decisions, including architectural details, play in terms of fulfilling conceptual ambitions in tangible works of architecture. Students develop and demonstrate their developing appreciation of these issues via case study analysis, a group project, individual technical drawings and a final examination. Students develop and demonstrate their awareness of these issues via the analysis of case studies, a large project-based assignment, and a final exam.

BDES2020
Architecture Studio 202

Credit points: 6 **Teacher/Coordinator:** Dr Jennifer Ferng and Dr Sean Anderson **Session:** Semester 2 **Classes:** Lecture and studio contact, plus self-directed preparation and assignments, for a minimum total student commitment averaging 9 hours per week. **Prerequisites:** BDES2010 or DESA2001 **Corequisites:** BDES2021 **Prohibitions:** DESA2002 **Assessment:** Minor Project (30%), Major Project (50%), Portfolio (20%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Architecture Studio 202 requires the design of a moderately complex building in an urban context. Students develop an increased awareness of the broader social, cultural and environmental consequences of architectural decisions. The design process that is fostered explores the creative tension between intuition and prescription, using accumulative techniques that are intended to elicit unexpected solutions. Participatory and collaborative work processes are promoted and students are required to sensitively and imaginatively negotiate between the internal logic of the design approach and urban strategies. They become increasingly attentive to the complexities of architectural design, from the interpretation of programmatic requirements in respect to the opportunities and limitations of particular site conditions to the spatial and tectonic implications of design decisions.

BDES2021
Architectural History/Theory 2

Credit points: 6 **Teacher/Coordinator:** Dr Sean Anderson **Session:** Semester 2 **Classes:** Lecture and tutorial contact, plus self-directed preparation and assignments, for a minimum total student commitment averaging 9 hours per week. **Prerequisites:** BDES1011 **Corequisites:** BDES2020 **Prohibitions:** DESA2111 **Assessment:** Attendance, discussions and weekly proformas (25%), group research presentation and building analysis (25%), final research essay (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Architectural History/Theory 2 offers a critical examination of the developments of modern architecture in design, theory, spatial programming and construction technology, as well as its social and environmental effects across the world from the eighteenth to the twentieth centuries. It provides a broad overview of diverse approaches to modern architecture and rethinks critically how they have advanced different architectural propositions about modern ways of dwelling and building under a constellation of social and cultural conditions. By exposing students to a variety of theoretical issues, this unit of study aims to enhance students' capability to reflect on the values embedded in design, and to develop their understanding of the intertwined relationship between space, society and power.

Fourth year

CIVL2810
Engineering Construction and Surveying

Credit points: 6 **Session:** Semester 1 **Classes:** Tutorial 2 hrs/week; Workgroup 3 hrs/week; Lecture 3 hrs/week. **Assumed knowledge:** MATH1001, MATH1002, MATH1003, MATH1005 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: In recent years - the course has included a 1.5 day camp at Webbs Creek (about 80km from Sydney). The camp is located in a bushland setting. It aims to provide valuable practice in practical field survey and has a secondary aim of providing a basis for social gathering (this aspect being requested in student feedback over recent years)

The objectives of this unit are to gain an understanding of the fundamentals of engineering construction including

- design, control, management, measurement and construction methods for excavation, embankments and other earthworks, hauling and associated operations.

- building construction fundamentals, including reinforced concrete, masonry, steel and timber.

- drilling and blasting

Engineering Survey topics aim (a) to provide basic analogue methods of distance, angle and height measurement and (b) to provide an understanding of three dimensional mapping using basic total station electronic field equipment with associated data capture ability and (c) to give an insight into future trends in the use of GPS and GIS systems.

At the end of this unit, students should develop basic competency in earthwork engineering and economic optimisation of related construction, including proposing and analysing systems and methods, estimation of probable output, unit cost and productivity evaluation. Students should have a basic knowledge of vertical construction in reinforced concrete, masonry, steel and timber. Students should also develop proficiency in the design and implementation of mapping systems in Civil Engineering, using analogue and electronic field equipment and associated software packages.

The syllabus comprises introduction to the framework under which construction projects are formulated and analysed; construction engineering fundamentals; construction systems related to excavation, hauling and embankment construction, including selection and evaluation of plant and methods as well as the expected output and cost; introduction to construction operations management. Introduction to engineering surveying, distance measurement, angle measurement, levelling, traversing, topographic surveys, electronic surveying equipment, future surveying technologies.

CIVL3812
Project Appraisal

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Online quizzes 2 hrs/week. **Prohibitions:** ENGG2850 **Assumed knowledge:** MATH1005 **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This UoS is a third-year core unit for students enrolled in any of the undergraduate streams in the School of Civil Engineering and elective for all other branches of engineering and other faculties. The objectives of this unit of study are to develop students' ability to critically analyse issues involved in project appraisal and to equip students with the concepts, tools and analytical processes to effectively carry out project appraisal tasks for businesses, non-profit organisations, and governments. At the end of this unit, students should be able to comprehend and relate to real-life examples the fundamental concepts in project appraisal (e.g. the meaning of time value for money, equivalence); calculate common financial indicators for a given project and explain the relevance of each to the appraisal of the project; rank projects by combining both financial and non-financial indicators (e.g. environmental and social); understand how risks and uncertainties affect evaluation outcomes and be able to deal with uncertainties and risks in analysis; apply techniques to account for the effects of inflation/deflation and exchange rates in analysis; understand the concept and mechanisms for depreciation and carry out pre-tax as well as post-tax analysis; understand the assumptions, pros and cons of each evaluation method and be able to explain why a particular method is appropriate/not appropriate for a given project. The syllabus comprises time value of money, cost of capital, simple/compound interest, nominal/effective interest, cost/benefit analysis of projects; equivalence, net present worth (value), future worth (value), annual worth (value), internal rate of return, external rate of return, payback period, cost-benefit analysis, cost-utility analysis, identifying and quantifying non-financial benefits/externalities, price changes and exchange rates, techniques for multi-criteria group decision-making, economic analysis of business investment projects, depreciation, capitalisation and valuation studies, replacement of assets, real option, project risk analysis, decision-tree analysis, binomial method, WACC, MARR, equity capital, debt.

CIVL3206
Steel Structures 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 3 hrs/week; Laboratory 2 hrs/week. **Assumed knowledge:** CIVL2110 AND CIVL2201 AND CIVL2230 AND CIVL3235 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: It is assumed that students are competent in the following areas: the methods of load transfer in structures - tension, compression, bending, shear, torsion, and bearing; an appreciation of stress and strain, and being able to determine stresses and strains in simple sections under axial force, bending moments, shear and torsion; calculating and understanding the physical significance of geometric section properties - centroid, Ix, Iy, Zx, Zy, Sx, Sy, rx, ry, J, Ag; knowledge of the basic elastic-plastic material properties of steel, E, *G, fy, fu; and knowledge of loading of structures. A special "assumed knowledge" lecture will be given in Week 1 to refresh the knowledge of students.*

This unit of study is concerned with the behaviour and design of steel structures. Statics provided the fundamentals of equilibrium upon which most structural engineering is based. Structural Concepts and Structural Analysis provided information on the loads (actions) on a structure and how structures resist these actions with a resulting distribution of internal actions (bending moments, shear forces, axial forces; BMDs, SFDs and AFDs). Structural Mechanics considered how these internal actions resulted in stresses and strains in members. Materials considered the microscopic and molecular structure of metals to determine its inherent mechanical properties such as yield stress. This unit of study will then combine the knowledge of stresses, material properties of steel, structural analysis, and loading, and consider new concepts and modes of failure, such as local and flexural torsional buckling, combined actions and second-order effects to understand the behaviour of steel members and frames, and how this behaviour is accounted for in the design standard AS 4100.

Both the units of study "Steel Structures 1" and "Concrete Structures 1" can be considered the culmination of the various elements of structural engineering begun in "Engineering Mechanics" in first year, and is further developed in "Civil Engineering Design" in final year. More advanced topics, such as plate behaviour, advanced buckling and connection design, are considered in the final year elective subject "Steel Structures 2".

It is recognised that not all students intend to become consulting structural engineers. The unit of study is designed so that students who make an effort to understand the concepts are most capable of passing. Students who are planning a career in the consulting structural engineering profession should be aiming at achieving a Distinction grade or higher.

CIVL3235
Structural Analysis

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 4 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** CIVL2110, CIVL2230 and MATH2061 **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The objectives of this unit are to provide an understanding of the principles of structural analysis by introducing the strain-displacement, stress-strain and equilibrium relationships for beam members; applying the relationships to the matrix displacement analysis of frame structures; and using computer software to conduct the linear-elastic and buckling analyses of frame structures.At the end of this unit, students will be able to deduce appropriate structural models for frame structures; and use computer methods and simple hand methods to obtain internal forces and displacements as well as buckling loads for frame structures. The syllabus comprises theoretical background (strain-displacement, stress-strain and equilibrium relationships), structural analysis software, matrix displacement method, beam theory, introduction to nonlinear analysis, buckling analysis.

BDES3010
Architecture Studio 301

Credit points: 6 **Teacher/Coordinator:** Dr Ross Anderson **Session:** Semester 1 **Classes:** Lecture and studio contact, plus self-directed preparation and assignments, for a minimum total student commitment averaging 9 hours per week. **Prerequisites:** BDES2020, or equivalents from DESA2002, DESA2111 **Corequisites:** BDES3023 **Prohibitions:** DESA3001 **Assessment:** Minor Project (30%), Major Project (50%), Portfolio (20%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Architecture Studio 301 engages in students the observational, analytical, interpretative and speculative capacities required to produce a conceptually and tectonically grounded solution to a medium-scale urban architectural problem. It seeks initially to refine skills in the development of a thematic framework for design, the analysis of broad urban contexts and specific site conditions, together with a strong awareness of historical and theoretical conditions for design. Students deploy these analyses in creative and experimental ways via the design of a medium-scale building with a complex functional program. Students are required to integrate multiple criteria - including thematic, conceptual, programmatic, contextual, tectonic and technical concerns - into a persuasive architectural design proposition.

BDES3012
Architectural Communications 3

Credit points: 6 **Teacher/Coordinator:** Dr Dagmar Reinhardt **Session:** Semester 2 **Classes:** Lecture, computer laboratory and studio contact, plus self-directed preparation and assignments, for a minimum total student commitment averaging 9 hours per week. **Prerequisites:** BDES2012 or DESA2002 **Corequisites:** BDES3020 **Prohibitions:** DESA3001 **Assessment:** Assignments (70%), Portfolio (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Architectural Communications 3 both consolidates students' abilities to effectively communicate architecture using graphic and verbal means and further advances their digital knowledge through concepts of movement and simulation. Students are introduced to interoperable animation and database software used for simulation and documentation of architecture, and they further develop familiarity with advanced digital fabrication. They work in a 3D modelling environment using Rhino, Grasshopper and 3DStudio Max. This unit of study aims to instil in students sensitivity to working creatively with hybrid techniques, and introduces them to dynamic communication procedures deployed in professional architectural practice to move between the digital and the real.

BDES3020
Architecture Studio 302

Credit points: 6 **Teacher/Coordinator:** Dr Sean Anderson **Session:** Semester 2 **Classes:** Lecture and studio contact, plus self-directed preparation and assignments, for a minimum total student commitment averaging 9 hours per week. **Prerequisites:** BDES3010 or DESA3001 **Corequisites:** BDES3012 **Prohibitions:** DESA3002 **Assessment:** Minor Project (30%), Major Project (50%), Portfolio (20%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

As the culminating design studio for the degree, Architecture Studio 302 presents students with the opportunity to express their own theoretical positioning through the design of an important civic building, and to demonstrate the technical and representational capacities that they have developed across the course of their degree. They work with a great deal of autonomy in a collaborative working environment alongside their peers and under the guidance of their tutor to produce conceptually challenging, integrated and compelling pre-professional architectural projects.

BDES3023
Architectural Technologies 3

Credit points: 6 **Teacher/Coordinator:** Dr Francesco Fiorito **Session:** Semester 1 **Classes:** Lecture and tutorial contact, plus self-directed preparation and assignments, for a minimum total student commitment averaging 9 hours per week. **Prerequisites:** BDES2013 or DESA2111 **Corequisites:** BDES3010 and BDES3011 **Prohibitions:** DAAP3002 **Assessment:** Assignments (60%), Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Architectural Technologies 3 develops in students an advanced understanding of moderately complex building systems. It addresses the technical design of buildings in their entirety and in their details, through the three interrelated perspectives of environment, structures and construction. As in Architectural Technologies 1 and 2, primary emphasis is placed on developing an understanding that appropriate formal architectural solutions can be the outcome of technological considerations and that, reciprocally, technical solutions can not only support but inform conceptual ambitions. A major project-based assignment, a case study analysis, individual technical drawings and a final examination are used as the vehicles for students to demonstrate the knowledge that they have gained in analyzing and synthesizing the various considerations that are to be addressed in the design of a building system that appropriately responds to, and integrates, the three key technical considerations of environment, structures and construction.

Fifth Year

CIVL3205
Concrete Structures 1

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Project Work - in class 3 hrs/week; Laboratory 2 hrs/week. **Assumed knowledge:** CIVL2110 AND CIVL2201 AND CIVL2230. Basic concepts of solid mechanics and structural mechanics, including: compatability of strains; stress-strain relationships; equilibrium; flexure, shear and torsion; statically determinate load effects (reactions, bending moments, shear forces); elastic beam theory (strains, stresses and beam deflections). **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The objectives of this unit are to provide a basic understanding of the behaviour of reinforced concrete members and structures; to provide a basic understanding of standard methods of analysis and design of reinforced concrete structures (including an understanding of capabilities and limitations); and to provide basic design training in a simulated professional engineering environment. At the end of this unit students will gain proficiency in basic methods of reinforced concrete analysis and design.

The syllabus covers the behaviour of reinforced concrete members and structures, including: material properties, 'elastic' analysis (stresses/deformations/time-dependence), ultimate strength of beams (flexure), ultimate strength of columns (short and slender), behaviour or reinforced concrete slabs, the reinforced concrete truss analogy (shear/torsion/and detailing implications), the design of typical elements of a reinforced concrete building, structural modelling, analysis of load-effects (incl.earthquakes), design criteria (for durability, fire-resistance, serviceability and strength), design calculation procedures, reinforcement detailing and structural drawings.

CIVL3612
Fluid Mechanics

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 1.30 hrs/week. **Assumed knowledge:** CIVL2201 AND CIVL2611 AND ENGG1802 AND MATH2061. This unit of study follows on from Fluid Mechanics CIVL2611, which provides the essential fundamental fluid mechanics background and theory, and is assumed to be known and fully understood. **Assessment:** Through semester assessment (55%) Final Exam (45%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to provide an understanding of the conservation of mass and momentum in differential forms for viscous fluid flows. It provides the foundation for advanced study of turbulence, flow around immersed bodies, open channel flow, and turbo-machinery.

CIVL4811
Engineering Design and Construction

Credit points: 6 **Session:** Semester 1 **Classes:** Workshop 3 hrs/week; Project Work - own time 1 hr/week; Presentation 2 hrs/week. **Assumed knowledge:** CIVL2810 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This unit aims to prepare students for employment in a broad range of engineering areas including design, planning and construction management.

The objectives of this unit are to develop an understanding of construction methods, strategies, equipment and machinery in a range of construction activities and an understanding of the principles involved in the design for those construction activities.

At the end of this unit, students will have developed a familiarity with a variety of construction methods, strategies, equipment and machinery in a range of construction activities such that they will be able, if and when the opportunity arises to participate as site engineers (or similar role) in the planning and execution of those construction activities, albeit with supervision and guidance from experienced professionals. Students will also have developed an understanding of the design principles and techniques involved in the planning for those construction activities such that they are able, if and when the opportunity arises, to participate as design engineers, in the planning and design for those construction activities, with supervision and guidance from experienced professionals. The range of topics covered in this course is such that the learning outcomes form a basis for later development of more detailed knowledge, dependent on the future career experiences of the student. The course does not prepare a student for immediate, unsupervised participation in construction and design work associated with the topics covered.

The construction topics covered in this course have not been previously addressed in CIVL2810 (Engineering Construction and Survey). The topics may vary dependent on current and planned projects in Sydney, NSW and Australia. At this stage the topics are hard rock tunnelling and general hard rock underground excavation; soft ground tunnelling; underground construction; micro tunnelling; cut and cover (cover and cut) tunnelling; earth retaining systems; piling; formwork and falsework (incl Tilt up, Ultrafloor, Sacrificial form); dewatering; pavement design and construction - rigid and flexible (incl and pavement construction materials); stormwater drainage design and construction; marine construction; civil construction in environmentally sensitive areas; contract administration for construction engineers; general engineering in remote localities (project based); construction methods in bridge engineering; QA documentation on a typical project; insurance in the construction industry occupational health and safety issues in the construction industry; timber engineeering; post-tensioned/prestressed concrete construction; civil engineering in a marine environment.

On day 1 of the course, a form based survey is taken to invite students to nominate specific areas of interest which may lead to adjustment in course content.

CIVL4860
Architectural to Structural Design

Credit points: 6 **Session:** Semester 2 **Classes:** Project Work - in class 4 hrs/week; Presentation 0.15 hrs/week; Project Work - own time 6 hrs/week. **Prerequisites:** CIVL3235 AND BDES3023 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This unit is restricted to students enrolled in the Bachelor of Engineering/Bachelor of Design in Architecture combined degree.

CIVL4860 is a core final year unit for BE/BDesArch students aimed at enhancing students' skills in bridging between the architectural and engineering disciplines. The Unit will have a particular focus on developing strategies for how best to resolve the frequently conflicting interests and preferred concept solutions for addressing architectural and structural requirements for a building with given functions. Students will work in groups on developing final building designs from scratch from project briefs. Architectural and structural designs will be detailed in group presentations and reports.

CIVL4903
Civil Engineering Design

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 1 hr/week; Tutorial 3 hrs/week. **Prerequisites:** CIVL3205 and CIVL3206 **Assumed knowledge:** CIVL2410, CIVL3612, CIVL4811 **Assessment:** Through semester assessment (75%) Final Exam (25%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is a fourth year core unit of study for the degree in Civil Engineering and fourth year elective for the degree in Project Engineering and Management (Civil).

The objective of this unit is to give students an appreciation of the role of the designer in the development of Civil Engineering projects. At the end of this unit, students will have developed an understanding of the design philosophy. They will gain this through their involvement in a number of exercises which cover the design sequence from concept to documentation.

The syllabus comprises: design sequence beginning with a 'brief' and including definition, value and criteria selection; generation of proposals; analysis of proposals; selection of design; development of details of a particular design selected; feasibility studies and examination of existing works; study of design projects by stages, including details of some aspects.

This unit is under the direction of an engineer in professional practice in cooperation with other professional practitioners and members of the academic staff. Lectures and exercises on the interaction between civil engineering and architectural design and practice are included in the unit.

ENGG4000
Practical Experience

Session: Semester 1, Semester 2 **Classes:** Practical Experience, **Prerequisites:** 36 Credit Points of Senior Units **Assessment:** Through semester assessment (100%) **Mode of delivery:** Professional practice

Note: Students should have completed three years of their BE program before enrolling in this unit.

The aim of this unit is to give students exposure to work in an engineering organisation and gain some professional experience; to enhance a student's abilities and experience in report writing; to encourage self-evaluation in the context of applying their theoretical knowledge to real industry practise. Students will gain a better appreciation of the role of engineers in the workplace. The assessment will enhance the student's ability to present structured observations and reflections in the mode of a formal written report.

Each student is required to gain exposure to professional engineering practice and environments and to submit a satisfactory written report of his or her work. The report will include the requirement of a detail logbook recording tasks given and timelines set for achieving these. Self-evaluation of a student's personal level of knowledge and its applicability to the workplace is a major component of the reporting. Normally 12 weeks (60 days) of practical work experience is required, though the Faculty may accept alternatives that are judged as equivalent. Students are strongly encouraged to undertake their work experience in the break between Year 3 and 4 and definitely prior to commencing their final semester of study, however any engineering work taken after completing 28 credit points of 3rd year units of study may be accepted for the requirements of this unit. The University Careers and Appointments Service is available to assist students to obtain suitable employment. This unit of study is a core unit of study in all BE programs and must be passed in order to graduate from those programs.

BDES3025
Architectural Professional Practice

Credit points: 6 **Teacher/Coordinator:** Suzanah Potts **Session:** Semester 2 **Classes:** Lecture and tutorial contact, plus self-directed preparation and assignments, for a minimum total student commitment averaging 9 hours per week. **Assessment:** Reports (20%), Assignment (80%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Architectural Professional Practice introduces students in the final semester of their undergraduate degree to the professional practice of architecture, focusing on design development within regulatory and practice management frameworks. Students are introduced to the fundamental principles of key regulatory requirements and critically deploy their understandings by investigating local practice case studies. They further develop a capacity to apply their knowledge in a particular context through an architectural design project that they take to Development Application level using current best practice.

Students must select 12cp from the following block of units.

Students must enrol in 12 credit points of Thesis units.

CIVL4022
Honours Thesis A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Research 10 hrs/week; Meeting, **Prerequisites:** 30 credits of 3rd year units of study and HWAM 65 or over. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: It is expected that the Thesis will be conducted over two consecutive semesters and that the majority of students will start in Semester 1. Commencement in Semester 2 requires permission of Thesis coordinator and School`s Director of Learning & Teaching and will only be allowed where there are good reasons for doing so. Students considering this option should discuss it with the Thesis coordinator at least one semester before they intend to start.

Honours Thesis provides an opportunity for students to conduct original research. Students will generally work in groups, although planning and writing of the thesis will be done individually; i.e., a separate thesis must be submitted by each student. Only in exceptional circumstances and by approval of Thesis course coordinator and the relevant academic supervisor concerned will a student be permitted to undertake a project individually.

Honours Thesis is a major task and is to be conducted with work spread over most of the year, in two successive Units of Study of 6 credits points each, Honours Thesis A (CIVL4022) and Honours Thesis B (CIVL4023). This particular unit of study, which must precede CIVL4023 Honours Thesis B, should cover the first half of the work required for a complete "final year" thesis project. In particular, it should include almost all planning of a research or investigation project, a major proportion of the necessary literature review (unless the entire project is based on a literature review and critical analysis), and a significant proportion of the investigative work required of the project.

CIVL4023
Honours Thesis B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research 10 hrs/week; Meeting, **Prerequisites:** 30 credit points of 3rd year units of study **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment.

Honours Thesis provides an opportunity for students to conduct original research. Students will generally work in groups, although planning and writing of the thesis will be done individually; i.e., a separate thesis must be submitted by each student. Only in exceptional circumstances and by approval of Thesis course coordinator and the relevant academic supervisor concerned will a student be permitted to undertake a project individually.

Honours Thesis is a major task and is to be conducted with work spread over most of the year, in two successive Units of Study of 6 credits points each, Honours Thesis A (CIVL4022) and Honours Thesis B (CIVL4023). This particular unit of study, which must be preceded by or be conducted concurrently with CIVL4022 Honours Thesis A, should cover the second half of the work required for a complete "final year" thesis project. In particular, it should include completion of all components of the research or investigation project planned but not undertaken or completed in CIVL4022 Honours Thesis A.

Resolutions of the Faculty of Engineering and Information Technology relating to the combined Bachelor of Engineering Honours (Civil)/Design in Architecture program.

1. Candidates for the degrees of Bachelor of Engineering Honours (Civil) and Bachelor of Design in Architecture must complete all the core units of the study as listed in the above table and complete a minimum of 240 credit points.2. Most Mathematics, Chemistry, Physics and Computer Science units of study offered by the Faculty of Science can be replaced by an equivalent advanced level units of study subject to prerequisite conditions (as required by the Faculty of Science) being met.3. Students considering doing Advanced Engineering options should seek advice from the relevant school advisor before enrolling. For a standard enrolment plan for Civil Engineering combined with Design in Architecture visit http://cusp.sydney.edu.au/engineering

Bachelor of Project Engineering and Management (Civil)

Course Overview

This combined degree provides students with the opportunity to develop both the technical expertise required in the engineering stream of their choice and the project management expertise to manage large projects. Many of the Bachelor of Engineering specialisations can be combined with the Bachelor of Project Management. Core project management subjects include project finance, project management, complex project coordination, analytics, statistics, risk management, organisational behaviour and psychology.

Developed in response to increasing industry demand, the Bachelor of Project Management is the world's first specialised undergraduate project management degree. Based on a complex systems approach, it uses multidisciplinary theories and methods to investigate a particular phenomenon from a holistic viewpoint. Combined degree graduates will be uniquely qualified and highly sought after as professional engineers with the additional ability to manage large-scale complex engineering projects.

Please note that the Bachelor of Project Engineering and Management is no longer offered to new students. The information about this degree provided in this handbook is for continuing students only.

Course Requirements

To meet requirements for the Bachelor of Engineering and Project Management, a candidate must successfully complete 240 credit points, comprising:

1. the core units of study as set out in the Bachelor of Project Management unit of study table;
2. the units of study specified for the relevant stream of Engineering and
3. any additional elective units of study as may be necessary to gain credit to complete the requirements of the degree.

Please note that no new enrolments are offered for the Bachelor of Project Engineering and Management. This program has been replaced by the Bachelor of Project Management, which can be taken as a single degree or in combination with any stream of Engineering.

For a standard enrolment plan for Project Engineering and Management (Civil) visit cusp.sydney.edu.au/students/view-degree-page/name/BE(PEM)

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Bachelor of Project Engineering and Management (Civil)			
Note: This program has been replaced by Bachelor of Project Management which can be taken as a single degree or combined with any stream of Engineering			
Candidates for the degree of Bachelor of Engineering in Project Engineering and Management (Civil) are required to gain credit points for the core units of study set out below. Any additional credit necessary to satisfy the degree requirement of not less than 192 credit points shall be gained by completing additional elective units of study, as recommended by the School (as set out below).			
Core units of study			
First year			
MATH1001 **Differential Calculus**	3	**A** HSC Mathematics Extension 1 **N** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001	Semester 1 Summer Main
MATH1002 **Linear Algebra**	3	**A** HSC Mathematics or MATH1111 **N** MATH1902, MATH1012, MATH1014	Semester 1 Summer Main
MATH1003 **Integral Calculus and Modelling**	3	**A** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **N** MATH1013, MATH1903, MATH1907	Semester 2 Summer Main
MATH1005 **Statistics**	3	**A** HSC Mathematics **N** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021	Semester 2 Summer Main Winter Main
ENGG1800 **Engineering Disciplines (Intro) Stream A**	6		Semester 1
ENGG1802 **Engineering Mechanics**	6		Semester 2 Summer Main
ENGG1803 **Professional Engineering 1**	6	**N** ENGG1061	Semester 1 Semester 2
PHYS1001 **Physics 1 (Regular)**	6	**A** HSC Physics **P** HSC Physics with a minimum mark of 65 **N** PHYS1002, EDUH1017, PHYS1901	Semester 1
Second year			
MATH2061 **Linear Mathematics and Vector Calculus**	6	**P** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **N** MATH2961, MATH2067, MATH2901, MATH2902, MATH2001, MATH2002	Semester 1 Summer Main
CIVL2201 **Structural Mechanics**	6	**A** From ENGG1802 Engineering Mechanics, students should be competent in the following areas. 1. The concept of force and momentum equilibrium in two and three dimensions. 2. Drawing free body diagrams. 3. Establishing and solving the equations of equilibrium from the FBD. 4. Setting out solutions logically, clearly and neatly. Students should be competent incertain mathematical skills. 1. Solving algebraic equations. 2. Differentiation and integration (including double integrals). 3. Drawing graphs of polynomials (especially) and other mathematical function. 4. Trigonometry. **P** ENGG1802 **N** AMME2301	Semester 1
CIVL2810 **Engineering Construction and Surveying**	6	**A** MATH1001, MATH1002, MATH1003, MATH1005 *In recent years - the course has included a 1.5 day camp at Webbs Creek (about 80km from Sydney). The camp is located in a bushland setting. It aims to provide valuable practice in practical field survey and has a secondary aim of providing a basis for social gathering (this aspect being requested in student feedback over recent years)*	Semester 1
CIVL2230 **Intro to Structural Concepts and Design**	6	**A** CIVL2110 AND CIVL2201 AND ENGG1802. Structural mechanics, first year mathematics, but these are not prerequisites *Basic structural elements include beams, columns slabs and simple frames.*	Semester 2
CIVL2410 **Soil Mechanics**	6	**A** Knowledge: CIVL2201 AND GEOL1501. An understanding of simple statics, equilibrium, forces and bending moments, and of stress and strain and the relationship between them. This is covered by University of Sydney courses ENGG 1802 Engineering Mechanics, CIVL2201 Structural Mechanics. Familiarity with the use of spreadsheets (Excel, Mathcad) to obtain solutions to engineering problems, and with the graphical presentation of this data. Familiarity with word processing packages for report presentation. Some of this is covered in the University of Sydney course ENGG1801 Engineering Computing. Familiarity with partial differential equations, and their analytical and numerical solution.	Semester 2
CIVL2611 **Introductory Fluid Mechanics**	6	**A** CIVL2201 AND ENGG1802 AND MATH1001. Students are expected to have a strong understanding of fundamental physics, statics, equilibrium, forces, and dimensional analysis. Familiarity with simple calculus, partial differential equations, and the analytical and numerical solutions.	Semester 2
CIVL3805 **Project Scope, Time and Cost Management**	6	**A** CIVL2810 **N** QBUS2350, ENGG1850	Semester 2
ENGG1801 **Engineering Computing**	6		Semester 1 Summer Late

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
Third year			
CIVL3010 **Sustainable Systems Engineering**	6	**A** ENGG1803	Semester 1
CIVL2110 **Materials**	6		Semester 1
CIVL3812 **Project Appraisal**	6	**A** MATH1005 **N** ENGG2850	Semester 1
CIVL3813 **Contracts Formulation and Management**	6	**A** CIVL3805. Students are expected to have grasped the concepts of basic legal and management principles and the understanding of construction and engineering terminologies. As there is no any prerequisite courses for this UoS, without prior knowledge student can perform exceptionally well with regular attendance and participation in course activities. *?For students in the BE Civil degree (or combined degrees with BE Civil) this unit is a 4th year elective. Please take careful note: It DOES NOT count as a third year elective. ?For students in the BE Project Engineering and Management (Civil) degree this is a 3rd year core unit.*	Semester 2
CIVL4810 **Mgmnt of People, Quality and Risk in PE**	6	**A** CIVL3805. Students are expected to have understood and applied basic tools for project scope, cost and time management for projects as taught in (CIVL3805)or equivalent courses.	Semester 2
Fourth year			
CIVL4811 **Engineering Design and Construction**	6	**A** CIVL2810 *This unit aims to prepare students for employment in a broad range of engineering areas including design, planning and construction management.*	Semester 1
CIVL4814 **Project Procurement and Tendering**	6	**A** CIVL3805	Semester 2
CIVL4815 **Project Formulation**	6	**P** CIVL3805, CIVL3812	Semester 1
ENGG4000 **Practical Experience**		**P** 36 Credit Points of Senior Units *Students should have completed three years of their BE program before enrolling in this unit.*	Semester 1 Semester 2
Students must select 12cp from the following block of units. Students enrol in either Honours Thesis A&B or Engineering Project A&B. For enrolment in Honours an ISWAM of 65% or greater is required.			
CIVL4022 **Honours Thesis A**	6	**P** 30 credits of 3rd year units of study and HWAM 65 or over. *Note: Department permission required for enrolment* *It is expected that the Thesis will be conducted over two consecutive semesters and that the majority of students will start in Semester 1. Commencement in Semester 2 requires permission of Thesis coordinator and School`s Director of Learning & Teaching and will only be allowed where there are good reasons for doing so. Students considering this option should discuss it with the Thesis coordinator at least one semester before they intend to start.*	Semester 1 Semester 2
CIVL4023 **Honours Thesis B**	6	**P** 30 credit points of 3rd year units of study *Note: Department permission required for enrolment*	Semester 1 Semester 2
CIVL4024 **Engineering Project A**	6	**P** 30 credit points of 3rd year units of study *Note: Department permission required for enrolment* *It is expected that the project will be conducted over two consecutive semesters and that the majority of students will start in Semester 1. Commencement in Semester 2 requires permission of Engineering Project course coordinator and School's Director of Learning & Teaching and will only be allowed where there are good reasons for doing so. Students considering this option should discuss it with the Engineering Project course coordinator at least one semester before they intend to start.*	Semester 1 Semester 2
CIVL4025 **Engineering Project B**	6	**P** 30 credits of 3rd year units of study *Note: Department permission required for enrolment*	Semester 1 Semester 2

Notes.

1. Students in the Honours program must enrol in CIVL4022 & CIVL4023, students in the Pass Program must enrol in CIVL4024 & CIVL4025.

2. With special permission from the Director of the Learning and Teaching, Civil Engineering, it is possible to take Honours Thesis A or Engineering Project A in Semester 2 and Honours Thesis B or Engineering Project B in Semester 1.

3. For core units of study offered by other than the Faculty of Engineering and Information Technologies, any assumed knowledge, prerequisite and corequisite requirements will be as prescribed by the faculty.

4. Candidates for the degree of Bachelor of Engineering in Project Engineering and Management (Civil) are expected to complete all the core units of study (156 credit points). They are also required to gain at least 24 credit points from the third and fourth year table of electives listed below. The remaining 12 credit points required for the degree can be obtained from the list of electives below or from other units of study offered by the University of Sydney subject to approval by the Director of the Learning and Teaching of Civil Engineering.

5. Candidates commencing a combined degree program that is a Bachelor of Engineering in Project Engineering and Management (Civil) with Bachelor of Commerce are required to complete all of the core units of study in the above specialisation requirements except for ACCT1003, ACCT1004, which are not required, therefore only 144 credit points are needed. This total of 144 credit points is only sufficient to be awarded a Bachelor of Engineering in Project Engineering and Management (Civil) as part of an approved combined degree program. The remaining 96 credit points for the combined degree will be taken in the Faculty of Economics and Business. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies and the Business School.

6. Candidates commencing a combined degree program that is a Bachelor of Engineering in Project Engineering and Management (Civil) with Bachelor of Arts, Bachelor of Science, or Bachelor of Medical Science are required to complete all of the core units of study in the above specialisation requirements. This remaining 84 credit points should be taken from the relevant faculty unit of study subject to the Joint Resolutions of the Faculty of Engineering and Information Technologies and the relevant faculty.

7. Candidates commencing a combined degree program that is a Bachelor of Engineering in Project Engineering and Management (Civil) with Bachelor of Laws are required to complete all of the core units of study in the above specialisation requirements except CIVL3010 and CIVL3813. The remaining 144 credit points for the combined degree will be taken in the Faculty of Laws. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies the Faculty of Laws.

8. Most Mathematics, Chemistry, Physics and Computer Science units of study offered by the Faculty of Science can be replaced by equivalent advanced level units of study subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing advanced options should seek advice from the relevant department before enrolling.

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Recommended elective units of study			
Third year			
CIVL3205 **Concrete Structures 1**	6	**A** CIVL2110 AND CIVL2201 AND CIVL2230. Basic concepts of solid mechanics and structural mechanics, including: compatability of strains; stress-strain relationships; equilibrium; flexure, shear and torsion; statically determinate load effects (reactions, bending moments, shear forces); elastic beam theory (strains, stresses and beam deflections).	Semester 1
CIVL3612 **Fluid Mechanics**	6	**A** CIVL2201 AND CIVL2611 AND ENGG1802 AND MATH2061. This unit of study follows on from Fluid Mechanics CIVL2611, which provides the essential fundamental fluid mechanics background and theory, and is assumed to be known and fully understood.	Semester 1
CIVL3206 **Steel Structures 1**	6	**A** CIVL2110 AND CIVL2201 AND CIVL2230 AND CIVL3235 *It is assumed that students are competent in the following areas: the methods of load transfer in structures - tension, compression, bending, shear, torsion, and bearing; an appreciation of stress and strain, and being able to determine stresses and strains in simple sections under axial force, bending moments, shear and torsion; calculating and understanding the physical significance of geometric section properties - centroid, Ix, Iy, Zx, Zy, Sx, Sy, rx, ry, J, Ag; knowledge of the basic elastic-plastic material properties of steel, E, G, fy, fu; and knowledge of loading of structures. A special "assumed knowledge" lecture will be given in Week 1 to refresh the knowledge of students.*	Semester 2
CIVL3235 **Structural Analysis**	6	**A** CIVL2110, CIVL2230 and MATH2061	Semester 2
CIVL3411 **Geotechnical Engineering**	6	**A** CIVL2410	Semester 2
CIVL2511 **Research Techniques**	6	**A** CIVL2201 AND ENGG1802. Basic understanding of Maths, Physics and Chemistry appropriate to student in 2nd year of study. Concepts of Force, Moment, Torque, Stress, Strain, Displacement, Velocity and Acceleration. These are covered in a range of courses but particularly CIVL2201 Structural Mechanics and ENGG1802 Engineering Mechanics	Semester 2
Fourth year			
CIVL4903 **Civil Engineering Design**	6	**A** CIVL2410, CIVL3612, CIVL4811 **P** CIVL3205 and CIVL3206	Semester 2
CIVL5266 **Steel Structures - Stability**	6	**A** There are no prerequisites for this unit of study but it is assumed that students are competent in the content covered in Structural Mechanics, Steel Structures, and Structural Analysis.	Semester 1
CIVL5269 **Concrete Structures - Strength & Service**	6	**P** CIVL3205 OR CIVL5507 OR CIVL9205	Semester 2
CIVL5351 **Geoenvironmental Engineering**	6		Semester 1
CIVL5458 **Numerical Methods in Civil Engineering**	6		Semester 1

Notes

1. Choice of electives as shown in the above table will depend upon subject availability, timetabling and prerequisite conditions.

3. At least one of CIVL3205 and CIVL3612 must be taken.

Exchange units of study

CIVL0011, CIVL0012, CIVL0013, CIVL0014, CIVL0015, CIVL0016, CIVL0017 AND CIVL0018 are available for exchange study programs.

For a standard enrolment plan for Project Engineering and Management (Civil) visit cusp.sydney.edu.au/students/view-degree-page/name/BE(PEM)

Unit of Study Descriptions

Bachelor of Project Engineering and Management (Civil)

Note: This program has been replaced by Bachelor of Project Management which can be taken as a single degree or combined with any stream of EngineeringCandidates for the degree of Bachelor of Engineering in Project Engineering and Management (Civil) are required to gain credit points for the core units of study set out below. Any additional credit necessary to satisfy the degree requirement of not less than 192 credit points shall be gained by completing additional elective units of study, as recommended by the School (as set out below).

Core units of study

First year

MATH1001
Differential Calculus

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001 **Assumed knowledge:** HSC Mathematics Extension 1 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1001 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study looks at complex numbers, functions of a single variable, limits and continuity, vector functions and functions of two variables. Differential calculus is extended to functions of two variables. Taylor's theorem as a higher order mean value theorem.

Textbooks
As set out in the Junior Mathematics Handbook.

MATH1002
Linear Algebra

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1902, MATH1012, MATH1014 **Assumed knowledge:** HSC Mathematics or MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1002 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study introduces vectors and vector algebra, linear algebra including solutions of linear systems, matrices, determinants, eigenvalues and eigenvectors.

Textbooks
As set out in the Junior Mathematics Handbook

MATH1003
Integral Calculus and Modelling

Credit points: 3 **Session:** Semester 2, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1013, MATH1903, MATH1907 **Assumed knowledge:** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1003 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.This unit of study first develops the idea of the definite integral from Riemann sums, leading to the Fundamental Theorem of Calculus. Various techniques of integration are considered, such as integration by parts.The second part is an introduction to the use of first and second order differential equations to model a variety of scientific phenomena.

Textbooks
As set out in the Junior Mathematics Handbook

MATH1005
Statistics

Credit points: 3 **Session:** Semester 2, Summer Main, Winter Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021 **Assumed knowledge:** HSC Mathematics **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1005 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit offers a comprehensive introduction to data analysis, probability, sampling, and inference including t-tests, confidence intervals and chi-squared goodness of fit tests.

Textbooks
As set out in the Junior Mathematics Handbook

ENGG1800
Engineering Disciplines (Intro) Stream A

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 1 hr/week; Laboratory 3 hrs/week. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces students to specialisations in the Engineering discipline areas of Aeronautical, Biomedical Chemical, Civil, Mechanical and Mechatronic Engineering, and Project Engineering and Management. By providing first-year students with an experience of these various engineering streams, the unit aims to develop the students' professional identity as an engineer and thus provide a suitable basis on which students can choose their discipline for further study.

Introductory sessions in the School of Aerospace,

Mechanical and Mechatronic Engineering

-4 weeks-

An overview of the degree requirements in each stream. The roles of the engineer in each stream (employments, skills, etc). How each of the subjects taught relate to the skills/knowledge and applications required of the engineers. Basically make sure students fully understand what engineers are in the discipline areas and why the students do the subjects they do. In each stream, one engineering technical topic will be taught as a problem solving exercise, and this topic will be the focus of the laboratory.

School of Civil Engineering

-4 weeks-

Introductory lectures in Engineering Economics and Construction Planning, Foundation Engineering, Structural Engineering, Materials, Environmental Engineering. Each student will be involved in the erection and dismantling of an 8 metre high steel and timber tower in the Civil Engineering Courtyard. Preliminary lectures related to the tower will include safety issues, loading, statical analysis, foundation calculations, construction management, engineering drawings and detailing, geometric calculations, and survey measurements. Exercises related to these issues will be performed before assembly and disassembly of the tower.

School of Chemical and Biomolecular Engineering

-4 weeks-

This course will enable students to gain an appreciation of: the methods and materials of construction of items of process equipment; the role of this equipment in building an entire chemical processing plant: its operation and maintenance and safety requirements and procedures. Students will dismantle, disassemble and operate items of process equipment. They will present written answers to questions, supplemented by drawings of process flowsheets, diagrams of dismantled equipment, and discussions of heat and mass balances and of process parameters.

ENGG1802
Engineering Mechanics

Credit points: 6 **Session:** Semester 2, Summer Main **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit aims to provide students with an understanding of and competence in solving statics and introductory dynamics problems in engineering. Tutorial sessions will help students to improve their group work and problem solving skills, and gain competency in extracting a simplified version of a problem from a complex situation. Emphasis is placed on the ability to work in 3D as well as 2D, including the 2D and 3D visualization of structures and structural components, and the vectorial 2D and 3D representations of spatial points, forces and moments. Introduction to kinematics and dynamics topics includes position, velocity and acceleration of a point; relative motion, force and acceleration, momentum, collisions and energy methods.

ENGG1803
Professional Engineering 1

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prohibitions:** ENGG1061 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Professional Engineering 1 is an introductory Unit of Study within the Faculty of Engineering. The semester 1 course is aimed at students from the School of Aerospace, Mechanical and Mechatronic Engineering. It seeks to introduce newly admitted undergraduates to general principles of professional engineering practice, a range of contemporary professional engineering issues, plus outline skills related to academic study within an engineering environment. The subject is structured around a team based design and build project, in which students apply the professional engineering concepts they are learning to an engineering project. Professional engineering topics to be covered include: accessing information, teamwork, creativity, leadership, written and oral communication, project management, problem solving, ethics, liability, work health and safety and environmental issues.

PHYS1001
Physics 1 (Regular)

Credit points: 6 **Session:** Semester 1 **Classes:** Three 1-hour lectures, one 3-hour laboratory per week for 9 weeks and one 1-hour tutorial per week. **Prerequisites:** HSC Physics with a minimum mark of 65 **Prohibitions:** PHYS1002, EDUH1017, PHYS1901 **Assumed knowledge:** HSC Physics **Assessment:** 3 hour exam plus laboratories, assignments and mid-semester tests (100%). **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for students who gained 65 marks or better in HSC Physics or equivalent. The lecture series contains three modules on the topics of mechanics, thermal physics, and oscillations and waves.

Textbooks

Young & Freedman. University Physics. 13th edition, with Mastering Physics, Addison-Wesley. 2012. Course lab manual.

Second year

MATH2061
Linear Mathematics and Vector Calculus

Credit points: 6 **Session:** Semester 1, Summer Main **Classes:** Three 1 hour lectures, one 1 hour tutorial and one 1 hour practice class per week. **Prerequisites:** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **Prohibitions:** MATH2961, MATH2067, MATH2901, MATH2902, MATH2001, MATH2002 **Assessment:** One 2 hour exam, assignments, quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit starts with an investigation of linearity: linear functions, general principles relating to the solution sets of homogeneous and inhomogeneous linear equations (including differential equations), linear independence and the dimension of a linear space. The study of eigenvalues and eigenvectors, begun in junior level linear algebra, is extended and developed. The unit then moves on to topics from vector calculus, including vector-valued functions (parametrised curves and surfaces; vector fields; div, grad and curl; gradient fields and potential functions), line integrals (arc length; work; path-independent integrals and conservative fields; flux across a curve), iterated integrals (double and triple integrals; polar, cylindrical and spherical coordinates; areas, volumes and mass; Green's Theorem), flux integrals (flow through a surface; flux integrals through a surface defined by a function of two variables, though cylinders, spheres and parametrised surfaces), Gauss' Divergence Theorem and Stokes' Theorem.

CIVL2201
Structural Mechanics

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** ENGG1802 **Prohibitions:** AMME2301 **Assumed knowledge:** From ENGG1802 Engineering Mechanics, students should be competent in the following areas. 1. The concept of force and momentum equilibrium in two and three dimensions. 2. Drawing free body diagrams. 3. Establishing and solving the equations of equilibrium from the FBD. 4. Setting out solutions logically, clearly and neatly. Students should be competent incertain mathematical skills. 1. Solving algebraic equations. 2. Differentiation and integration (including double integrals). 3. Drawing graphs of polynomials (especially) and other mathematical function. 4. Trigonometry. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The primary objective of this unit is to understand internal actions (forces and moments) in structures (deformable objects) under loads in three key areas: how structures resist external loads by internal actions; the distribution of internal actions within structures; and the deformations, stresses and strains associated with the internal actions. At the end of this unit, students should be able to understand the basic methods of load transfer in structures - tension, compression, bending, shear and torsion (internal actions); apply the equations of equilibrium to determine the distribution of internal actions in a simple structure by drawing BMDs, SFDs, AFDs, and TMDs; understand the significance and methods of calculation of the geometric properties of structural sections (I, Z, S, J etc); understand the effect of internal forces and deformations of bodies through the concept and calculation of strains and stresses; appreciate the behaviour of structures by analysing structures without numerical calculations; display a knowledge of basic material properties, combined stresses and failure criteria; and demonstrate their hands-on experience of the behaviour of structural members via experiments and the ability to prepare written reports on those experiments. Emphasis in the assessment scheme will be placed on understanding structural behaviour and solving problems, rather than remembering formulae or performing complex calculations. The course seeks to utilise and improve the generic skills of students, in areas such as problem solving, neat and logical setting out of solutions, report writing, and team work. The syllabus comprises introduction; equilibrium; internal actions: BMDs, SFDs, AFDs, and TMDs; elasticity, stress and strain, and basic material properties; axial forces: tension and compression; elastic bending of beams; shear force and shear stresses in beams; torsion; deflection of beams; pipes and pressure vessels; trusses; material properties, combined stresses and yield criteria; advanced bending; introduction to buckling and instability.

CIVL2810
Engineering Construction and Surveying

Credit points: 6 **Session:** Semester 1 **Classes:** Tutorial 2 hrs/week; Workgroup 3 hrs/week; Lecture 3 hrs/week. **Assumed knowledge:** MATH1001, MATH1002, MATH1003, MATH1005 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: In recent years - the course has included a 1.5 day camp at Webbs Creek (about 80km from Sydney). The camp is located in a bushland setting. It aims to provide valuable practice in practical field survey and has a secondary aim of providing a basis for social gathering (this aspect being requested in student feedback over recent years)

The objectives of this unit are to gain an understanding of the fundamentals of engineering construction including

- design, control, management, measurement and construction methods for excavation, embankments and other earthworks, hauling and associated operations.

- building construction fundamentals, including reinforced concrete, masonry, steel and timber.

- drilling and blasting

Engineering Survey topics aim (a) to provide basic analogue methods of distance, angle and height measurement and (b) to provide an understanding of three dimensional mapping using basic total station electronic field equipment with associated data capture ability and (c) to give an insight into future trends in the use of GPS and GIS systems.

At the end of this unit, students should develop basic competency in earthwork engineering and economic optimisation of related construction, including proposing and analysing systems and methods, estimation of probable output, unit cost and productivity evaluation. Students should have a basic knowledge of vertical construction in reinforced concrete, masonry, steel and timber. Students should also develop proficiency in the design and implementation of mapping systems in Civil Engineering, using analogue and electronic field equipment and associated software packages.

The syllabus comprises introduction to the framework under which construction projects are formulated and analysed; construction engineering fundamentals; construction systems related to excavation, hauling and embankment construction, including selection and evaluation of plant and methods as well as the expected output and cost; introduction to construction operations management. Introduction to engineering surveying, distance measurement, angle measurement, levelling, traversing, topographic surveys, electronic surveying equipment, future surveying technologies.

CIVL2230
Intro to Structural Concepts and Design

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1.5 hrs/week. **Assumed knowledge:** CIVL2110 AND CIVL2201 AND ENGG1802. Structural mechanics, first year mathematics, but these are not prerequisites **Assessment:** Through semester assessment (25%) Final Exam (75%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Basic structural elements include beams, columns slabs and simple frames.

The primary objective is to develop an understanding of design concepts and an introduction to the design of steel, concrete and composite structures. This involves calculation of loads on structures caused by gravity, wind and earthquake; and analysis and design of basic structural elements.

CIVL2410
Soil Mechanics

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 1 hr/week; Laboratory 2 hrs/week. **Assumed knowledge:** Knowledge: CIVL2201 AND GEOL1501. An understanding of simple statics, equilibrium, forces and bending moments, and of stress and strain and the relationship between them. This is covered by University of Sydney courses ENGG 1802 Engineering Mechanics, CIVL2201 Structural Mechanics. Familiarity with the use of spreadsheets (Excel, Mathcad) to obtain solutions to engineering problems, and with the graphical presentation of this data. Familiarity with word processing packages for report presentation. Some of this is covered in the University of Sydney course ENGG1801 Engineering Computing. Familiarity with partial differential equations, and their analytical and numerical solution. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course provides an elementary introduction to Geotechnical Engineering, and provides the basic mechanics necessary for the detailed study of Geotechnical Engineering. This course aims to provide an understanding of: the nature of soils as engineering materials; common soil classification schemes; the importance of water in the soil and the effects of water movement; methods of predicting soil settlements, the stress-strain-strength response of soils, and earth pressures.

CIVL2611
Introductory Fluid Mechanics

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 1 hr/week. **Assumed knowledge:** CIVL2201 AND ENGG1802 AND MATH1001. Students are expected to have a strong understanding of fundamental physics, statics, equilibrium, forces, and dimensional analysis. Familiarity with simple calculus, partial differential equations, and the analytical and numerical solutions. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The objective of this unit of study is to develop an understanding of basic fluid concepts for inviscid and incompressible fluids. Topics to be covered will include: basic fluid properties, hydrostatics, buoyancy, stability, pressure distribution in a fluid with rigid body motion, fluid dynamics, conservation of mass and momentum, dimensional analysis, open channel flow, and pipe flow.

This core unit of study together with CIVL3612 forms the basis for further studies in the applied areas of ocean, coastal and wind engineering and other elective fluid mechanics units which may be offered.

CIVL3805
Project Scope, Time and Cost Management

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Independent study and assessment work 3 hrs/week. **Prohibitions:** QBUS2350, ENGG1850 **Assumed knowledge:** CIVL2810 **Assessment:** Through semester assessment (65%) Final Exam (35%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is a core course for the Bachelor of Project Engineering & Management (Civil) and an elective for Civil Engineering degree and other branches of engineering and faculties. The general aim of this unit of study is to offer the student the opportunity to develop an understanding of the scope, time and cost management in project environments. Students will engage with some of the key concepts and various activities which underpin project scope, time and cost management. At the end of this unit, students will be able to: develop Work Breakdown Structure (WBS), develop network diagrams, and undertake Critical Path Analysis (CPA) and Earned Value Analysis (EVA) using the given project information; explain in depth why scope, time and cost management are important to project management; analyse a project situation that involves scope, time and cost management issues; and explain how the components of scope, time and cost management interrelate in project environments. The syllabus comprises the project planning cycle, working with the project sponsor, scope initiation and definition, project scope definition tools, WBS, network scheduling techniques, CPA, Just-in-Time philosophy, estimating and budgeting, cash flow management, EVA and application of project management software.

ENGG1801
Engineering Computing

Credit points: 6 **Session:** Semester 1, Summer Late **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will introduce students to fundamental principles of programming. The language used will be Matlab but the principles taught are readily portable to other languages like C and Java. The unit material will be presented in a manner which will help students to draw a connection between programming constructs and real engineering applications. The unit will use engineering inspired case-studies : especially from Civil, Chemical, Aerospace and Mechanical streams, to motivate new material. There will be a major project which uses programming to solve a real world engineering problem. The extensive Matlab library for visualization will also be introduced. Matlab will cover two-thirds of the unit. The remaining one-third will be devoted to the use of Excel in engineering scenarios. Furthermore, cross integration between Matlab and Excel will also be highlighted.

Third year

CIVL3010
Sustainable Systems Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Project Work - own time 2 hrs/week. **Assumed knowledge:** ENGG1803 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Engineering graduates apply their technical skills in a wide variety of legal, institutional, and environmental settings, acting as agents and managers of technology-driven social change. Engineering decision-making and problem-solving are made more complex by technical, economic, environmental, social and ethical constraints. In particular, environmental sustainability has given rise to a new framework of engineering analysis that is now an essential part of the work of engineers. The goals of this unit are to introduce students to major problems of environmental deterioration, especially climate change and energy, and to concepts of sustainability within a system dynamics framework, and engage students in active reflection on the role of civil engineers in addressing these issues; to develop the students skills at quantifying the impact of engineering decisions within the broader economic, environmental and socio-cultural contexts; to develop communication skills through participation in group discussions, oral presentations, and written report writing. Lectures, group discussions, case problems and projects are all used in teaching and learning in this unit of study.

At the end of the unit, students will be able to:

a. identify and analyse important ecological, social and ethical issues deriving from technology-driven change, including new paradigms of environmental sustainability within system dynamics framework, especially in relation to long-range air pollution and energy.

b. write environmental impact statements for engineering projects and identify and analyse the impacts of infrastructure projects on the social and natural environments.

c. use design and analysis tools such as the Life-Cycle Analysis and the BASIX system to develop better engineering design solutions.

d. understand the influence of organizational, ethical and legal factors on engineering practice.

The secondary objectives of the UoS are:

a. to improve students team-work ability.

b. to improve students communication skills, through verbal and written media.

c. to improve students skills in research and use of library resources.

The syllabus comprises role(s) of civil engineers, historical development of profession, air pollution and climate change, energy; a system dynamics approach to sustainability; definitions and practice of sustainability; BASIX design system; environmental impact statements; life-cycle analyses; ethics in engineering.

CIVL2110
Materials

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Materials are an important part of the civil engineers' work. Indeed, civil engineers who are concerned with the design, construction, and maintenance of facilities need to understand the behaviour and performance of the materials used. And as it happens, mechanical properties - which are essential and basic for civil engineers - are highly dependent on the structure of materials at various scales. Therefore, it is important that a student in Civil Engineering possesses a fundamental knowledge in materials science.

This unit of study aims to provide students with the tools necessary to select the adequate material for a particular application and to assess its mechanical behaviour while in use. This course will focus mainly on materials for civil engineering and construction applications, i.e. metals, concrete and soils.

CIVL3812
Project Appraisal

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Online quizzes 2 hrs/week. **Prohibitions:** ENGG2850 **Assumed knowledge:** MATH1005 **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This UoS is a third-year core unit for students enrolled in any of the undergraduate streams in the School of Civil Engineering and elective for all other branches of engineering and other faculties. The objectives of this unit of study are to develop students' ability to critically analyse issues involved in project appraisal and to equip students with the concepts, tools and analytical processes to effectively carry out project appraisal tasks for businesses, non-profit organisations, and governments. At the end of this unit, students should be able to comprehend and relate to real-life examples the fundamental concepts in project appraisal (e.g. the meaning of time value for money, equivalence); calculate common financial indicators for a given project and explain the relevance of each to the appraisal of the project; rank projects by combining both financial and non-financial indicators (e.g. environmental and social); understand how risks and uncertainties affect evaluation outcomes and be able to deal with uncertainties and risks in analysis; apply techniques to account for the effects of inflation/deflation and exchange rates in analysis; understand the concept and mechanisms for depreciation and carry out pre-tax as well as post-tax analysis; understand the assumptions, pros and cons of each evaluation method and be able to explain why a particular method is appropriate/not appropriate for a given project. The syllabus comprises time value of money, cost of capital, simple/compound interest, nominal/effective interest, cost/benefit analysis of projects; equivalence, net present worth (value), future worth (value), annual worth (value), internal rate of return, external rate of return, payback period, cost-benefit analysis, cost-utility analysis, identifying and quantifying non-financial benefits/externalities, price changes and exchange rates, techniques for multi-criteria group decision-making, economic analysis of business investment projects, depreciation, capitalisation and valuation studies, replacement of assets, real option, project risk analysis, decision-tree analysis, binomial method, WACC, MARR, equity capital, debt.

CIVL3813
Contracts Formulation and Management

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** CIVL3805. Students are expected to have grasped the concepts of basic legal and management principles and the understanding of construction and engineering terminologies. As there is no any prerequisite courses for this UoS, without prior knowledge student can perform exceptionally well with regular attendance and participation in course activities. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: ?For students in the BE Civil degree (or combined degrees with BE Civil) this unit is a 4th year elective. Please take careful note: It DOES NOT count as a third year elective. ?For students in the BE Project Engineering and Management (Civil) degree this is a 3rd year core unit.

The objectives of this unit are to give students a fundamental knowledge of the legal system and contract terms under which projects are generally conducted. Initially, emphasis will be on contract negotiations and understanding what negotiation is about and how to prepare for negotiations and also how to manage the negotiation so that a suitable outcome for both parties may be achieved. Also being able to deal with difficult opponents will be something that will be considered.

Emphasis will be on the principles of contract formulation, administration and finalisation, including prevention and/or settlement of disputes in projects. The syllabus comprises brief overview of the legal system in Australia and comparison with other legal systems introduction to project delivery systems and the running of a typical project, introduction to contract law and the formation of contracts, the principles of standard form contracts as well as bespoke drafting, an understanding of the risks undertaken by the different contracting parties, a detailed review of a standard contract promoting an understanding of major project issues such as time, variations and payment; implementation and administration; potential liabilities associated with project participation; contract conditions and specifications; understanding insurances and alternate dispute resolution procedures; notification requirements including time bar, understanding the commercial significance of issues such as latent conditions, subcontracting, bank guarantees and security of payment legislation.

CIVL4810
Mgmnt of People, Quality and Risk in PE

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Project Work - own time 4 hrs/week. **Assumed knowledge:** CIVL3805. Students are expected to have understood and applied basic tools for project scope, cost and time management for projects as taught in (CIVL3805)or equivalent courses. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is a fourth year core unit of study for the Bachelor of Project Engineering & Management. It is also an elective for other branches of engineering and faculties. The objective of this unit is to provide underpinning knowledge and skills in the application of tools to the project management environment for risk, quality and people management including leading and managing project teams. At the end of this unit, students will be able to understand and apply the tools of team building and project management leadership, as well as apply tools for design and implementation of integrated plans for risk, quality, human resource and procurement. The competency level achieved will enable application of integration tools to a range of simple generic projects as well as provide input to plans for more complex projects. The syllabus comprises team management, project leadership, modern quality management principles and techniques, quality assurance, preparation of quality plans; risk analysis, planning and risk management, as well as linking risk and quality management to human resourcing and procurement methodologies. The use of integrated planning software such as MS Project, Gantt Project and social media tools for project management will be explained and practised. The definitions and processes of Project Management will largely follow the US based Project Management Institutes, PMBOK as is used in the Australian Institution of Project Management Standards at the level of Certified Practising Project Manager,(CPPM). Other International standards such as ICPMA's, ICB3.0 standard will also be covered.

Fourth year

CIVL4811
Engineering Design and Construction

Credit points: 6 **Session:** Semester 1 **Classes:** Workshop 3 hrs/week; Project Work - own time 1 hr/week; Presentation 2 hrs/week. **Assumed knowledge:** CIVL2810 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This unit aims to prepare students for employment in a broad range of engineering areas including design, planning and construction management.

The objectives of this unit are to develop an understanding of construction methods, strategies, equipment and machinery in a range of construction activities and an understanding of the principles involved in the design for those construction activities.

At the end of this unit, students will have developed a familiarity with a variety of construction methods, strategies, equipment and machinery in a range of construction activities such that they will be able, if and when the opportunity arises to participate as site engineers (or similar role) in the planning and execution of those construction activities, albeit with supervision and guidance from experienced professionals. Students will also have developed an understanding of the design principles and techniques involved in the planning for those construction activities such that they are able, if and when the opportunity arises, to participate as design engineers, in the planning and design for those construction activities, with supervision and guidance from experienced professionals. The range of topics covered in this course is such that the learning outcomes form a basis for later development of more detailed knowledge, dependent on the future career experiences of the student. The course does not prepare a student for immediate, unsupervised participation in construction and design work associated with the topics covered.

The construction topics covered in this course have not been previously addressed in CIVL2810 (Engineering Construction and Survey). The topics may vary dependent on current and planned projects in Sydney, NSW and Australia. At this stage the topics are hard rock tunnelling and general hard rock underground excavation; soft ground tunnelling; underground construction; micro tunnelling; cut and cover (cover and cut) tunnelling; earth retaining systems; piling; formwork and falsework (incl Tilt up, Ultrafloor, Sacrificial form); dewatering; pavement design and construction - rigid and flexible (incl and pavement construction materials); stormwater drainage design and construction; marine construction; civil construction in environmentally sensitive areas; contract administration for construction engineers; general engineering in remote localities (project based); construction methods in bridge engineering; QA documentation on a typical project; insurance in the construction industry occupational health and safety issues in the construction industry; timber engineeering; post-tensioned/prestressed concrete construction; civil engineering in a marine environment.

On day 1 of the course, a form based survey is taken to invite students to nominate specific areas of interest which may lead to adjustment in course content.

CIVL4814
Project Procurement and Tendering

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** CIVL3805 **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is a fourth year core unit of study for the Bachelor of Project Engineering and Management (Civil), elective for all other branches of engineering and other faculties. The general aim of this unit is to offer student the opportunity to develop an understanding of the procurement of built facilities and the methods of job allocation in project environments. Students will be engaged in a real construction case study project where key practical concepts which underpin procurement will be taught. At the end of this unit of study, students should be able to: evaluate a client's procurement situation and apply an appropriate procurement route; explain how and why a particular procurement route is chosen; undertake procurement assessment exercises; analyze a contractor's strategic responses in tendering (bidding) decision-making; discuss why a particular bidding strategy is chosen in different contexts; and evaluate a contractor's bidding performance using competitor analysis techniques. The syllabus comprises fundamentals of building procurement, assessment of procurement risks, competitive bidding, cost estimating, the competitive environment in the construction industry, contractors' competitive positioning, contractors' decision-making in bidding competition, bidding strategies and competitor analysis.

CIVL4815
Project Formulation

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 4 hrs/week. **Prerequisites:** CIVL3805, CIVL3812 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is a fourth-year core unit for PEM students and an elective for all other branches of engineering and other faculties. The assumed knowledge for this Unit includes Project Appraisal (CIVL3812) and Project Scope, Time and Cost Management (CIVL3805). The objective of this unit is, through the integration of areas of project management knowledge learned in various PEM subjects, to develop students' ability to develop project proposals through carrying out a feasibility study and developing a project definition plan for a real-life engineering project. This unit is relevant for students who intend to pursue a career related to project management. At the end of this unit, students should have developed understanding of the fundamentals of project conceptualisation, appraisal and planning plus the abilities to: model and analyse basic financing and cash flow requirements; develop risk management plan, marketing and sales plan, stakeholder management and communication plan, operations plan; and design professional documentation and presentation to a board of review. In addition, this unit also develops students' abilities in problem solving, working with other students, conducting independent research, communication in team environment, information need identification and collection, and understanding social and environmental issues. The syllabus comprises feasibility study, project appraisal, risk assessment and management, sensitivity analysis, project planning, project integration management, carbon-trading scheme, global warming, environmental impact assessment, investment capital, venture capital, due diligence, project planning, operational planning, revenue projection, community consultation, communication management, stakeholder management, political environment.

ENGG4000
Practical Experience

Session: Semester 1, Semester 2 **Classes:** Practical Experience, **Prerequisites:** 36 Credit Points of Senior Units **Assessment:** Through semester assessment (100%) **Mode of delivery:** Professional practice

Note: Students should have completed three years of their BE program before enrolling in this unit.

The aim of this unit is to give students exposure to work in an engineering organisation and gain some professional experience; to enhance a student's abilities and experience in report writing; to encourage self-evaluation in the context of applying their theoretical knowledge to real industry practise. Students will gain a better appreciation of the role of engineers in the workplace. The assessment will enhance the student's ability to present structured observations and reflections in the mode of a formal written report.

Each student is required to gain exposure to professional engineering practice and environments and to submit a satisfactory written report of his or her work. The report will include the requirement of a detail logbook recording tasks given and timelines set for achieving these. Self-evaluation of a student's personal level of knowledge and its applicability to the workplace is a major component of the reporting. Normally 12 weeks (60 days) of practical work experience is required, though the Faculty may accept alternatives that are judged as equivalent. Students are strongly encouraged to undertake their work experience in the break between Year 3 and 4 and definitely prior to commencing their final semester of study, however any engineering work taken after completing 28 credit points of 3rd year units of study may be accepted for the requirements of this unit. The University Careers and Appointments Service is available to assist students to obtain suitable employment. This unit of study is a core unit of study in all BE programs and must be passed in order to graduate from those programs.

Students must select 12cp from the following block of units.

Students enrol in either Honours Thesis A&B or Engineering Project A&B. For enrolment in Honours an ISWAM of 65% or greater is required.

CIVL4022
Honours Thesis A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Research 10 hrs/week; Meeting, **Prerequisites:** 30 credits of 3rd year units of study and HWAM 65 or over. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: It is expected that the Thesis will be conducted over two consecutive semesters and that the majority of students will start in Semester 1. Commencement in Semester 2 requires permission of Thesis coordinator and School`s Director of Learning & Teaching and will only be allowed where there are good reasons for doing so. Students considering this option should discuss it with the Thesis coordinator at least one semester before they intend to start.

Honours Thesis provides an opportunity for students to conduct original research. Students will generally work in groups, although planning and writing of the thesis will be done individually; i.e., a separate thesis must be submitted by each student. Only in exceptional circumstances and by approval of Thesis course coordinator and the relevant academic supervisor concerned will a student be permitted to undertake a project individually.

Honours Thesis is a major task and is to be conducted with work spread over most of the year, in two successive Units of Study of 6 credits points each, Honours Thesis A (CIVL4022) and Honours Thesis B (CIVL4023). This particular unit of study, which must precede CIVL4023 Honours Thesis B, should cover the first half of the work required for a complete "final year" thesis project. In particular, it should include almost all planning of a research or investigation project, a major proportion of the necessary literature review (unless the entire project is based on a literature review and critical analysis), and a significant proportion of the investigative work required of the project.

CIVL4023
Honours Thesis B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research 10 hrs/week; Meeting, **Prerequisites:** 30 credit points of 3rd year units of study **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment.

Honours Thesis provides an opportunity for students to conduct original research. Students will generally work in groups, although planning and writing of the thesis will be done individually; i.e., a separate thesis must be submitted by each student. Only in exceptional circumstances and by approval of Thesis course coordinator and the relevant academic supervisor concerned will a student be permitted to undertake a project individually.

Honours Thesis is a major task and is to be conducted with work spread over most of the year, in two successive Units of Study of 6 credits points each, Honours Thesis A (CIVL4022) and Honours Thesis B (CIVL4023). This particular unit of study, which must be preceded by or be conducted concurrently with CIVL4022 Honours Thesis A, should cover the second half of the work required for a complete "final year" thesis project. In particular, it should include completion of all components of the research or investigation project planned but not undertaken or completed in CIVL4022 Honours Thesis A.

CIVL4024
Engineering Project A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Project Work - own time 10 hrs/week; Meeting, **Prerequisites:** 30 credit points of 3rd year units of study **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: It is expected that the project will be conducted over two consecutive semesters and that the majority of students will start in Semester 1. Commencement in Semester 2 requires permission of Engineering Project course coordinator and School's Director of Learning & Teaching and will only be allowed where there are good reasons for doing so. Students considering this option should discuss it with the Engineering Project course coordinator at least one semester before they intend to start.

Engineering Project A & B provide an opportunity for students to undertake a major project in a specialised area relevant to civil engineering. Students will generally work in groups, although planning and writing of reports will be done individually; i.e., a separate report must be submitted by each student. Only in exceptional circumstances and by approval of Engineering Project course coordinator and the relevant academic supervisor concerned will a student be permitted to undertake a project individually.

Engineering Project is spread over a whole year, in two successive Units of Study of 6 credits points each, Engineering Project A (CIVL4024) and Engineering Project B (CIVL4025). This particular unit of study, which must precede CIVL4025 Engineering Project B, should cover the first half of the work required for a complete 'final year' thesis project. In particular, it should include almost all project planning, a major proportion of the necessary background research, and a significant proportion of the investigative or design work required of the project.

CIVL4025
Engineering Project B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Meeting, Project Work - own time 10 hrs/week. **Prerequisites:** 30 credits of 3rd year units of study **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment.

Engineering Project A & B provide an opportunity for students to undertake a major project in a specialised area relevant to civil engineering. Students will generally work in groups, although planning and writing of reports will be done individually; i.e., a separate report must be submitted by each student. Only in exceptional circumstances and by approval of Engineering Project course coordinator and the relevant academic supervisor concerned will a student be permitted to undertake a project individually.

Engineering Project is spread over a whole year, in two successive Units of Study of 6 credits points each, Engineering Project A (CIVL4024) and Engineering Project B (CIVL4025). This particular unit of study, which must be preceded by or be conducted concurrently with CIVL4024 Engineering Project A, should cover the second half of the required project work. In particular, it should include completion of all components planned but not undertaken or completed in CIVL4024 Engineering Project A.

Notes.

1. Students in the Honours program must enrol in CIVL4022 & CIVL4023, students in the Pass Program must enrol in CIVL4024 & CIVL4025. 2. With special permission from the Director of the Learning and Teaching, Civil Engineering, it is possible to take Honours Thesis A or Engineering Project A in Semester 2 and Honours Thesis B or Engineering Project B in Semester 1. 3. For core units of study offered by other than the Faculty of Engineering and Information Technologies, any assumed knowledge, prerequisite and corequisite requirements will be as prescribed by the faculty.4. Candidates for the degree of Bachelor of Engineering in Project Engineering and Management (Civil) are expected to complete all the core units of study (156 credit points). They are also required to gain at least 24 credit points from the third and fourth year table of electives listed below. The remaining 12 credit points required for the degree can be obtained from the list of electives below or from other units of study offered by the University of Sydney subject to approval by the Director of the Learning and Teaching of Civil Engineering.5. Candidates commencing a combined degree program that is a Bachelor of Engineering in Project Engineering and Management (Civil) with Bachelor of Commerce are required to complete all of the core units of study in the above specialisation requirements except for ACCT1003, ACCT1004, which are not required, therefore only 144 credit points are needed. This total of 144 credit points is only sufficient to be awarded a Bachelor of Engineering in Project Engineering and Management (Civil) as part of an approved combined degree program. The remaining 96 credit points for the combined degree will be taken in the Faculty of Economics and Business. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies and the Business School.6. Candidates commencing a combined degree program that is a Bachelor of Engineering in Project Engineering and Management (Civil) with Bachelor of Arts, Bachelor of Science, or Bachelor of Medical Science are required to complete all of the core units of study in the above specialisation requirements. This remaining 84 credit points should be taken from the relevant faculty unit of study subject to the Joint Resolutions of the Faculty of Engineering and Information Technologies and the relevant faculty.7. Candidates commencing a combined degree program that is a Bachelor of Engineering in Project Engineering and Management (Civil) with Bachelor of Laws are required to complete all of the core units of study in the above specialisation requirements except CIVL3010 and CIVL3813. The remaining 144 credit points for the combined degree will be taken in the Faculty of Laws. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and Information Technologies the Faculty of Laws.8. Most Mathematics, Chemistry, Physics and Computer Science units of study offered by the Faculty of Science can be replaced by equivalent advanced level units of study subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing advanced options should seek advice from the relevant department before enrolling.

Recommended elective units of study

Third year

CIVL3205
Concrete Structures 1

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Project Work - in class 3 hrs/week; Laboratory 2 hrs/week. **Assumed knowledge:** CIVL2110 AND CIVL2201 AND CIVL2230. Basic concepts of solid mechanics and structural mechanics, including: compatability of strains; stress-strain relationships; equilibrium; flexure, shear and torsion; statically determinate load effects (reactions, bending moments, shear forces); elastic beam theory (strains, stresses and beam deflections). **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The objectives of this unit are to provide a basic understanding of the behaviour of reinforced concrete members and structures; to provide a basic understanding of standard methods of analysis and design of reinforced concrete structures (including an understanding of capabilities and limitations); and to provide basic design training in a simulated professional engineering environment. At the end of this unit students will gain proficiency in basic methods of reinforced concrete analysis and design.

The syllabus covers the behaviour of reinforced concrete members and structures, including: material properties, 'elastic' analysis (stresses/deformations/time-dependence), ultimate strength of beams (flexure), ultimate strength of columns (short and slender), behaviour or reinforced concrete slabs, the reinforced concrete truss analogy (shear/torsion/and detailing implications), the design of typical elements of a reinforced concrete building, structural modelling, analysis of load-effects (incl.earthquakes), design criteria (for durability, fire-resistance, serviceability and strength), design calculation procedures, reinforcement detailing and structural drawings.

CIVL3612
Fluid Mechanics

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 1.30 hrs/week. **Assumed knowledge:** CIVL2201 AND CIVL2611 AND ENGG1802 AND MATH2061. This unit of study follows on from Fluid Mechanics CIVL2611, which provides the essential fundamental fluid mechanics background and theory, and is assumed to be known and fully understood. **Assessment:** Through semester assessment (55%) Final Exam (45%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to provide an understanding of the conservation of mass and momentum in differential forms for viscous fluid flows. It provides the foundation for advanced study of turbulence, flow around immersed bodies, open channel flow, and turbo-machinery.

CIVL3206
Steel Structures 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 3 hrs/week; Laboratory 2 hrs/week. **Assumed knowledge:** CIVL2110 AND CIVL2201 AND CIVL2230 AND CIVL3235 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: It is assumed that students are competent in the following areas: the methods of load transfer in structures - tension, compression, bending, shear, torsion, and bearing; an appreciation of stress and strain, and being able to determine stresses and strains in simple sections under axial force, bending moments, shear and torsion; calculating and understanding the physical significance of geometric section properties - centroid, Ix, Iy, Zx, Zy, Sx, Sy, rx, ry, J, Ag; knowledge of the basic elastic-plastic material properties of steel, E, G, fy, fu; and knowledge of loading of structures. A special "assumed knowledge" lecture will be given in Week 1 to refresh the knowledge of students.

This unit of study is concerned with the behaviour and design of steel structures. Statics provided the fundamentals of equilibrium upon which most structural engineering is based. Structural Concepts and Structural Analysis provided information on the loads (actions) on a structure and how structures resist these actions with a resulting distribution of internal actions (bending moments, shear forces, axial forces; BMDs, SFDs and AFDs). Structural Mechanics considered how these internal actions resulted in stresses and strains in members. Materials considered the microscopic and molecular structure of metals to determine its inherent mechanical properties such as yield stress. This unit of study will then combine the knowledge of stresses, material properties of steel, structural analysis, and loading, and consider new concepts and modes of failure, such as local and flexural torsional buckling, combined actions and second-order effects to understand the behaviour of steel members and frames, and how this behaviour is accounted for in the design standard AS 4100.

Both the units of study "Steel Structures 1" and "Concrete Structures 1" can be considered the culmination of the various elements of structural engineering begun in "Engineering Mechanics" in first year, and is further developed in "Civil Engineering Design" in final year. More advanced topics, such as plate behaviour, advanced buckling and connection design, are considered in the final year elective subject "Steel Structures 2".

It is recognised that not all students intend to become consulting structural engineers. The unit of study is designed so that students who make an effort to understand the concepts are most capable of passing. Students who are planning a career in the consulting structural engineering profession should be aiming at achieving a Distinction grade or higher.

CIVL3235
Structural Analysis

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 4 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** CIVL2110, CIVL2230 and MATH2061 **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The objectives of this unit are to provide an understanding of the principles of structural analysis by introducing the strain-displacement, stress-strain and equilibrium relationships for beam members; applying the relationships to the matrix displacement analysis of frame structures; and using computer software to conduct the linear-elastic and buckling analyses of frame structures.At the end of this unit, students will be able to deduce appropriate structural models for frame structures; and use computer methods and simple hand methods to obtain internal forces and displacements as well as buckling loads for frame structures. The syllabus comprises theoretical background (strain-displacement, stress-strain and equilibrium relationships), structural analysis software, matrix displacement method, beam theory, introduction to nonlinear analysis, buckling analysis.

CIVL3411
Geotechnical Engineering

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 4 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** CIVL2410 **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The objectives of this unit are to provide an understanding of the factors influencing soil strength, and to give practice in the application of this understanding by exploring the stability of slopes, retaining walls and foundations. At the end of this unit students will be able to: determine the strength parameters appropriate to a range of stability problems, and understand the difference between total and effective stress approaches; evaluate strength parameters from laboratory data; critically analyse foundation stability and slope stability problems; use spreadsheets to perform parametric studies and produce design charts for simple geotechnical design problems; and communicate the results of experiments and analyses using written methods appropriate for professional geotechnical engineers. The syllabus comprises; methods of analysis for gravity and sheet pile retaining walls; reinforced soil; slope stability, including modes of failure, analysis and computer methods; bearing capacity of shallow foundations under general loading, and axial and lateral capacities of deep pile foundations; the mechanical behaviour of sands and clays; and Critical State models.

CIVL2511
Research Techniques

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/week; Project Work - in class 4 hrs/week; Site Visit 2 hrs/week; Presentation 0.33 hrs/week. **Assumed knowledge:** CIVL2201 AND ENGG1802. Basic understanding of Maths, Physics and Chemistry appropriate to student in 2nd year of study. Concepts of Force, Moment, Torque, Stress, Strain, Displacement, Velocity and Acceleration. These are covered in a range of courses but particularly CIVL2201 Structural Mechanics and ENGG1802 Engineering Mechanics **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The objectives of this unit are to introduce students to the philosophy and principles of measurement, and its uses in Civil Engineering practice and research. The instrumentation used in practice, the underlying physical principles and the basic electrical/electronic and signal processing issues. It will introduce students to issues in the planning and construction of experiments. Give experience working in groups and in producing reports.

At the end of this unit, students should gain an understanding of the importance of measurement, of the methods and application of measurement; ability to conduct experiments and interpret measurements. The course will reinforce key concepts in Structural Mechanics, Fluid Mechanics, Soil Mechanics and Surveying.

The syllabus comprises principles of measurement, presentation of data, error analysis, stress and strain, sensor types and technologies wave based techniques and wave analysis, photographic techniques, signal processing, electric circuit theory.

Fourth year

CIVL4903
Civil Engineering Design

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 1 hr/week; Tutorial 3 hrs/week. **Prerequisites:** CIVL3205 and CIVL3206 **Assumed knowledge:** CIVL2410, CIVL3612, CIVL4811 **Assessment:** Through semester assessment (75%) Final Exam (25%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is a fourth year core unit of study for the degree in Civil Engineering and fourth year elective for the degree in Project Engineering and Management (Civil).

The objective of this unit is to give students an appreciation of the role of the designer in the development of Civil Engineering projects. At the end of this unit, students will have developed an understanding of the design philosophy. They will gain this through their involvement in a number of exercises which cover the design sequence from concept to documentation.

The syllabus comprises: design sequence beginning with a 'brief' and including definition, value and criteria selection; generation of proposals; analysis of proposals; selection of design; development of details of a particular design selected; feasibility studies and examination of existing works; study of design projects by stages, including details of some aspects.

This unit is under the direction of an engineer in professional practice in cooperation with other professional practitioners and members of the academic staff. Lectures and exercises on the interaction between civil engineering and architectural design and practice are included in the unit.

CIVL5266
Steel Structures - Stability

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** There are no prerequisites for this unit of study but it is assumed that students are competent in the content covered in Structural Mechanics, Steel Structures, and Structural Analysis. **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Objectives:

This Unit aims to:

- provide fundamental understanding at advanced level of the behaviour and design steel structural members, notably members undergoing cross-sectional and/or global buckling.

- provide fundamental understanding of the methods available for determining buckling loads of structural members and elements, and explain how classical solutions to buckling problems are incorporated in national design standards for steel structures, including AS4100 and AS/NZS4600.

Outcomes:

It is anticipated that at the end of this unit of study students will be familiar with the buckling behaviour of steel structures and will understand the methods available for determining buckling loads of structural members and cross-section. Students will have a good understanding of the stability design provisions for steel structures specified in the standards AS4100 and AS/NZS4600, and will be proficient in using software for calculating buckling loads.

Syllabus Summary:

Stability theory, Plate theory, Stability of plates and plate assemblies, Theory for thin-walled members in torsion and bi-axial bending, Stability of thin-walled members, Stability design to AS4100 and AS/NZS4600, Direct Strength Method.

CIVL5269
Concrete Structures - Strength & Service

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** CIVL3205 OR CIVL5507 OR CIVL9205 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This Unit reviews the fundamental concepts of 'elastic' behaviour of reinforced concrete structures and introduces models of behaviour and methods of analysis related to the time-dependent effects of creep and shrinkage (at service loads). This Unit also examines the non-linear (strain-softening) behaviour of reinforced concrete and the related effects concerning the strength of statically-indeterminate reinforced concrete structures. In particular, this Unit examines the concepts of ductility, moment-redistribution and plastic design (for beams and slabs). Strut-and-tie modelling of reinforced concrete members is also described. Design guidelines will reflect requirements of the Australian Standards and Eurocodes.

Outcomes:

This Unit will provide students with the following knowledge and skills:

- understanding of the fundamental concepts and theoretical models concerning the time-dependent structural effects of concrete creep and shrinkage;

- ability to carry out calculations to estimate 'elastic' load-effects (stresses/strains/deformations) for reinforced concrete structures (at service loads), accounting for the time-dependent effects of concrete creep and shrinkage;

- understanding of the fundamental concepts and theoretical models of the strain-softening behaviour of reinforced concrete (in flexure);

- understanding of the fundamental concepts and numerical models of ductility and moment redistribution for reinforced concrete beams;

- ability to quantitatively assess the ductility and moment-redistribution capacity of reinforced concrete beams;

- understanding of the fundamental concepts and numerical models of plastic behaviour and design for reinforced concrete beams and slabs (including yield-line analysis);

- ability to determine the ultimate plastic load-carrying capacity of statically-indeterminate reinforced-concrete beams and slabs;

- ability to use strut-and-tie models of reinforced concrete behaviour.

CIVL5351
Geoenvironmental Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Objectives: To develop an understanding of the geotechnical aspects of the design and management of industrial and domestic waste disposal systems.

Learning Outcomes: 1. Analyse flow regime in soil using Darcy equation; 2. Analyse contaminant migration in soil using coupled flow and reactive diffusion advection equations; 3. Design a single or double composite landfill liner satisfying groundwater quality requirements; 4. Predict the potential for methane production in a landfill and assess the feasibility of waste-to-energy conversion; 5. Conduct research on a geoenvironmental topic as part for group.

Syllabus Summary: introduction to geoenvironmental engineering; integrated waste management and life cycle assessment; soil composition and mineralogy; types and characteristics of contaminants; theory of water seepage in soil and hydraulic conductivity; theory of reactive contaminant transport in soil including molecular diffusion, mechanical dispersion and advective flow; analytical and numerical solutions of reactive diffusion advection equation; design of landfills; geosynthetics and geomembranes; defects and leakage rates; methane generation in landfills and landfill gas management.

CIVL5458
Numerical Methods in Civil Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Objectives:

The objective of this unit is to provide students with fundamental knowledge of finite element analysis and how to apply this knowledge to the solution of civil engineering problems at intermediate and advanced levels.

At the end of this unit, students should acquire knowledge of methods of formulating finite element equations, basic element types, the use of finite element methods for solving problems in structural, geotechnical and continuum analysis and the use of finite element software packages. The syllabus comprises introduction to finite element theory, analysis of bars, beams and columns, and assemblages of these structural elements; analysis of elastic continua; problems of plane strain, plane stress and axial symmetry; use, testing and validation of finite element software packages; and extensions to apply this knowledge to problems encountered in engineering practice.

Outcomes:

On completion of this unit, students will have gained the following knowledge and skills:

1. Knowledge of methods of formulating finite element equations. This will provide students with an insight into the principles at the basis of the FE elements available in commercial FE software.

2. Knowledge of basic element types. Students will be able to evaluate the adequacy of different elements in providing accurate and reliable results.

3. Knowledge of the use of finite element methods for solving problems in structural and geotechnical engineering applications. Students will be exposed to some applications to enable them to gain familiarity with FE analyses.

4. Knowledge of the use of finite element programming and modeling.

5. Extended knowledge of the application of FE to solve civil engineering problems.

Notes

1. Choice of electives as shown in the above table will depend upon subject availability, timetabling and prerequisite conditions.3. At least one of CIVL3205 and CIVL3612 must be taken.

Exchange units of study

CIVL0011, CIVL0012, CIVL0013, CIVL0014, CIVL0015, CIVL0016, CIVL0017 AND CIVL0018 are available for exchange study programs.

For a standard enrolment plan for Project Engineering and Management (Civil) visit cusp.sydney.edu.au/students/view-degree-page/name/BE(PEM)

School of Electrical and Information Engineering

Electrical engineering encompasses electronic, computer systems, telecommunications, control and electrical power engineering. It is concerned with the way electrical energy is produced and used in homes, in the community and in industry. Electrical engineers design and build the systems and machines that generate, transmit, measure, control and use electrical energy essential to modern life.

The Bachelor of Engineering Honours (Electrical) is a four year degree that has foundations in physics, mathematics, computer science and basic electrical engineering principles. You will learn core skills in these areas which are developed through the course themes of electrical circuits, electronics and computer systems, signals and communications, power systems, control, energy systems and management.

The School of Electrical and Information Engineering offers the following Bachelor of Engineering Honours degree specialisations:

- Electrical
- Electrical (Computer)
- Electrical (Power)
- Electrical (Telecommunications)
- Software, and
- Combined degrees with Science, Commerce, Arts, Medical Science, Project Management and Law.

Candidates for the degree of Bachelor of Engineering Honours in Electrical Engineering, Electrical (Computer), Electrical (Power), Electrical (Telecommunications) and Software Engineering are required to gain credit for a prescribed number of credit points of core and recommended units of study. The core units of study are set out in the tables below pertaining to each specialisation. The recommended units of study are as defined for each specialisation.

Note: Not all recommended units of study shall be available each year.

Bachelor of Engineering Honours (Electrical) (Computer)

Course Overview

The Bachelor of Engineering Honours (Electrical) (Computer) has foundations in physics, mathematics, computer science and basic electrical engineering principles.

You will learn core skills in these areas which are developed through the course themes of electrical circuits, electronics and computer systems, signals and communications, power systems, control, energy systems and management. In third and fourth years, you will specialise in advanced computer systems, computer networking, and software engineering. A wide range of computer-oriented electives are also available, including studies in artificial intelligence and integrated circuit design. Computer-based tutorials are a feature of the course.

Demand for computer engineering graduates is strong and you may pursue a career in embedded microprocessor systems, digital control systems, image processing, digital signal processing, tracking and surveillance, measurement and sensing, data processing systems, software engineering, biomedical engineering and power systems.

Course Requirements

To meet requirements for the Bachelor of Engineering Honours (Electrical) (Computer), a candidate must successfully complete 192 credit points, comprising:

- core and elective units of study relating to the specialist stream, as prescribed by the table of units of study for the stream; and
- any additional free elective units of study as may be necessary to gain credit to complete the award.

For a standard enrolment plan for Electrical (Computer) Engineering visit cusp.sydney.edu.au/students/view-degree-page/name/BE(Elec)(Comp)

Unit of Study Table

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*

Bachelor of Engineering Honours (Electrical) (Computer)

All candidates for the Bachelor of Engineering Honours (Electrical) (Computer) (including those enrolled in a combined degree) must satisfy the requirements described in the table of core units of study.

Candidates will also need to choose a number of recommended units of study for Electrical Engineering (Computer), which consist of:

- all level 3, 4 and 5 ELEC units which do not appear in the table of core units; and

- such other units of study as may be so designated by the Head of School.

Requirements for the Bachelor of Engineering Honours (Electrical) (Computer)

Candidates for the Bachelor of Engineering Honours (Electrical) (Computer) are required to complete a total of not less than 192 credit points including at least 168 credit points made up of units from the table of core units and recommended units of study. The additional 24 credit points may consist, in whole or in part, of free elective units of study approved by the Head of School.

Requirements for the Bachelor of Engineering Honours (Electrical) (Computer) in a combined degree

Candidates for the Bachelor of Engineering Honours (Electrical) (Computer) combined with the Bachelor of Commerce, Bachelor of Project Management or Bachelor of Law are required to complete at least 144 credit points made up of units from the table of core units and recommended units of study.

for the Bachelor of Engineering Honours (Electrical) (Computer) combined with the Bachelor of Science or Bachelor of Arts are required to complete at least 156 credit points made up of units from the table of core units and recommended units of study.

for the Bachelor of Engineering Honours (Electrical) (Computer) combined with the Bachelor of Medical Science are required to complete at least 156 credit points made up of units from the table of core units and recommended units of study, but may choose to replace up to 12 credit points of recommended units with CHEM1101 Chemistry 1A and BIOL1001 Concepts in Biology.

Candidates in all combined degree courses shall also satisfy such other requirements as are prescribed in the joint resolutions of the Faculty of Engineering and Information Technologies and the second faculty concerned.

Electrical Engineering (Computer) core units of study

First year

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
PHYS1001 **Physics 1 (Regular)**	6	**A** HSC Physics **P** HSC Physics with a minimum mark of 65 **N** PHYS1002, EDUH1017, PHYS1901	Semester 1
ELEC1601 **Foundations of Computer Systems**	6	**A** HSC Mathematics extension 1 or 2	Semester 2
ENGG1805 **Professional Engineering and IT**	6		Semester 1
MATH1001 **Differential Calculus**	3	**A** HSC Mathematics Extension 1 **N** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001	Semester 1 Summer Main
MATH1002 **Linear Algebra**	3	**A** HSC Mathematics or MATH1111 **N** MATH1902, MATH1012, MATH1014	Semester 1 Summer Main
MATH1003 **Integral Calculus and Modelling**	3	**A** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **N** MATH1013, MATH1903, MATH1907	Semester 2 Summer Main
MATH1005 **Statistics**	3	**A** HSC Mathematics **N** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021	Semester 2 Summer Main Winter Main
PHYS1003 **Physics 1 (Technological)**	6	**A** HSC Physics or PHYS1001 or PHYS1002 or PHYS1901 or equivalent. **N** PHYS1902, PHYS1004 *It is recommended that PHYS1001 or PHYS1002 or PHYS1901 be completed before this unit*	Semester 2
INFO1103 **Introduction to Programming**	6		Semester 1 Semester 2
INFO1105 **Data Structures**	6	**P** INFO1003 or INFO1103 or INFO1903 or INFS1000	Semester 2

Second year

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
ELEC1103 **Fundamentals of Elec and Electronic Eng**	6	**A** Basic knowledge of differentiation & integration, and HSC Physics	Semester 1
ELEC2103 **Simulation & Numerical Solutions in Eng**	6	**A** ELEC1103. Understanding of the fundamental concepts and building blocks of electrical and electronics circuits and aspects of professional project management, teamwork, and ethics. **N** COSC1901, COSC1001	Semester 2
ELEC2104 **Electronic Devices and Circuits**	6	**A** Knowledge: ELEC1103. Ohm's Law and Kirchoff's Laws; action of Current and Voltage sources; network analysis and the superposition theorem; Thevenin and Norton equivalent circuits; inductors and capacitors, transient response of RL, RC and RLC circuits; the ability to use power supplies, oscilloscopes, function generators, meters, etc.	Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
ELEC2302 **Signals and Systems**	6	**A** MATH1001 Differential Calculus and MATH1002 Linear Algebra and MATH1003 Integral Calculus and Modelling. Basic knowledge of differentiation & integration, differential equations, and linear algebra.	Semester 2
ELEC2602 **Digital Logic**	6	**A** ELEC1601. This unit of study assumes some knowledge of digital data representation and basic computer organisation	Semester 1
MATH2061 **Linear Mathematics and Vector Calculus**	6	**P** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **N** MATH2961, MATH2067, MATH2901, MATH2902, MATH2001, MATH2002	Semester 1 Summer Main
PHYS2213 **Physics 2EE**	6	**A** (MATH1001 or MATH1901) and (MATH1002 or MATH1902) and (MATH1003 or MATH1903). MATH1005 or MATH1905 would also be useful **P** (PHYS1001 or PHYS1901) and (PHYS1003 or PHYS1902) **N** PHYS2902, PHYS2011, PHYS2203, PHYS2002, PHYS2901, PHYS2012, PHYS2001, PHYS2912, PHYS2911	Semester 2
COMP2129 **Operating Systems and Machine Principles**	6	**A** INFO1105 OR INFO1905. **P** INFO1103.	Semester 1
Third year			
ELEC3506 **Data Communications and the Internet**	6	**N** NETS2150	Semester 2
ELEC3607 **Embedded Systems**	6	**A** ELEC1601 AND ELEC2602. Logic operations, theorems and Boolean algebra, data representation, number operations (binary, hex, integers and floating point), combinational logic analysis and synthesis, sequential logic, registers, counters, bus systems, state machines, simple CAD tools for logic design, basic computer organisation, the CPU, peripheral devices, software organisation, machine language, assembly language, operating systems, data communications and computer networks. **P** ELEC1601 and ELEC2602	Semester 1
ELEC3608 **Computer Architecture**	6	**A** ELEC3607. Basic knowledge of assembly language and microprocessor systems is required. **P** ELEC2602	Semester 2
At least 2 of the following 6 units of study:			
ELEC3104 **Engineering Electromagnetics**	6	**A** Differential calculus, integral calculus, vector integral calculus; electrical circuit theory and analysis using lumped elements; fundamental electromagnetic laws and their use in the calculation of static fields.	Semester 1
ELEC3304 **Control**	6	**A** Specifically the following concepts are assumed knowledge for this unit: familiarity with basic Algebra, Differential and Integral Calculus, Physics; solution of linear differential equations, Matrix Theory, eigenvalues and eigenvectors; linear electrical circuits, ideal op-amps; continuous linear time-invariant systems and their time and frequency domain representations, Laplace transform, Fourier transform. **P** MATH2061 and ELEC2302 **N** AMME3500	Semester 2
ELEC3305 **Digital Signal Processing**	6	**A** Specifically the following concepts are assumed knowledge for this unit: familiarity with basic Algebra, Differential and Integral Calculus, continuous linear time-invariant systems and their time and frequency domain representations, Fourier transform, sampling of continuous time signals. **P** ELEC2302	Semester 1
ELEC3404 **Electronic Circuit Design**	6	**A** A background in basic electronics and circuit theory is assumed.	Semester 1
ELEC3702 **Management for Engineers**	6	**N** ENGG3005, MECH3661	Semester 2
COMP3520 **Operating Systems Internals**	6	**P** COMP2129	Semester 1
Fourth year			
ELEC4702 **Practical Experience**		**P** 24 CP of senior or senior advanced units of study.	Semester 1 Semester 2
Students must enrol in 12 credit points of Thesis units.			
ELEC4712 **Honours Thesis A**	6	**P** 36 credits of 3rd year units of study *Note: Department permission required for enrolment* *Note that students require permission from the HOS to do both A and B units in the same Semester, and will have an accelerated assessment schedule. Note also that entry to Honours Thesis is by permission.*	Semester 1 Semester 2
ELEC4713 **Honours Thesis B**	6	*Note: Department permission required for enrolment* *Note that students require permission from the HOS to do both A and B units in the same Semester, and will have an accelerated assessment schedule. Note also that entry to Honours Thesis is by permission.*	Semester 1 Semester 2

Notes

1. The Mathematics, Physics and Information Technology units of study may be replaced by equivalent advanced level units of study (if available) subject to prerequisite conditions being met.

2. Students whose EWAM is less than 65 before enrolling in ELEC4712 & ELEC4713, or at the end of their degree requirements, will receive a Pass degree.

For a standard enrolment plan for Electrical(Computer) Engineering visit cusp.sydney.edu.au/students/view-degree-page/name/BE(Elec)(Comp)

Unit of Study Descriptions

Bachelor of Engineering Honours (Electrical) (Computer)

All candidates for the Bachelor of Engineering Honours (Electrical) (Computer) (including those enrolled in a combined degree) must satisfy the requirements described in the table of core units of study.Candidates will also need to choose a number of recommended units of study for Electrical Engineering (Computer), which consist of:- all level 3, 4 and 5 ELEC units which do not appear in the table of core units; and - such other units of study as may be so designated by the Head of School.

Requirements for the Bachelor of Engineering Honours (Electrical) (Computer)

Candidates for the Bachelor of Engineering Honours (Electrical) (Computer) are required to complete a total of not less than 192 credit points including at least 168 credit points made up of units from the table of core units and recommended units of study. The additional 24 credit points may consist, in whole or in part, of free elective units of study approved by the Head of School.

Requirements for the Bachelor of Engineering Honours (Electrical) (Computer) in a combined degree

Candidates for the Bachelor of Engineering Honours (Electrical) (Computer) combined with the Bachelor of Commerce, Bachelor of Project Management or Bachelor of Law are required to complete at least 144 credit points made up of units from the table of core units and recommended units of study.for the Bachelor of Engineering Honours (Electrical) (Computer) combined with the Bachelor of Science or Bachelor of Arts are required to complete at least 156 credit points made up of units from the table of core units and recommended units of study.for the Bachelor of Engineering Honours (Electrical) (Computer) combined with the Bachelor of Medical Science are required to complete at least 156 credit points made up of units from the table of core units and recommended units of study, but may choose to replace up to 12 credit points of recommended units with CHEM1101 Chemistry 1A and BIOL1001 Concepts in Biology.Candidates in all combined degree courses shall also satisfy such other requirements as are prescribed in the joint resolutions of the Faculty of Engineering and Information Technologies and the second faculty concerned.

Electrical Engineering (Computer) core units of study

First year

PHYS1001
Physics 1 (Regular)

Credit points: 6 **Session:** Semester 1 **Classes:** Three 1-hour lectures, one 3-hour laboratory per week for 9 weeks and one 1-hour tutorial per week. **Prerequisites:** HSC Physics with a minimum mark of 65 **Prohibitions:** PHYS1002, EDUH1017, PHYS1901 **Assumed knowledge:** HSC Physics **Assessment:** 3 hour exam plus laboratories, assignments and mid-semester tests (100%). **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for students who gained 65 marks or better in HSC Physics or equivalent. The lecture series contains three modules on the topics of mechanics, thermal physics, and oscillations and waves.

Textbooks

Young & Freedman. University Physics. 13th edition, with Mastering Physics, Addison-Wesley. 2012. Course lab manual.

ELEC1601
Foundations of Computer Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** HSC Mathematics extension 1 or 2 **Assessment:** Through semester assessment (61%) Final Exam (39%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study introduces the fundamental digital concepts upon which the design and operation of modern digital computers are based. A prime aim of the unit is to develop a professional view of, and a capacity for inquiry into, the field of computing.

Topics covered include: data representation, basic computer organisation, the CPU, elementary gates and logic, peripheral devices, software organisation, machine language, assembly language, operating systems, data communications and computer networks.

ENGG1805
Professional Engineering and IT

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week; Project Work - own time 2 hrs. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

ENGG1805 aims to introduce students to the fundamental principles that underlie the study of engineering and information technologies. It lays the foundation for later studies, and presents to the students challenges common to a multidisciplinary engineering environment. The subject also provides students with the opportunity to develop an understanding of engineering ethics and of working as a part of a team.

Professional Engineering and IT (6CP) is composed from the following five parts: (a) Introduction to engineering: the engineer as problem solver, critical analysis of greatest engineering achievements and failure. (b) Introduction to common engineering software tools: word processors, project management tools (c) Ethics and workplace health and safety. (d) Testing - concepts of destructive and not destructive tests will be given on samples. (e) "Meet the professionals" - A selection of guest speakers will address students on the most important aspects of the engineering profession. (f) Design Process - The process of design synthesis as an important part of engineering: students will be required to complete an engineering design (from conception, to implementation and testing) maintaining proper lab notes.

MATH1001
Differential Calculus

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001 **Assumed knowledge:** HSC Mathematics Extension 1 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1001 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study looks at complex numbers, functions of a single variable, limits and continuity, vector functions and functions of two variables. Differential calculus is extended to functions of two variables. Taylor's theorem as a higher order mean value theorem.

Textbooks

As set out in the Junior Mathematics Handbook.

MATH1002
Linear Algebra

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1902, MATH1012, MATH1014 **Assumed knowledge:** HSC Mathematics or MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1002 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study introduces vectors and vector algebra, linear algebra including solutions of linear systems, matrices, determinants, eigenvalues and eigenvectors.

Textbooks

As set out in the Junior Mathematics Handbook

MATH1003
Integral Calculus and Modelling

Credit points: 3 **Session:** Semester 2, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1013, MATH1903, MATH1907 **Assumed knowledge:** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1003 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.This unit of study first develops the idea of the definite integral from Riemann sums, leading to the Fundamental Theorem of Calculus. Various techniques of integration are considered, such as integration by parts.The second part is an introduction to the use of first and second order differential equations to model a variety of scientific phenomena.

Textbooks

As set out in the Junior Mathematics Handbook

MATH1005
Statistics

Credit points: 3 **Session:** Semester 2, Summer Main, Winter Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021 **Assumed knowledge:** HSC Mathematics **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1005 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit offers a comprehensive introduction to data analysis, probability, sampling, and inference including t-tests, confidence intervals and chi-squared goodness of fit tests.

Textbooks

As set out in the Junior Mathematics Handbook

PHYS1003
Physics 1 (Technological)

Credit points: 6 **Session:** Semester 2 **Classes:** Three 1-hour lectures, one 3-hour laboratory per week for 10 weeks, one 1-hour tutorial per week. **Prohibitions:** PHYS1902, PHYS1004 **Assumed knowledge:** HSC Physics or PHYS1001 or PHYS1002 or PHYS1901 or equivalent. **Assessment:** 3 hour exam plus laboratories, tutorials, and assignments (100%). **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: It is recommended that PHYS1001 or PHYS1002 or PHYS1901 be completed before this unit

This unit of study is designed for students majoring in physical and engineering sciences and emphasis is placed on applications of physical principles to the technological world. The lecture series contains modules on the topics of fluids, electromagnetism, and quantum physics.

Textbooks

Young & Freedman. University Physics. 13th edition, with Mastering Physics. Addison-Wesley. Course lab manual.

INFO1103
Introduction to Programming

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Laboratory 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Programming in a legible, maintainable, reusable way is essential to solve complex problems in the pervasive computing environments. This unit will equip students with foundation of programming concepts that are common to widely used programming languages. The "fundamentals-first & objects-later" strategy is used to progressively guide this introductory unit from necessary and important building blocks of programming to the object-oriented approach. Java, one of the most popular programming languages, is used in this unit. It provides interdisciplinary approaches, applications and examples to support students from broad backgrounds such as science, engineering, and mathematics.

INFO1105
Data Structures

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1003 or INFO1103 or INFO1903 or INFS1000 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will teach some powerful ideas that are central to quality software: data abstraction and recursion. It will also show how one can analyse the scalability of algorithms using mathematical tools of asymptotic notation. Contents include: both external "interface" view, and internal "implementation" details, for commonly used data structures, including lists, stacks, queues, priority queues, search trees, hash tables, and graphs; asymptotic analysis of algorithm scalability, including use of recurrence relations to analyse recursive code. This unit covers the way information is represented in each structure, algorithms for manipulating the structure, and analysis of asymptotic complexity of the operations. Outcomes include: ability to write code that recursively performs an operation on a data structure; experience designing an algorithmic solution to a problem using appropriate data structures, coding the solution, and analysing its complexity.

Second year

ELEC1103
Fundamentals of Elec and Electronic Eng

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Basic knowledge of differentiation & integration, and HSC Physics **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to develop knowledge of the fundamental concepts and building blocks of electrical and electronics circuits.This is a foundation unit in circuit theory. Circuit theory is the electrical engineer's fundamental tool.

The concepts learnt in this unit will be made use of heavily in many units of study (in later years) in the areas of electronics, instrumentation, electrical machines, power systems, communication systems, and signal processing.

Topics: a) Basic electrical and electronic circuit concepts: Circuits, circuit elements, circuit laws, node and mesh analysis, circuit theorems, energy storage, capacitors and inductors, circuits with switches, transient response, sine waves and complex analysis, phasors,

impedance, ac power.; b) Project management, teamwork, ethics; c) Safety issues

ELEC2103
Simulation & Numerical Solutions in Eng

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 1 hr/week; Laboratory 3 hrs/week; Project Work - own time 3 hrs/week. **Prohibitions:** COSC1901, COSC1001 **Assumed knowledge:** ELEC1103. Understanding of the fundamental concepts and building blocks of electrical and electronics circuits and aspects of professional project management, teamwork, and ethics. **Assessment:** Through semester assessment (25%) Final Exam (75%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Objectives:

* How to apply the software package Matlab to achieve engineering solutions

* Critical assessment of various computer numerical techniques

* Professional project management, teamwork, ethics

This unit assumes an understanding of the fundamental concepts and building blocks of electrical and electronics circuits. As well as covering the specific topics described in the following paragraphs, it aims to develop skills in professional project management and teamwork and promote an understanding of ethics.

Basic features of Matlab. The Matlab desktop. Interactive use with the command window. Performing arithmetic, using complex numbers and mathematical functions. Writing script and function m-files. Matrix manipulations. Control flow. Two dimensional graphics. Application of Matlab to simple problems from circuit theory, electronics, signals and systems and control. Investigation of the steady state and transient behaviour of LCR circuits.

Matlab based numerical solutions applicable to numerical optimization, ordinary differential equations, and data fitting. Introduction to symbolic mathematics in Matlab. Applications, including the derivation of network functions for simple problems in circuit analysis. Introduction to the use of Simulink for system modelling and simulation.

ELEC2104
Electronic Devices and Circuits

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/fortnight; Laboratory 3 hrs/fortnight **Assumed knowledge:** Knowledge: ELEC1103. Ohm's Law and Kirchoff's Laws; action of Current and Voltage sources; network analysis and the superposition theorem; Thevenin and Norton equivalent circuits; inductors and capacitors, transient response of RL, RC and RLC circuits; the ability to use power supplies, oscilloscopes, function generators, meters, etc. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Modern Electronics has come to be known as microelectronics which refers to the Integrated Circuits (ICs) containing millions of discrete devices. This course introduces some of the basic electronic devices like diodes and different types of transistors. It also aims to introduce students the analysis and design techniques of circuits involving these discrete devices as well as the integrated circuits.

Completion of this course is essential to specialize in Electrical, Telecommunication or Computer Engineering stream. The knowledge of ELEC1103 is assumed.

ELEC2302
Signals and Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/week; E-Learning 1 hr/week. **Assumed knowledge:** MATH1001 Differential Calculus and MATH1002 Linear Algebra and MATH1003 Integral Calculus and Modelling. Basic knowledge of differentiation & integration, differential equations, and linear algebra. **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to teach some of the basic properties of many engineering signals and systems and the necessary mathematical tools that aid in this process. The particular emphasis is on the time and frequency domain modeling of linear time invariant systems. The concepts learnt in this unit will be heavily used in many units of study (in later years) in the areas of communication, control, power systems and signal processing. A basic knowledge of differentiation and integration, differential equations, and linear algebra is assumed.

ELEC2602
Digital Logic

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week; Laboratory pre-work 2 hrs/week. **Assumed knowledge:** ELEC1601. This unit of study assumes some knowledge of digital data representation and basic computer organisation **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The purpose of this unit is to equip the students with the skills to design simple digital logic circuits which comprise modules of larger digital systems.

The following topics are covered: logic operations, theorems and Boolean algebra, number operations (binary, hex, integer and floating point), combinational logic analysis and synthesis, sequential logic, registers, counters, bus systems, state machines, simple CAD tools for logic design, and the design of a simple computer.

MATH2061
Linear Mathematics and Vector Calculus

Credit points: 6 **Session:** Semester 1, Summer Main **Classes:** Three 1 hour lectures, one 1 hour tutorial and one 1 hour practice class per week. **Prerequisites:** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **Prohibitions:** MATH2961, MATH2067, MATH2901, MATH2902, MATH2001, MATH2002 **Assessment:** One 2 hour exam, assignments, quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit starts with an investigation of linearity: linear functions, general principles relating to the solution sets of homogeneous and inhomogeneous linear equations (including differential equations), linear independence and the dimension of a linear space. The study of eigenvalues and eigenvectors, begun in junior level linear algebra, is extended and developed. The unit then moves on to topics from vector calculus, including vector-valued functions (parametrised curves and surfaces; vector fields; div, grad and curl; gradient fields and potential functions), line integrals (arc length; work; path-independent integrals and conservative fields; flux across a curve), iterated integrals (double and triple integrals; polar, cylindrical and spherical coordinates; areas, volumes and mass; Green's Theorem), flux integrals (flow through a surface; flux integrals through a surface defined by a function of two variables, though cylinders, spheres and parametrised surfaces), Gauss' Divergence Theorem and Stokes' Theorem.

PHYS2213
Physics 2EE

Credit points: 6 **Session:** Semester 2 **Classes:** Three 1 hour lectures per week; one 2 hour computational laboratory per week for 10 weeks. **Prerequisites:** (PHYS1001 or PHYS1901) and (PHYS1003 or PHYS1902) **Prohibitions:** PHYS2902, PHYS2011, PHYS2203, PHYS2002, PHYS2901, PHYS2012, PHYS2001, PHYS2912, PHYS2911 **Assumed knowledge:** (MATH1001 or MATH1901) and (MATH1002 or MATH1902) and (MATH1003 or MATH1903). MATH1005 or MATH1905 would also be useful **Assessment:** One 3 hour exam, one 1-hour computational test, assignments, computational lab work (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is designed to build on the knowledge gained in Junior Physics, to provide Electrical Engineering students with the knowledge of relevant topics of Physics at the Intermediate level, and with associated skills. Completion of the unit provides a solid foundation for further studies in Electrical Engineering and related engineering areas. The aims of this unit are linked to the generic attributes required of graduates of the University in knowledge skills, thinking skills, personal skills and attributes, and practical skills. By the end of this unit of study, students will be able to describe and apply concepts in optics, electromagnetism and basic solid state physics and technology at the Intermediate level. They will be able to use computational techniques to analyze optics problems. The modules in this unit of study are: Optics (13 lectures): The wave nature of light, optical phenomena and the interaction of light with matter: interference and diffraction effects; fundamental limits to resolution of optical instruments; polarisation; dispersion; coherence. These are presented

within the context of several key optical technologies including lasers, CD/DVD players, optical fibre communication systems, gratings and Mach Zehnder modulation. Electromagnetic Properties of Matter (12 lectures): Electric and magnetic effects in materials; the combination of electric and magnetic fields to produce light and other electromagnetic waves in vacuum and matter. Solid State and Device Physics (13 lectures): Introduction to quantum mechanics, Fermi-Dirac statistics, electronic properties of solids (metal, semiconductors & insulators), doping and the semiconductor PN junction; introduction to nanotechnology; fabrication technologies, nano-imaging technologies, nanoelectronics. Computational Physics (10 sessions of 2 hours each): In a computing laboratory students use Matlab-based simulation software to conduct virtual experiments in optics, which illustrate and extend the relevant lectures. Students also gain experience in the use of computers to solve problems in physics.

Textbooks

Notes published by the School of Physics: - Physics 2EE Computational Physics Optics Notes - Physics 2EE Electromagnetic Properties of Matter Notes - Physics 2EE Solid State and Device Physics Notes Other relevant texts: see the Unit of Study outline.

COMP2129
Operating Systems and Machine Principles

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1103. **Assumed knowledge:** INFO1105 OR INFO1905. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

In this unit of study elementary methods for developing robust, efficient, and re-usable software will be covered. The unit is taught in C, in a Unix environment. Specific coding topics include memory management, the pragmatic aspects of implementing data structures such as lists and hash tables and managing concurrent threads. Debugging tools and techniques are discussed and common programming errors are considered along with defensive programming techniques to avoid such errors. Emphasis is placed on using common Unix tools to manage aspects of the software construction process, such as version control and regression testing. The subject is taught from a practical viewpoint and it includes a considerable amount of programming practice.

Third year

ELEC3506
Data Communications and the Internet

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/fortnight; Tutorial 2 hrs/week. **Prohibitions:** NETS2150 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Students undertaking this unit should be familiar with fundamental digital technologies and representations such as bit complement and internal word representation. Students should also have a basic understanding of the physical properties of communication channels, techniques and limitations. Furthermore, students should be able to apply fundamental mathematical skills.

The unit will cover the following specific material: Communication reference models (TCP/IP and OSI). Circuit switched and packet switched communication. Network node functions and building blocks. LAN, MAN, WAN, WLAN technologies. Protocols fundamental mechanisms. The TCP/IP core protocols (IP, ICMP, DHCP, ARP, TCP, UDP etc.). Applications and protocols (FTP, Telnet, SMTP, HTTP etc.), Network Management and Security.

ELEC3607
Embedded Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week. **Prerequisites:** ELEC1601 and ELEC2602 **Assumed knowledge:** ELEC1601 AND ELEC2602. Logic operations, theorems and Boolean algebra, data representation, number operations (binary, hex, integers and floating point), combinational logic analysis and synthesis, sequential logic, registers, counters, bus systems, state machines, simple CAD tools for logic design, basic computer organisation, the CPU, peripheral devices, software organisation, machine language, assembly language, operating systems, data communications and computer networks. **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Embedded systems have become pervasive in modern society. The aim of this unit of study is to teach students about embedded systems architecture, design methodology, interfacing and programming. Topics covered include peripheral devices, interrupts, direct memory access (DMA), assembly language, communications and data acquisition. A major design project is part of this course.

ELEC3608
Computer Architecture

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Project Work - own time 4 hrs. **Prerequisites:** ELEC2602 **Assumed knowledge:** ELEC3607. Basic knowledge of assembly language and microprocessor systems is required. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study explores the design of a computer system at the architectural and digital logic level. Topics covered include instruction sets, computer arithmetic, performance evaluation, datapath design, pipelining, memory hierarchies including caches and virtual memory, I/O devices, and bus-based I/O systems. Students will design a pipelined reduced instruction set processor.

At least 2 of the following 6 units of study:

ELEC3104
Engineering Electromagnetics

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Differential calculus, integral calculus, vector integral calculus; electrical circuit theory and analysis using lumped elements; fundamental electromagnetic laws and their use in the calculation of static fields. **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces students to the broad spectrum of engineering electromagnetics and helps students to develop theoretical and analytical skills in the area of electrical and telecommunications engineering and develop understanding of the basic electromagnetic theory underpinning optical communications, wireless communications and electrical engineering.

ELEC3304
Control

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs. **Prerequisites:** MATH2061 and ELEC2302 **Prohibitions:** AMME3500 **Assumed knowledge:** Specifically the following concepts are assumed knowledge for this unit: familiarity with basic Algebra, Differential and Integral Calculus, Physics; solution of linear differential equations, Matrix Theory, eigenvalues and eigenvectors; linear electrical circuits, ideal op-amps; continuous linear time-invariant systems and their time and frequency domain representations, Laplace transform, Fourier transform. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit is mainly concerned with the application of feedback control to continuous-time, linear time-invariant systems. It aims to give the students an appreciation of the possibilities in the design of control and automation in a range of application areas. The concepts learnt in this unit will be made use of heavily in many units of study in the areas of communication, control, electronics, and signal processing.

The following specific topics are covered: Modelling of physical systems using state space, differential equations, and transfer functions, dynamic response of linear time invariant systems and the role of system poles and zeros on it, simplification of complex systems, stability of feedback systems and their steady state performance, Routh-Hurwitz stability criterion, sketching of root locus and controller design using the root locus, Proportional, integral and derivative control, lead and lag compensators, frequency response techniques, Nyquist stability criterion, gain and phase margins, compensator design in the frequency domain, state space design for single input single-output systems, pole placement state variable feedback control and observer design.

ELEC3305
Digital Signal Processing

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs; Laboratory 2 hrs; Project Work - own time 1 hr. **Prerequisites:** ELEC2302 **Assumed knowledge:** Specifically the following concepts are assumed knowledge for this unit: familiarity with basic Algebra, Differential and Integral Calculus, continuous linear time-invariant systems and their time and frequency domain representations, Fourier transform, sampling of continuous time signals. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to teach how signals are processed by computers. It describes the key concepts of digital signal processing, including details of various transforms and filter design. Students are expected to implement and test some of these ideas on a digital signal processor (DSP). Completion of the unit will facilitate progression to advanced study in the area and to work in the industrial use of DSP.

The following topics are covered. Review of analog and digital signals. Analog to digital and digital to analog conversion. Some useful digital signals. Difference equations and filtering. Impulse and step response of filters. Convolution representation of filters. The Z-transform. Transfer functions and stability. Discrete time Fourier transform (DTFT) and frequency response of filters. Finite impulse response (FIR) filter design: windowing method. Infinite impulse response (IIR) filter design: Butterworth filters, Chebyshev filters, Elliptic filters and impulse invariant design. Discrete Fourier Transform (DFT): windowing effects. Fast Fourier Transform (FFT): decimation in time algorithm. DSP hardware.

ELEC3404
Electronic Circuit Design

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/fortnight; Laboratory 3 hrs/fortnight. **Assumed knowledge:** A background in basic electronics and circuit theory is assumed. **Assessment:** Through semester assessment (70%) Final Exam (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to teach students analysis and design techniques for electronic systems such as signal amplifiers, differential amplifiers and power amplifiers. Completion of this unit will allow progression to advanced studies or to work in electronics and telecommunication engineering.

Topics covered are as follows. The BJT and MOSFET as an amplifier. Biasing in amplifier circuits. Small signal operation and models. Single stage amplifiers. Internal capacitances and high frequency models. The frequency response of the common-emitter amplifier. Current sources and current mirrors. Differential amplifiers. Output stages and power amplifiers:class A, class B and class AB.

ELEC3702
Management for Engineers

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week. **Prohibitions:** ENGG3005, MECH3661 **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to develop an understanding of the principles and practices of industry, to provide an overview of the various issues facing an industrial organisation, and of the basic approaches to their management, to understand the changing nature and effects of globalisation on Australia`s economic performance, the competitiveness of Australian firms, and the generation of employment and wealth, to gain an insight into the importance of innovation at all levels and functions of all organisations, and of the ways of developing people-skills and organisational styles to promote innovation, to develop the broader skills required by employers of engineers, and to understand the objectives and roles appropriate to governments. The following topics are covered; Engineers and management, Microeconomics, Macroeconomics, Managerial decision analysis, Management science models, Behaviour of people in organisations, Human resource management, Strategic management, Accounting and management, Operations management, Marketing for engineers, Legal environment of business, Industrial relations.

COMP3520
Operating Systems Internals

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** COMP2129 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will provide a comprehensive dicsussion of relevant OS issues and principles and describe how those principles are put into practice in real operating systems. The contents include internal structure of OS; several ways each major aspect (process scheduling, inter-process communication, memory management, device management, file systems) can be implemented; the performance impact of design choices; case studies of common OS (Linux, MS Windows NT, etc.).

Fourth year

ELEC4702
Practical Experience

Session: Semester 1, Semester 2 **Classes:** Practical Experience, **Prerequisites:** 24 CP of senior or senior advanced units of study. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Professional practice

The Bachelor of Engineering degree requires students to obtain industrial work experience of twelve weeks (60 working days) duration towards satisfying the requirements for award of the degree. Students may undertake their work experience after completion of a minimum of 24 credit points of Year 3 units of study when they have built up a sufficient background of engineering. In general, the type of job that is acceptable for work experience should be in an engineering environment but not necessarily in the same discipline of the degree the student is pursuing. The student is required to inform the School of any work arrangements made by email.

Assessment in this unit is by the submission of a written report of about 4-6 pages on the industrial experience undertaken. The report is to describe the overall structure of the company, the areas that the student became familiar with and their relationship to the firm and, finally, what the student did. A certificate from the company stating the period of employment and the type of work you have undertaken should be attached to your report. The student should inform the company that a short report on the work experience is to be submitted to the School.

The report is to be submitted to the School electronically (see details on the course website http://www.eelab.usyd.edu.au/eLearning/elec4702.html). There is no deadline for submission of the report but it is a good practice to submit it in the first two weeks after the new semester started.

Students must enrol in 12 credit points of Thesis units.

ELEC4712
Honours Thesis A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Project Work - own time 12 hrs/week. **Prerequisites:** 36 credits of 3rd year units of study **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: Note that students require permission from the HOS to do both A and B units in the same Semester, and will have an accelerated assessment schedule. Note also that entry to Honours Thesis is by permission.

Students will work individually or in groups on an assigned project for the Semester. The concepts covered depend on the nature of the project, but broadly cover research and inquiry, and information literacy. While recognising that some projects can be interdisciplinary in nature, it is the normal expectation that the students would do the project in their chosen area of specialisation, i.e. Power Engineering, Telecommunications Engineering, Computer Engineering, and Software Engineering students would do projects in the general area of Power, Telecommunications, Computer, and Software respectively.

ELEC4713
Honours Thesis B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Project Work - own time 12 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: Note that students require permission from the HOS to do both A and B units in the same Semester, and will have an accelerated assessment schedule. Note also that entry to Honours Thesis is by permission.

Students will work individually or in groups on an assigned project for the Semester. The concepts covered depend on the nature of the project, but broadly cover research and inquiry, and information literacy.

Notes

1. The Mathematics, Physics and Information Technology units of study may be replaced by equivalent advanced level units of study (if available) subject to prerequisite conditions being met.2. Students whose EWAM is less than 65 before enrolling in ELEC4712 & ELEC4713, or at the end of their degree requirements, will receive a Pass degree.
For a standard enrolment plan for Electrical(Computer) Engineering visit cusp.sydney.edu.au/students/view-degree-page/name/BE(Elec)(Comp)

Bachelor of Engineering Honours (Electrical)

Course Overview

Electrical engineering encompasses electronic, computer systems, telecommunications, control and electrical power engineering. It is concerned with the way electrical energy is produced and used in homes, in the community and in industry. Electrical engineers design and build the systems and machines that generate, transmit, measure, control and use electrical energy essential to modern life.

The Bachelor of Engineering Honours (Electrical) is a four year degree that has foundations in physics, mathematics, computer science and basic electrical engineering principles. You will learn core skills in these areas which are developed through the course themes of electrical circuits, electronics and computer systems, signals and communications, power systems, control, energy systems and management.

Course Requirements

To meet requirements for the Bachelor of Engineering Honours(Electrical), a candidate must successfully complete 192 credit points, comprising:

1. core and elective units of study relating to the specialist stream, as prescribed by the table of units of study for the stream; and
2. any additional free elective units of study as may be necessary to gain credit to complete the award.

For a standard enrolment plan for Electrical Engineering visit cusp.sydney.edu.au/students/view-degree-page/name/BE(Elec)

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session

Bachelor of Engineering Honours (Electrical)

All candidates for the Bachelor of Engineering Honours (Electrical) (including those enrolled in a combined degree) must satisfy the requirements described in the table of core units of study.

Candidates will also need to choose a number of recommended units of study for Electrical Engineering, which consist of:

- all level 3, 4 and 5 ELEC units which do not appear in the table of core units; and
- such other units of study as may be so designated by the Head of School.

Requirements for the Bachelor of Engineering Honours (Electrical)

Candidates for the Bachelor of Engineering Honours (Electrical) are required to complete a total of not less than 192 credit points including at least 168 credit points made up of units from the table of core units and recommended units of study. The additional 24 credit points may consist, in whole or in part, of free elective units of study approved by the Head of School.

Requirements for the Bachelor of Engineering Honours (Electrical) in a combined degree

Candidates in the combined degree course of BEHons (Electrical) with the BCom, BPM or LLB are required to complete at least 144 credit points made up of units from the table of core units and recommended units of study.

Candidates in the combined degree course of BEHons (Electrical) with the BSc or BA are required to complete at least 156 credit points made up of units from the table of core units and recommended units of study.

Candidates in the combined degree course of BEHons (Electrical) with the BMedSc are required to complete at least 156 credit points made up of units from the table of core units and recommended units of study, but may choose to replace up to 12 credit points of recommended units with CHEM1101 Chemistry 1A and BIOL1001 Concepts in Biology.

Candidates in all combined degree courses shall also satisfy such other requirements for the combined course as are prescribed in the joint resolutions of the Faculty of Engineering and Information Technologies and the second faculty concerned.

Electrical Engineering core units of study

First year

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
ELEC1601 **Foundations of Computer Systems**	6	**A** HSC Mathematics extension 1 or 2	Semester 2
ENGG1805 **Professional Engineering and IT**	6		Semester 1
MATH1001 **Differential Calculus**	3	**A** HSC Mathematics Extension 1 **N** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001	Semester 1 Summer Main
MATH1002 **Linear Algebra**	3	**A** HSC Mathematics or MATH1111 **N** MATH1902, MATH1012, MATH1014	Semester 1 Summer Main
MATH1003 **Integral Calculus and Modelling**	3	**A** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **N** MATH1013, MATH1903, MATH1907	Semester 2 Summer Main
MATH1005 **Statistics**	3	**A** HSC Mathematics **N** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021	Semester 2 Summer Main Winter Main
PHYS1001 **Physics 1 (Regular)**	6	**A** HSC Physics **P** HSC Physics with a minimum mark of 65 **N** PHYS1002, EDUH1017, PHYS1901	Semester 1
PHYS1003 **Physics 1 (Technological)**	6	**A** HSC Physics or PHYS1001 or PHYS1002 or PHYS1901 or equivalent. **N** PHYS1902, PHYS1004 *It is recommended that PHYS1001 or PHYS1002 or PHYS1901 be completed before this unit*	Semester 2
INFO1103 **Introduction to Programming**	6		Semester 1 Semester 2
INFO1105 **Data Structures**	6	**P** INFO1003 or INFO1103 or INFO1903 or INFS1000	Semester 2

Second year

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
ELEC1103 **Fundamentals of Elec and Electronic Eng**	6	**A** Basic knowledge of differentiation & integration, and HSC Physics	Semester 1
ELEC2103 **Simulation & Numerical Solutions in Eng**	6	**A** ELEC1103. Understanding of the fundamental concepts and building blocks of electrical and electronics circuits and aspects of professional project management, teamwork, and ethics. **N** COSC1901, COSC1001	Semester 2
ELEC2104 **Electronic Devices and Circuits**	6	**A** Knowledge: ELEC1103. Ohm's Law and Kirchoff's Laws; action of Current and Voltage sources; network analysis and the superposition theorem; Thevenin and Norton equivalent circuits; inductors and capacitors, transient response of RL, RC and RLC circuits; the ability to use power supplies, oscilloscopes, function generators, meters, etc.	Semester 2
ELEC2302 **Signals and Systems**	6	**A** MATH1001 Differential Calculus and MATH1002 Linear Algebra and MATH1003 Integral Calculus and Modelling. Basic knowledge of differentiation & integration, differential equations, and linear algebra.	Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
ELEC2602 **Digital Logic**	6	**A** ELEC1601. This unit of study assumes some knowledge of digital data representation and basic computer organisation	Semester 1
MATH2061 **Linear Mathematics and Vector Calculus**	6	**P** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **N** MATH2961, MATH2067, MATH2901, MATH2902, MATH2001, MATH2002	Semester 1 Summer Main
PHYS2213 **Physics 2EE**	6	**A** (MATH1001 or MATH1901) and (MATH1002 or MATH1902) and (MATH1003 or MATH1903). MATH1005 or MATH1905 would also be useful **P** (PHYS1001 or PHYS1901) and (PHYS1003 or PHYS1902) **N** PHYS2902, PHYS2011, PHYS2203, PHYS2002, PHYS2901, PHYS2012, PHYS2001, PHYS2912, PHYS2911	Semester 2
COMP2129 **Operating Systems and Machine Principles**	6	**A** INFO1105 OR INFO1905. **P** INFO1103.	Semester 1
Third year			
At least 5 of the following 9 units of study:			
ELEC3104 **Engineering Electromagnetics**	6	**A** Differential calculus, integral calculus, vector integral calculus; electrical circuit theory and analysis using lumped elements; fundamental electromagnetic laws and their use in the calculation of static fields.	Semester 1
ELEC3203 **Electricity Networks**	6	**A** This unit of study assumes a competence in first year mathematics (in particular, the ability to work with complex numbers), in elementary circuit theory and in basic electromagnetics.	Semester 1
ELEC3206 **Electrical Energy Conversion Systems**	6	**A** Following concepts are assumed knowledge for this unit of study: familiarity with circuit theory, electronic devices, ac power, capacitors and inductors, and electric circuits such as three-phase circuits and circuits with switches, the use of basic laboratory equipment such as oscilloscope and power supply.	Semester 2
ELEC3304 **Control**	6	**A** Specifically the following concepts are assumed knowledge for this unit: familiarity with basic Algebra, Differential and Integral Calculus, Physics; solution of linear differential equations, Matrix Theory, eigenvalues and eigenvectors; linear electrical circuits, ideal op-amps; continuous linear time-invariant systems and their time and frequency domain representations, Laplace transform, Fourier transform. **P** MATH2061 and ELEC2302 **N** AMME3500	Semester 2
ELEC3305 **Digital Signal Processing**	6	**A** Specifically the following concepts are assumed knowledge for this unit: familiarity with basic Algebra, Differential and Integral Calculus, continuous linear time-invariant systems and their time and frequency domain representations, Fourier transform, sampling of continuous time signals. **P** ELEC2302	Semester 1
ELEC3404 **Electronic Circuit Design**	6	**A** A background in basic electronics and circuit theory is assumed.	Semester 1
ELEC3505 **Communications**	6	**A** Confidence in mathematical operation usually needed to handle telecommunications problems such as Fourier transform, fundamental in signals and systems theory, convolution, and similar techniques.	Semester 1
ELEC3607 **Embedded Systems**	6	**A** ELEC1601 AND ELEC2602. Logic operations, theorems and Boolean algebra, data representation, number operations (binary, hex, integers and floating point), combinational logic analysis and synthesis, sequential logic, registers, counters, bus systems, state machines, simple CAD tools for logic design, basic computer organisation, the CPU, peripheral devices, software organisation, machine language, assembly language, operating systems, data communications and computer networks. **P** ELEC1601 and ELEC2602	Semester 1
ELEC3702 **Management for Engineers**	6	**N** ENGG3005, MECH3661	Semester 2
Fourth year			
ELEC4702 **Practical Experience**		**P** 24 CP of senior or senior advanced units of study.	Semester 1 Semester 2
Students must enrol in 12cp of Thesis units			
ELEC4712 **Honours Thesis A**	6	**P** 36 credits of 3rd year units of study *Note: Department permission required for enrolment* *Note that students require permission from the HOS to do both A and B units in the same Semester, and will have an accelerated assessment schedule. Note also that entry to Honours Thesis is by permission.*	Semester 1 Semester 2
ELEC4713 **Honours Thesis B**	6	*Note: Department permission required for enrolment* *Note that students require permission from the HOS to do both A and B units in the same Semester, and will have an accelerated assessment schedule. Note also that entry to Honours Thesis is by permission.*	Semester 1 Semester 2
Notes			
1. The Mathematics, Physics and Information Technology units of study may be replaced by equivalent advanced level units of study (if available) subject to prerequisite conditions being met.			
2. Students whose EWAM is less than 65 before enrolling in ELEC4712 & ELEC4713, or at the end of their degree requirements, will receive a Pass degree.			

For a standard enrolment plan for Electrical Engineering visit cusp.sydney.edu.au/students/view-degree-page/name/BE(Elec)

Unit of Study Descriptions

Bachelor of Engineering Honours (Electrical)

All candidates for the Bachelor of Engineering Honours (Electrical) (including those enrolled in a combined degree) must satisfy the requirements described in the table of core units of study.Candidates will also need to choose a number of recommended units of study for Electrical Engineering, which consist of:- all level 3, 4 and 5 ELEC units which do not appear in the table of core units; and- such other units of study as may be so designated by the Head of School.

Requirements for the Bachelor of Engineering Honours (Electrical)

Candidates for the Bachelor of Engineering Honours (Electrical) are required to complete a total of not less than 192 credit points including at least 168 credit points made up of units from the table of core units and recommended units of study. The additional 24 credit points may consist, in whole or in part, of free elective units of study approved by the Head of School.

Requirements for the Bachelor of Engineering Honours (Electrical) in a combined degree

Candidates in the combined degree course of BEHons (Electrical) with the BCom, BPM or LLB are required to complete at least 144 credit points made up of units from the table of core units and recommended units of study.Candidates in the combined degree course of BEHons (Electrical) with the BSc or BA are required to complete at least 156 credit points made up of units from the table of core units and recommended units of study.Candidates in the combined degree course of BEHons (Electrical) with the BMedSc are required to complete at least 156 credit points made up of units from the table of core units and recommended units of study, but may choose to replace up to 12 credit points of recommended units with CHEM1101 Chemistry 1A and BIOL1001 Concepts in Biology.Candidates in all combined degree courses shall also satisfy such other requirements for the combined course as are prescribed in the joint resolutions of the Faculty of Engineering and Information Technologies and the second faculty concerned.

Electrical Engineering core units of study

First year

ELEC1601
Foundations of Computer Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** HSC Mathematics extension 1 or 2 **Assessment:** Through semester assessment (61%) Final Exam (39%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study introduces the fundamental digital concepts upon which the design and operation of modern digital computers are based. A prime aim of the unit is to develop a professional view of, and a capacity for inquiry into, the field of computing.

Topics covered include: data representation, basic computer organisation, the CPU, elementary gates and logic, peripheral devices, software organisation, machine language, assembly language, operating systems, data communications and computer networks.

ENGG1805
Professional Engineering and IT

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week; Project Work - own time 2 hrs. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

ENGG1805 aims to introduce students to the fundamental principles that underlie the study of engineering and information technologies. It lays the foundation for later studies, and presents to the students challenges common to a multidisciplinary engineering environment. The subject also provides students with the opportunity to develop an understanding of engineering ethics and of working as a part of a team.

Professional Engineering and IT (6CP) is composed from the following five parts: (a) Introduction to engineering: the engineer as problem solver, critical analysis of greatest engineering achievements and failure. (b) Introduction to common engineering software tools: word processors, project management tools (c) Ethics and workplace health and safety. (d) Testing - concepts of destructive and not destructive tests will be given on samples. (e) "Meet the professionals" - A selection of guest speakers will address students on the most important aspects of the engineering profession. (f) Design Process - The process of design synthesis as an important part of engineering: students will be required to complete an engineering design (from conception, to implementation and testing) maintaining proper lab notes.

MATH1001
Differential Calculus

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001 **Assumed knowledge:** HSC Mathematics Extension 1 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1001 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study looks at complex numbers, functions of a single variable, limits and continuity, vector functions and functions of two variables. Differential calculus is extended to functions of two variables. Taylor's theorem as a higher order mean value theorem.

Textbooks
As set out in the Junior Mathematics Handbook.

MATH1002
Linear Algebra

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1902, MATH1012, MATH1014 **Assumed knowledge:** HSC Mathematics or MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1002 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study introduces vectors and vector algebra, linear algebra including solutions of linear systems, matrices, determinants, eigenvalues and eigenvectors.

Textbooks
As set out in the Junior Mathematics Handbook

MATH1003
Integral Calculus and Modelling

Credit points: 3 **Session:** Semester 2, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1013, MATH1903, MATH1907 **Assumed knowledge:** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1003 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.This unit of study first develops the idea of the definite integral from Riemann sums, leading to the Fundamental Theorem of Calculus. Various techniques of integration are considered, such as integration by parts.The second part is an introduction to the use of first and second order differential equations to model a variety of scientific phenomena.

Textbooks
As set out in the Junior Mathematics Handbook

MATH1005
Statistics

Credit points: 3 **Session:** Semester 2, Summer Main, Winter Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021 **Assumed knowledge:** HSC Mathematics **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1005 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit offers a comprehensive introduction to data analysis, probability, sampling, and inference including t-tests, confidence intervals and chi-squared goodness of fit tests.

Textbooks
As set out in the Junior Mathematics Handbook

PHYS1001
Physics 1 (Regular)

Credit points: 6 **Session:** Semester 1 **Classes:** Three 1-hour lectures, one 3-hour laboratory per week for 9 weeks and one 1-hour tutorial per week. **Prerequisites:** HSC Physics with a minimum mark of 65 **Prohibitions:** PHYS1002, EDUH1017, PHYS1901 **Assumed knowledge:** HSC Physics **Assessment:** 3 hour exam plus laboratories, assignments and mid-semester tests (100%). **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for students who gained 65 marks or better in HSC Physics or equivalent.The lecture series contains three modules on the topics of mechanics, thermal physics, and oscillations and waves.

Textbooks
Young & Freedman. University Physics. 13th edition, with Mastering Physics, Addison-Wesley. 2012. Course lab manual.

PHYS1003
Physics 1 (Technological)

Credit points: 6 **Session:** Semester 2 **Classes:** Three 1-hour lectures, one 3-hour laboratory per week for 10 weeks, one 1-hour tutorial per week. **Prohibitions:** PHYS1902, PHYS1004 **Assumed knowledge:** HSC Physics or PHYS1001 or PHYS1002 or PHYS1901 or equivalent. **Assessment:** 3 hour exam plus laboratories, tutorials, and assignments (100%). **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: It is recommended that PHYS1001 or PHYS1002 or PHYS1901 be completed before this unit

This unit of study is designed for students majoring in physical and engineering sciences and emphasis is placed on applications of physical principles to the technological world. The lecture series contains modules on the topics of fluids, electromagnetism, and quantum physics.

Textbooks
Young & Freedman. University Physics. 13th edition, with Mastering Physics. Addison-Wesley. Course lab manual.

INFO1103
Introduction to Programming

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Laboratory 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Programming in a legible, maintainable, reusable way is essential to solve complex problems in the pervasive computing environments. This unit will equip students with foundation of programming concepts that are common to widely used programming languages. The "fundamentals-first & objects-later" strategy is used to progressively guide this introductory unit from necessary and important building blocks of programming to the object-oriented approach. Java, one of the most popular programming languages, is used in this unit. It provides interdisciplinary approaches, applications and examples to support students from broad backgrounds such as science, engineering, and mathematics.

INFO1105
Data Structures

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1003 or INFO1103 or INFO1903 or INFS1000 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will teach some powerful ideas that are central to quality software: data abstraction and recursion. It will also show how one can analyse the scalability of algorithms using mathematical tools of asymptotic notation. Contents include: both external "interface" view, and internal "implementation" details, for commonly used data structures, including lists, stacks, queues, priority queues, search trees, hash tables, and graphs; asymptotic analysis of algorithm scalability, including use of recurrence relations to analyse recursive code. This unit covers the way information is represented in each structure, algorithms for manipulating the structure, and analysis of asymptotic complexity of the operations. Outcomes include: ability to write code that recursively performs an operation on a data structure; experience designing an algorithmic solution to a problem using appropriate data structures, coding the solution, and analysing its complexity.

Second year

ELEC1103
Fundamentals of Elec and Electronic Eng

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Basic knowledge of differentiation & integration, and HSC Physics **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to develop knowledge of the fundamental concepts and building blocks of electrical and electronics circuits.This is a foundation unit in circuit theory. Circuit theory is the electrical engineer's fundamental tool.

The concepts learnt in this unit will be made use of heavily in many units of study (in later years) in the areas of electronics, instrumentation, electrical machines, power systems, communication systems, and signal processing.

Topics: a) Basic electrical and electronic circuit concepts: Circuits, circuit elements, circuit laws, node and mesh analysis, circuit theorems, energy storage, capacitors and inductors, circuits with switches, transient response, sine waves and complex analysis, phasors, impedance, ac power.; b) Project management, teamwork, ethics; c) Safety issues

ELEC2103
Simulation & Numerical Solutions in Eng

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 1 hr/week; Laboratory 3 hrs/week; Project Work - own time 3 hrs/week. **Prohibitions:** COSC1901, COSC1001 **Assumed knowledge:** ELEC1103. Understanding of the fundamental concepts and building blocks of electrical and electronics circuits and aspects of professional project management, teamwork, and ethics.

Assessment: Through semester assessment (25%) Final Exam (75%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Objectives:

* How to apply the software package Matlab to achieve engineering solutions

* Critical assessment of various computer numerical techniques

* Professional project management, teamwork, ethics

This unit assumes an understanding of the fundamental concepts and building blocks of electrical and electronics circuits. As well as covering the specific topics described in the following paragraphs, it aims to develop skills in professional project management and teamwork and promote an understanding of ethics.

Basic features of Matlab. The Matlab desktop. Interactive use with the command window. Performing arithmetic, using complex numbers and mathematical functions. Writing script and function m-files. Matrix manipulations. Control flow. Two dimensional graphics. Application of Matlab to simple problems from circuit theory, electronics, signals and systems and control. Investigation of the steady state and transient behaviour of LCR circuits.

Matlab based numerical solutions applicable to numerical optimization, ordinary differential equations, and data fitting. Introduction to symbolic mathematics in Matlab. Applications, including the derivation of network functions for simple problems in circuit analysis. Introduction to the use of Simulink for system modelling and simulation.

ELEC2104
Electronic Devices and Circuits

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/fortnight; Laboratory 3 hrs/fortnight **Assumed knowledge:** Knowledge: ELEC1103. Ohm's Law and Kirchoff's Laws; action of Current and Voltage sources; network analysis and the superposition theorem; Thevenin and Norton equivalent circuits; inductors and capacitors, transient response of RL, RC and RLC circuits; the ability to use power supplies, oscilloscopes, function generators, meters, etc. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Modern Electronics has come to be known as microelectronics which refers to the Integrated Circuits (ICs) containing millions of discrete devices. This course introduces some of the basic electronic devices like diodes and different types of transistors. It also aims to introduce students the analysis and design techniques of circuits involving these discrete devices as well as the integrated circuits.

Completion of this course is essential to specialize in Electrical, Telecommunication or Computer Engineering stream. The knowledge of ELEC1103 is assumed.

ELEC2302
Signals and Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/week; E-Learning 1 hr/week. **Assumed knowledge:** MATH1001 Differential Calculus and MATH1002 Linear Algebra and MATH1003 Integral Calculus and Modelling. Basic knowledge of differentiation & integration, differential equations, and linear algebra. **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to teach some of the basic properties of many engineering signals and systems and the necessary mathematical tools that aid in this process. The particular emphasis is on the time and frequency domain modeling of linear time invariant systems. The concepts learnt in this unit will be heavily used in many units of study (in later years) in the areas of communication, control, power systems and signal processing. A basic knowledge of differentiation and integration, differential equations, and linear algebra is assumed.

ELEC2602
Digital Logic

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week; Laboratory pre-work 2 hrs/week. **Assumed knowledge:** ELEC1601. This unit of study assumes some knowledge of digital data representation and basic computer organisation **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The purpose of this unit is to equip the students with the skills to design simple digital logic circuits which comprise modules of larger digital systems.

The following topics are covered: logic operations, theorems and Boolean algebra, number operations (binary, hex, integer and floating point), combinational logic analysis and synthesis, sequential logic, registers, counters, bus systems, state machines, simple CAD tools for logic design, and the design of a simple computer.

MATH2061
Linear Mathematics and Vector Calculus

Credit points: 6 **Session:** Semester 1, Summer Main **Classes:** Three 1 hour lectures, one 1 hour tutorial and one 1 hour practice class per week. **Prerequisites:** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **Prohibitions:** MATH2961, MATH2067, MATH2901, MATH2902, MATH2001, MATH2002 **Assessment:** One 2 hour exam, assignments, quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit starts with an investigation of linearity: linear functions, general principles relating to the solution sets of homogeneous and inhomogeneous linear equations (including differential equations), linear independence and the dimension of a linear space. The study of eigenvalues and eigenvectors, begun in junior level linear algebra, is extended and developed. The unit then moves on to topics from vector calculus, including vector-valued functions (parametrised curves and surfaces; vector fields; div, grad and curl; gradient fields and potential functions), line integrals (arc length; work; path-independent integrals and conservative fields; flux across a curve), iterated integrals (double and triple integrals; polar, cylindrical and spherical coordinates; areas, volumes and mass; Green's Theorem), flux integrals (flow through a surface; flux integrals through a surface defined by a function of two variables, though cylinders, spheres and parametrised surfaces), Gauss' Divergence Theorem and Stokes' Theorem.

PHYS2213
Physics 2EE

Credit points: 6 **Session:** Semester 2 **Classes:** Three 1 hour lectures per week; one 2 hour computational laboratory per week for 10 weeks. **Prerequisites:** (PHYS1001 or PHYS1901) and (PHYS1003 or PHYS1902) **Prohibitions:** PHYS2902, PHYS2011, PHYS2203, PHYS2002, PHYS2901, PHYS2012, PHYS2001, PHYS2912, PHYS2911 **Assumed knowledge:** (MATH1001 or MATH1901) and (MATH1002 or MATH1902) and (MATH1003 or MATH1903). MATH1005 or MATH1905 would also be useful **Assessment:** One 3 hour exam, one 1-hour computational test, assignments, computational lab work (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is designed to build on the knowledge gained in Junior Physics, to provide Electrical Engineering students with the knowledge of relevant topics of Physics at the Intermediate level, and with associated skills. Completion of the unit provides a solid foundation for further studies in Electrical Engineering and related engineering areas. The aims of this unit are linked to the generic attributes required of graduates of the University in knowledge skills, thinking skills, personal skills and attributes, and practical skills. By the end of this unit of study, students will be able to describe and apply concepts in optics, electromagnetism and basic solid state physics and technology at the Intermediate level. They will be able to use computational techniques to analyze optics problems. The modules in this unit of study are: Optics (13 lectures): The wave nature of light, optical phenomena and the interaction of light with matter: interference and diffraction effects; fundamental limits to resolution of optical instruments; polarisation; dispersion; coherence. These are presented within the context of several key optical technologies including lasers, CD/DVD players, optical fibre communication systems, gratings and Mach Zehnder modulation. Electromagnetic Properties of Matter (12 lectures): Electric and magnetic effects in materials; the combination of electric and magnetic fields to produce light and other electromagnetic waves in vacuum and matter. Solid State and Device Physics (13 lectures): Introduction to quantum mechanics, Fermi-Dirac statistics, electronic properties of solids (metal, semiconductors & insulators), doping and the semiconductor PN junction; introduction to nanotechnology; fabrication technologies, nano-imaging technologies, nanoelectronics. Computational Physics (10 sessions of 2 hours each): In a computing laboratory students use Matlab-based simulation software to conduct virtual experiments in optics, which illustrate and extend the relevant lectures. Students also gain experience in the use of computers to solve problems in physics.

Textbooks

Notes published by the School of Physics: - Physics 2EE Computational Physics Optics Notes - Physics 2EE Electromagnetic Properties of Matter Notes - Physics 2EE Solid State and Device Physics Notes Other relevant texts: see the Unit of Study outline.

COMP2129
Operating Systems and Machine Principles

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1103. **Assumed knowledge:** INFO1105 OR INFO1905. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

In this unit of study elementary methods for developing robust, efficient, and re-usable software will be covered. The unit is taught in C, in a Unix environment. Specific coding topics include memory management, the pragmatic aspects of implementing data structures such as lists and hash tables and managing concurrent threads. Debugging tools and techniques are discussed and common programming errors are considered along with defensive programming techniques to avoid such errors. Emphasis is placed on using common Unix tools to manage aspects of the software construction process, such as version control and regression testing. The subject is taught from a practical viewpoint and it includes a considerable amount of programming practice.

Third year

At least 5 of the following 9 units of study:

ELEC3104
Engineering Electromagnetics

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Differential calculus, integral calculus, vector integral calculus; electrical circuit theory and analysis using lumped elements; fundamental electromagnetic laws and their use in the calculation of static fields. **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces students to the broad spectrum of engineering electromagnetics and helps students to develop theoretical and analytical skills in the area of electrical and telecommunications engineering and develop understanding of the basic electromagnetic theory underpinning optical communications, wireless communications and electrical engineering.

ELEC3203
Electricity Networks

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** This unit of study assumes a competence in first year mathematics (in particular, the ability to work with complex numbers), in elementary circuit theory and in basic electromagnetics. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study provides an introduction to electrical power engineering and lays the groundwork for more specialised units. It assumes a competence in first year mathematics (in particular, the ability to work with complex numbers), in elementary circuit theory and in elements of introductory physics. A revision will be carried out of the use of phasors in steady state ac circuit analysis and of power factor and complex power. The unit comprises an overview of modern electric power system with particular emphasis on generation and transmission. The following specific topics are covered. The use of three phase systems and their analysis under balanced conditions. Transmission lines: calculation of parameters, modelling, analysis. Transformers: construction, equivalent circuits. Generators: construction, modelling for steady state operation. The use of per unit system. The analysis of systems with a number of voltage levels. The load flow problem: bus and impedance matrices, solution methods. Power system transient stability. The control of active and reactive power. Electricity markets, market structures and economic dispatch. Types of electricity grids, radial, mesh, networks. Distribution systems and smart grids.

ELEC3206
Electrical Energy Conversion Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs; Laboratory 3 hrs; Project Work - own time 3 hrs. **Assumed knowledge:** Following concepts are assumed knowledge for this unit of study: familiarity with circuit theory, electronic devices, ac power, capacitors and inductors, and electric circuits such as three-phase circuits and circuits with switches, the use of basic laboratory equipment such as oscilloscope and power supply. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to give students a good understanding of electrical energy conversion techniques and equipment.

Students who successfully complete this unit will

1) have a broad view of electrical energy conversion systems including transformers, DC machines, induction machines and synchronous machines;

2) be able to analyze and solve problems in transformers and electric machines;

3) have gained confidence in their ability to undertake more advanced study in the power area.

The following specific topics are covered: magnetic circuits, inductance, sinusoidal excitation, hysteresis and eddy current loss, permanent magnets, electromechanical energy conversion, singly-excited and doubly-excited systems, transformers, single-phase, equivalent circuit parameters, three-phase transformers, autotransformers, DC machines, separate excitation, shunt excitation, series excitation, and compound excitation, efficiency, armature reaction, induction machines, revolving field, equivalent circuit, squirrel cage machines, measurements of the parameters, DC resistance test, no-load test, blocked-rotor test, synchronous machines, field relationships, power-angle relationships, salient pole machines.

ELEC3304
Control

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs. **Prerequisites:** MATH2061 and ELEC2302 **Prohibitions:** AMME3500 **Assumed knowledge:** Specifically the following concepts are assumed knowledge for this unit: familiarity with basic Algebra, Differential and Integral Calculus, Physics; solution of linear differential equations, Matrix Theory, eigenvalues and eigenvectors; linear electrical circuits, ideal op-amps; continuous linear time-invariant systems and their time and frequency domain representations, Laplace transform, Fourier transform. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit is mainly concerned with the application of feedback control to continuous-time, linear time-invariant systems. It aims to give the students an appreciation of the possibilities in the design of control and automation in a range of application areas. The concepts learnt in this unit will be made use of heavily in many units of study in the areas of communication, control, electronics, and signal processing.

The following specific topics are covered: Modelling of physical systems using state space, differential equations, and transfer functions, dynamic response of linear time invariant systems and the role of system poles and zeros on it, simplification of complex systems, stability of feedback systems and their steady state performance, Routh-Hurwitz stability criterion, sketching of root locus and controller design using the root locus, Proportional, integral and derivative control, lead and lag compensators, frequency response techniques, Nyquist stability criterion, gain and phase margins, compensator design in the frequency domain, state space design for single input single-output systems, pole placement state variable feedback control and observer design.

ELEC3305
Digital Signal Processing

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs; Laboratory 2 hrs; Project Work - own time 1 hr. **Prerequisites:** ELEC2302 **Assumed knowledge:** Specifically the following concepts are assumed knowledge for this unit: familiarity with basic Algebra, Differential and Integral Calculus, continuous linear time-invariant systems and their time and frequency domain representations, Fourier transform, sampling of continuous time signals. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to teach how signals are processed by computers. It describes the key concepts of digital signal processing, including details of various transforms and filter design. Students are expected to implement and test some of these ideas on a digital signal processor (DSP). Completion of the unit will facilitate progression to advanced study in the area and to work in the industrial use of DSP.

The following topics are covered. Review of analog and digital signals. Analog to digital and digital to analog conversion. Some useful digital signals. Difference equations and filtering. Impulse and step response of filters. Convolution representation of filters. The Z-transform. Transfer functions and stability. Discrete time Fourier transform (DTFT) and frequency response of filters. Finite impulse response (FIR) filter design: windowing method. Infinite impulse response (IIR) filter design: Butterworth filters, Chebyshev filters, Elliptic filters and impulse invariant design. Discrete Fourier Transform (DFT): windowing effects. Fast Fourier Transform (FFT): decimation in time algorithm. DSP hardware.

ELEC3404
Electronic Circuit Design

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/fortnight; Laboratory 3 hrs/fortnight. **Assumed knowledge:** A background in basic electronics and circuit theory is assumed. **Assessment:** Through semester assessment (70%) Final Exam (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to teach students analysis and design techniques for electronic systems such as signal amplifiers, differential amplifiers and power amplifiers. Completion of this unit will allow progression to advanced studies or to work in electronics and telecommunication engineering.

Topics covered are as follows. The BJT and MOSFET as an amplifier. Biasing in amplifier circuits. Small signal operation and models. Single stage amplifiers. Internal capacitances and high frequency models. The frequency response of the common-emitter amplifier. Current sources and current mirrors. Differential amplifiers. Output stages and power amplifiers:class A, class B and class AB.

ELEC3505
Communications

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/fortnight; Tutorial 3 hrs/fortnight. **Assumed knowledge:** Confidence in mathematical operation usually needed to handle telecommunications problems such as Fourier transform, fundamental in signals and systems theory, convolution, and similar techniques. **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is an intermediate unit of study in telecommunications following on the general concepts studied in earlier units such as Signal and Systems and leading on to more advanced units such as Digital Communication Systems. Student will learn how to critically design and evaluate digital communication systems including the elements of a digital transmission system, understand the limitations of communications channels, different analog and digital modulation schemes and reasons to use digital techniques instead of analog, and the effect of noise and interference in performance of the digital communication systems. On completion of this unit, students will have sufficient knowledge of the physical channel of a telecommunications network to approach the study of higher layers of the network stack.

The following topics are covered. Introduction to communications systems, random signals and stochastic process, components, signals and channels, sampling, quantization, pulse amplitude modulation (PAM), pulse code modulation (PCM), quantization noise, time division multiplexing, delta modulation. Digital communications: baseband signals, digital PAM, eye diagram, equalization, correlative coding, error probabilities in baseband digital transmission, bandpass transmission, digital amplitude shift keying (ASK), frequency shift keying (FSK), phase shift keying (PSK) and quadrature shift keying (QPSK), error probabilities in bandpass digital transmission, a case study of digital communication systems. Introduction to information theory: fundamental limits in communications, channel capacity and channel coding, signal compression.

ELEC3607
Embedded Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week. **Prerequisites:** ELEC1601 and ELEC2602 **Assumed knowledge:** ELEC1601 AND ELEC2602. Logic operations, theorems and Boolean algebra, data representation, number operations (binary, hex, integers and floating point), combinational logic analysis and synthesis, sequential logic, registers, counters, bus systems, state machines, simple CAD tools for logic design, basic computer organisation, the CPU, peripheral devices, software organisation, machine language, assembly language, operating systems, data communications and computer networks. **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Embedded systems have become pervasive in modern society. The aim of this unit of study is to teach students about embedded systems architecture, design methodology, interfacing and programming. Topics covered include peripheral devices, interrupts, direct memory access (DMA), assembly language, communications and data acquisition. A major design project is part of this course.

ELEC3702
Management for Engineers

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week. **Prohibitions:** ENGG3005, MECH3661 **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to develop an understanding of the principles and practices of industry, to provide an overview of the various issues facing an industrial organisation, and of the basic approaches to their management, to understand the changing nature and effects of globalisation on Australia`s economic performance, the competitiveness of Australian firms, and the generation of employment and wealth, to gain an insight into the importance of innovation at all levels and functions of all organisations, and of the ways of developing people-skills and organisational styles to promote innovation, to develop the broader skills required by employers of engineers, and to understand the objectives and roles appropriate to governments. The following topics are covered; Engineers and management, Microeconomics, Macroeconomics, Managerial decision analysis, Management science models, Behaviour of people in organisations, Human resource management, Strategic management, Accounting and management, Operations management, Marketing for engineers, Legal environment of business, Industrial relations.

Fourth year

ELEC4702
Practical Experience

Session: Semester 1, Semester 2 **Classes:** Practical Experience, **Prerequisites:** 24 CP of senior or senior advanced units of study. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Professional practice

The Bachelor of Engineering degree requires students to obtain industrial work experience of twelve weeks (60 working days) duration towards satisfying the requirements for award of the degree. Students may undertake their work experience after completion of a minimum of 24 credit points of Year 3 units of study when they have built up a sufficient background of engineering. In general, the type of job that is acceptable for work experience should be in an engineering environment but not necessarily in the same discipline of the degree the student is pursuing. The student is required to inform the School of any work arrangements made by email.

Assessment in this unit is by the submission of a written report of about 4-6 pages on the industrial experience undertaken. The report is to describe the overall structure of the company, the areas that the student became familiar with and their relationship to the firm and, finally, what the student did. A certificate from the company stating the period of employment and the type of work you have undertaken should be attached to your report. The student should inform the company that a short report on the work experience is to be submitted to the School.

The report is to be submitted to the School electronically (see details on the course website http://www.eelab.usyd.edu.au/eLearning/elec4702.html). There is no deadline for submission of the report but it is a good practice to submit it in the first two weeks after the new semester started.

Students must enrol in 12cp of Thesis units

ELEC4712
Honours Thesis A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Project Work - own time 12 hrs/week. **Prerequisites:** 36 credits of 3rd year units of study **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: Note that students require permission from the HOS to do both A and B units in the same Semester, and will have an accelerated assessment schedule. Note also that entry to Honours Thesis is by permission.

Students will work individually or in groups on an assigned project for the Semester. The concepts covered depend on the nature of the project, but broadly cover research and inquiry, and information literacy. While recognising that some projects can be interdisciplinary in nature, it is the normal expectation that the students would do the project in their chosen area of specialisation, i.e. Power Engineering, Telecommunications Engineering, Computer Engineering, and Software Engineering students would do projects in the general area of Power, Telecommunications, Computer, and Software respectively.

ELEC4713
Honours Thesis B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Project Work - own time 12 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: Note that students require permission from the HOS to do both A and B units in the same Semester, and will have an accelerated assessment schedule. Note also that entry to Honours Thesis is by permission.

Students will work individually or in groups on an assigned project for the Semester. The concepts covered depend on the nature of the project, but broadly cover research and inquiry, and information literacy.

Notes

1. The Mathematics, Physics and Information Technology units of study may be replaced by equivalent advanced level units of study (if available) subject to prerequisite conditions being met.2. Students whose EWAM is less than 65 before enrolling in ELEC4712 & ELEC4713, or at the end of their degree requirements, will receive a Pass degree.

For a standard enrolment plan for Electrical Engineering visit cusp.sydney.edu.au/students/view-degree-page/name/BE(Elec)

Bachelor of Engineering Honours (Electrical) (Power)

Course Overview

The Bachelor of Engineering Honours (Electrical) (Power) has been designed in consultation with key industrial partners, and is complemented with real-world project work. The projects offered include the protection of industrial and power plants, as well as transmission and distribution networks.

You will complete foundation study in physics, mathematics, computer science and basic electrical engineering principles. Your further study will be completed in the areas of electrical circuits, electronics and computer systems, signals and communications, power systems, control, energy systems and management.

Power engineers plan, design, construct, operate and maintain power systems and equipment. This is the infrastructure that generates, transports and distributes electricity, the heartbeat of modern society. As an electrical engineering graduate with a specialisation in power, you may pursue a career with major corporations and government departments involved with providing and using electrical power, or conduct research on developing alternative power sources such as solar and wind energy.

Course Requirements

To meet requirements for the Bachelor of Engineering Honours (Electrical) (Power), a candidate must successfully complete 192 credit points, comprising:

1. core and elective units of study relating to the specialist stream, as prescribed by the table of units of study for the stream; and
2. any additional free elective units of study as may be necessary to gain credit to complete the award.

For a standard enrolment plan for Electrical(Power) Engineering visit http://cusp.sydney.edu.au/students/view-degree-page/name/BE(Elec)(Power)

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Bachelor of Engineering Honours (Electrical) (Power)			
All candidates for the Bachelor of Engineering Honours (Electrical) (Power) (including those enrolled in a combined degree) must satisfy the requirements described in the table of core units of study. Candidates will also need to choose a number of recommended units of study for Electrical Engineering (Power), which consist of: - all level 3, 4 and 5 ELEC units which do not appear in the table of core units; and - such other units of study as may be so designated by the Head of School.			
Requirements for the Bachelor of Engineering Honours (Electrical) (Power)			
Candidates for the Bachelor of Engineering Honours (Electrical) (Power) are required to complete a total of not less than 192 credit points including at least 168 credit points made up of units from the table of core units and recommended units of study. The additional 24 credit points may consist, in whole or in part, of free elective units of study approved by the Head of School.			
Requirements for the Bachelor of Engineering Honours (Electrical) (Power) in a combined degree			
Candidates for the Bachelor of Electrical Engineering Honours (Electrical) (Power) combined with the Bachelor of Commerce, Bachelor of Project Management or Bachelor of Law are required to complete at least 144 credit points made up of units from the table of core units and recommended units of study. Candidates for the Bachelor of Electrical Engineering Honours (Electrical) (Power) combined with the Bachelor of Science or Bachelor of Arts are required to complete at least 156 credit points made up of units from the table of core units and recommended units of study. Candidates for the Bachelor of Electrical Engineering Honours (Electrical) (Power) combined with the Bachelor of Medical Science are required to complete at least 156 credit points made up of units from the table of core units and recommended units of study, but may choose to replace up to 12 credit points of recommended units with CHEM1101 Chemistry 1A and BIOL1001 Concepts in Biology. Candidates in all combined degree courses shall also satisfy such other requirements as are prescribed in the joint resolutions of the Faculty of Engineering and Information Technologies and the second faculty concerned.			
Electrical Engineering (Power) core units of study			
First year			
ELEC1601 **Foundations of Computer Systems**	6	**A** HSC Mathematics extension 1 or 2	Semester 2
ENGG1805 **Professional Engineering and IT**	6		Semester 1
MATH1001 **Differential Calculus**	3	**A** HSC Mathematics Extension 1 **N** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001	Semester 1 Summer Main
MATH1002 **Linear Algebra**	3	**A** HSC Mathematics or MATH1111 **N** MATH1902, MATH1012, MATH1014	Semester 1 Summer Main
MATH1003 **Integral Calculus and Modelling**	3	**A** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **N** MATH1013, MATH1903, MATH1907	Semester 2 Summer Main
MATH1005 **Statistics**	3	**A** HSC Mathematics **N** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021	Semester 2 Summer Main Winter Main
PHYS1001 **Physics 1 (Regular)**	6	**A** HSC Physics **P** HSC Physics with a minimum mark of 65 **N** PHYS1002, EDUH1017, PHYS1901	Semester 1
PHYS1003 **Physics 1 (Technological)**	6	**A** HSC Physics or PHYS1001 or PHYS1002 or PHYS1901 or equivalent. **N** PHYS1902, PHYS1004 *It is recommended that PHYS1001 or PHYS1002 or PHYS1901 be completed before this unit*	Semester 2
INFO1103 **Introduction to Programming**	6		Semester 1 Semester 2
INFO1105 **Data Structures**	6	**P** INFO1003 or INFO1103 or INFO1903 or INFS1000	Semester 2
Second year			
ELEC1103 **Fundamentals of Elec and Electronic Eng**	6	**A** Basic knowledge of differentiation & integration, and HSC Physics	Semester 1
ELEC2103 **Simulation & Numerical Solutions in Eng**	6	**A** ELEC1103. Understanding of the fundamental concepts and building blocks of electrical and electronics circuits and aspects of professional project management, teamwork, and ethics. **N** COSC1901, COSC1001	Semester 2
ELEC2104 **Electronic Devices and Circuits**	6	**A** Knowledge: ELEC1103. Ohm's Law and Kirchoff's Laws; action of Current and Voltage sources; network analysis and the superposition theorem; Thevenin and Norton equivalent circuits; inductors and capacitors, transient response of RL, RC and RLC circuits; the ability to use power supplies, oscilloscopes, function generators, meters, etc.	Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
ELEC2302 **Signals and Systems**	6	**A** MATH1001 Differential Calculus and MATH1002 Linear Algebra and MATH1003 Integral Calculus and Modelling. Basic knowledge of differentiation & integration, differential equations, and linear algebra.	Semester 2
ELEC2602 **Digital Logic**	6	**A** ELEC1601. This unit of study assumes some knowledge of digital data representation and basic computer organisation	Semester 1
MATH2061 **Linear Mathematics and Vector Calculus**	6	**P** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **N** MATH2961, MATH2067, MATH2901, MATH2902, MATH2001, MATH2002	Semester 1 Summer Main
PHYS2213 **Physics 2EE**	6	**A** (MATH1001 or MATH1901) and (MATH1002 or MATH1902) and (MATH1003 or MATH1903). MATH1005 or MATH1905 would also be useful **P** (PHYS1001 or PHYS1901) and (PHYS1003 or PHYS1902) **N** PHYS2902, PHYS2011, PHYS2203, PHYS2002, PHYS2901, PHYS2012, PHYS2001, PHYS2912, PHYS2911	Semester 2
COMP2129 **Operating Systems and Machine Principles**	6	**A** INFO1105 OR INFO1905. **P** INFO1103.	Semester 1
Third year			
ELEC3203 **Electricity Networks**	6	**A** This unit of study assumes a competence in first year mathematics (in particular, the ability to work with complex numbers), in elementary circuit theory and in basic electromagnetics.	Semester 1
ELEC3204 **Power Electronics and Applications**	6	**A** 1. Differential equations, linear algebra, complex variables, analysis of linear circuits. 2. Fourier theory applied to periodic and non-periodic signals. 3. Software such as MATLAB to perform signal analysis and filter design. 4. Familiarity with the use of basic laboratory equipment such as oscilloscope, function generator, power supply, etc. 5. Basic electric circuit theory and analysis **P** ELEC2104	Semester 1
ELEC3206 **Electrical Energy Conversion Systems**	6	**A** Following concepts are assumed knowledge for this unit of study: familiarity with circuit theory, electronic devices, ac power, capacitors and inductors, and electric circuits such as three-phase circuits and circuits with switches, the use of basic laboratory equipment such as oscilloscope and power supply.	Semester 2
ELEC3304 **Control**	6	**A** Specifically the following concepts are assumed knowledge for this unit: familiarity with basic Algebra, Differential and Integral Calculus, Physics; solution of linear differential equations, Matrix Theory, eigenvalues and eigenvectors; linear electrical circuits, ideal op-amps; continuous linear time-invariant systems and their time and frequency domain representations, Laplace transform, Fourier transform. **P** MATH2061 and ELEC2302 **N** AMME3500	Semester 2
Fourth year			
ELEC4702 **Practical Experience**		**P** 24 CP of senior or senior advanced units of study.	Semester 1 Semester 2
ELEC5204 **Power Systems Analysis and Protection**	6	**A** The unit assumes basic knowledge of circuits, familiarity with basic mathematics, competence with basic circuit theory and an understanding of three phase systems, transformers, transmission lines and associated modeling and operation of such equipment.	Semester 1
ELEC5205 **High Voltage Engineering**	6	**A** The following previous knowledge is assumed for this unit. Circuit analysis techniques, electricity networks, power system fundamentals. **P** ELEC3203 OR ELEC9203	Semester 2
Students must enrol in 12 credit points of Thesis units.			
ELEC4712 **Honours Thesis A**	6	**P** 36 credits of 3rd year units of study *Note: Department permission required for enrolment* *Note that students require permission from the HOS to do both A and B units in the same Semester, and will have an accelerated assessment schedule. Note also that entry to Honours Thesis is by permission.*	Semester 1 Semester 2
ELEC4713 **Honours Thesis B**	6	*Note: Department permission required for enrolment* *Note that students require permission from the HOS to do both A and B units in the same Semester, and will have an accelerated assessment schedule. Note also that entry to Honours Thesis is by permission.*	Semester 1 Semester 2
Notes			
1. The Mathematics, Physics and Information Technology units of study may be replaced by equivalent advanced level units of study (if available) subject to prerequisite conditions being met.			
2. Students whose EWAM is less than 65 before enrolling in ELEC4712 & ELEC4713, or at the end of their degree requirements, will receive a Pass degree.			

For a standard enrolment plan for Electrical(Power) Engineering visit http://cusp.sydney.edu.au/students/view-degree-page/name/BE(Elec)(Power)

Unit of Study Descriptions

Bachelor of Engineering Honours (Electrical) (Power)

All candidates for the Bachelor of Engineering Honours (Electrical) (Power) (including those enrolled in a combined degree) must satisfy the requirements described in the table of core units of study.Candidates will also need to choose a number of recommended units of study for Electrical Engineering (Power), which consist of: - all level 3, 4 and 5 ELEC units which do not appear in the table of core units; and - such other units of study as may be so designated by the Head of School.

Requirements for the Bachelor of Engineering Honours (Electrical) (Power)

Candidates for the Bachelor of Engineering Honours (Electrical) (Power) are required to complete a total of not less than 192 credit points including at least 168 credit points made up of units from the table of core units and recommended units of study. The additional 24 credit points may consist, in whole or in part, of free elective units of study approved by the Head of School.

Requirements for the Bachelor of Engineering Honours (Electrical) (Power) in a combined degree

Candidates for the Bachelor of Electrical Engineering Honours (Electrical) (Power) combined with the Bachelor of Commerce, Bachelor of Project Management or Bachelor of Law are required to complete at least 144 credit points made up of units from the table of core units and recommended units of study.Candidates for the Bachelor of Electrical Engineering Honours (Electrical) (Power) combined with the Bachelor of Science or Bachelor of Arts are required to complete at least 156 credit points made up of units from the table of core units and recommended units of study.Candidates for the Bachelor of Electrical Engineering Honours (Electrical) (Power) combined with the Bachelor of Medical Science are required to complete at least 156 credit points made up of units from the table of core units and recommended units of study, but may choose to replace up to 12 credit points of recommended units with CHEM1101 Chemistry 1A and BIOL1001 Concepts in Biology.Candidates in all combined degree courses shall also satisfy such other requirements as are prescribed in the joint resolutions of the Faculty of Engineering and Information Technologies and the second faculty concerned.

Electrical Engineering (Power) core units of study

First year

ELEC1601
Foundations of Computer Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** HSC Mathematics extension 1 or 2 **Assessment:** Through semester assessment (61%) Final Exam (39%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study introduces the fundamental digital concepts upon which the design and operation of modern digital computers are based. A prime aim of the unit is to develop a professional view of, and a capacity for inquiry into, the field of computing.

Topics covered include: data representation, basic computer organisation, the CPU, elementary gates and logic, peripheral devices, software organisation, machine language, assembly language, operating systems, data communications and computer networks.

ENGG1805
Professional Engineering and IT

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week; Project Work - own time 2 hrs. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

ENGG1805 aims to introduce students to the fundamental principles that underlie the study of engineering and information technologies. It lays the foundation for later studies, and presents to the students challenges common to a multidisciplinary engineering environment. The subject also provides students with the opportunity to develop an understanding of engineering ethics and of working as a part of a team.

Professional Engineering and IT (6CP) is composed from the following five parts: (a) Introduction to engineering: the engineer as problem solver, critical analysis of greatest engineering achievements and failure. (b) Introduction to common engineering software tools: word processors, project management tools (c) Ethics and workplace health and safety. (d) Testing - concepts of destructive and not destructive tests will be given on samples. (e) "Meet the professionals" - A selection of guest speakers will address students on the most important aspects of the engineering profession. (f) Design Process - The process of design synthesis as an important part of engineering: students will be required to complete an engineering design (from conception, to implementation and testing) maintaining proper lab notes.

MATH1001
Differential Calculus

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001 **Assumed knowledge:** HSC Mathematics Extension 1 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1001 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study looks at complex numbers, functions of a single variable, limits and continuity, vector functions and functions of two variables. Differential calculus is extended to functions of two variables. Taylor's theorem as a higher order mean value theorem.

Textbooks
As set out in the Junior Mathematics Handbook.

MATH1002
Linear Algebra

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1902, MATH1012, MATH1014 **Assumed knowledge:** HSC Mathematics or MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1002 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study introduces vectors and vector algebra, linear algebra including solutions of linear systems, matrices, determinants, eigenvalues and eigenvectors.

Textbooks

As set out in the Junior Mathematics Handbook

MATH1003
Integral Calculus and Modelling

Credit points: 3 **Session:** Semester 2, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1013, MATH1903, MATH1907 **Assumed knowledge:** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1003 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.This unit of study first develops the idea of the definite integral from Riemann sums, leading to the Fundamental Theorem of Calculus. Various techniques of integration are considered, such as integration by parts.The second part is an introduction to the use of first and second order differential equations to model a variety of scientific phenomena.

Textbooks

As set out in the Junior Mathematics Handbook

MATH1005
Statistics

Credit points: 3 **Session:** Semester 2, Summer Main, Winter Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021 **Assumed knowledge:** HSC Mathematics **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1005 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit offers a comprehensive introduction to data analysis, probability, sampling, and inference including t-tests, confidence intervals and chi-squared goodness of fit tests.

Textbooks

As set out in the Junior Mathematics Handbook

PHYS1001
Physics 1 (Regular)

Credit points: 6 **Session:** Semester 1 **Classes:** Three 1-hour lectures, one 3-hour laboratory per week for 9 weeks and one 1-hour tutorial per week. **Prerequisites:** HSC Physics with a minimum mark of 65 **Prohibitions:** PHYS1002, EDUH1017, PHYS1901 **Assumed knowledge:** HSC Physics **Assessment:** 3 hour exam plus laboratories, assignments and mid-semester tests (100%). **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for students who gained 65 marks or better in HSC Physics or equivalent.The lecture series contains three modules on the topics of mechanics, thermal physics, and oscillations and waves.

Textbooks

Young & Freedman. University Physics. 13th edition, with Mastering Physics, Addison-Wesley. 2012. Course lab manual.

PHYS1003
Physics 1 (Technological)

Credit points: 6 **Session:** Semester 2 **Classes:** Three 1-hour lectures, one 3-hour laboratory per week for 10 weeks, one 1-hour tutorial per week. **Prohibitions:** PHYS1902, PHYS1004 **Assumed knowledge:** HSC Physics or PHYS1001 or PHYS1002 or PHYS1901 or equivalent. **Assessment:** 3 hour exam plus laboratories, tutorials, and assignments (100%). **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: It is recommended that PHYS1001 or PHYS1002 or PHYS1901 be completed before this unit

This unit of study is designed for students majoring in physical and engineering sciences and emphasis is placed on applications of physical principles to the technological world. The lecture series contains modules on the topics of fluids, electromagnetism, and quantum physics.

Textbooks

Young & Freedman. University Physics. 13th edition, with Mastering Physics. Addison-Wesley. Course lab manual.

INFO1103
Introduction to Programming

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Laboratory 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Programming in a legible, maintainable, reusable way is essential to solve complex problems in the pervasive computing environments. This unit will equip students with foundation of programming concepts that are common to widely used programming languages. The "fundamentals-first & objects-later" strategy is used to progressively guide this introductory unit from necessary and important building blocks of programming to the object-oriented approach. Java, one of the most popular programming languages, is used in this unit. It provides interdisciplinary approaches, applications and examples to support students from broad backgrounds such as science, engineering, and mathematics.

INFO1105
Data Structures

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1003 or INFO1103 or INFO1903 or INFS1000 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will teach some powerful ideas that are central to quality software: data abstraction and recursion. It will also show how one can analyse the scalability of algorithms using mathematical tools of asymptotic notation. Contents include: both external "interface" view, and internal "implementation" details, for commonly used data structures, including lists, stacks, queues, priority queues, search trees, hash tables, and graphs; asymptotic analysis of algorithm scalability, including use of recurrence relations to analyse recursive code. This unit covers the way information is represented in each structure, algorithms for manipulating the structure, and analysis of asymptotic complexity of the operations. Outcomes include: ability to write code that recursively performs an operation on a data structure; experience designing an algorithmic solution to a problem using appropriate data structures, coding the solution, and analysing its complexity.

Second year

ELEC1103
Fundamentals of Elec and Electronic Eng

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Basic knowledge of differentiation & integration, and HSC Physics **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to develop knowledge of the fundamental concepts and building blocks of electrical and electronics circuits.This is a foundation unit in circuit theory. Circuit theory is the electrical engineer's fundamental tool.

The concepts learnt in this unit will be made use of heavily in many units of study (in later years) in the areas of electronics, instrumentation, electrical machines, power systems, communication systems, and signal processing.

Topics: a) Basic electrical and electronic circuit concepts: Circuits, circuit elements, circuit laws, node and mesh analysis, circuit theorems, energy storage, capacitors and inductors, circuits with switches, transient response, sine waves and complex analysis, phasors,

impedance, ac power.; b) Project management, teamwork, ethics; c) Safety issues

ELEC2103
Simulation & Numerical Solutions in Eng

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 1 hr/week; Laboratory 3 hrs/week; Project Work - own time 3 hrs/week. **Prohibitions:** COSC1901, COSC1001 **Assumed knowledge:** ELEC1103. Understanding of the fundamental concepts and building blocks of electrical and electronics circuits and aspects of professional project management, teamwork, and ethics. **Assessment:** Through semester assessment (25%) Final Exam (75%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Objectives:

* How to apply the software package Matlab to achieve engineering solutions

* Critical assessment of various computer numerical techniques

* Professional project management, teamwork, ethics

This unit assumes an understanding of the fundamental concepts and building blocks of electrical and electronics circuits. As well as covering the specific topics described in the following paragraphs, it aims to develop skills in professional project management and teamwork and promote an understanding of ethics.

Basic features of Matlab. The Matlab desktop. Interactive use with the command window. Performing arithmetic, using complex numbers and mathematical functions. Writing script and function m-files. Matrix manipulations. Control flow. Two dimensional graphics. Application of Matlab to simple problems from circuit theory, electronics, signals and systems and control. Investigation of the steady state and transient behaviour of LCR circuits.

Matlab based numerical solutions applicable to numerical optimization, ordinary differential equations, and data fitting. Introduction to symbolic mathematics in Matlab. Applications, including the derivation of network functions for simple problems in circuit analysis. Introduction to the use of Simulink for system modelling and simulation.

ELEC2104
Electronic Devices and Circuits

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/fortnight; Laboratory 3 hrs/fortnight **Assumed knowledge:** Knowledge: ELEC1103. Ohm's Law and Kirchoff's Laws; action of Current and Voltage sources; network analysis and the superposition theorem; Thevenin and Norton equivalent circuits; inductors and capacitors, transient response of RL, RC and RLC circuits; the ability to use power supplies, oscilloscopes, function generators, meters, etc. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Modern Electronics has come to be known as microelectronics which refers to the Integrated Circuits (ICs) containing millions of discrete devices. This course introduces some of the basic electronic devices like diodes and different types of transistors. It also aims to introduce students the analysis and design techniques of circuits involving these discrete devices as well as the integrated circuits.

Completion of this course is essential to specialize in Electrical, Telecommunication or Computer Engineering stream. The knowledge of ELEC1103 is assumed.

ELEC2302
Signals and Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/week; E-Learning 1 hr/week. **Assumed knowledge:** MATH1001 Differential Calculus and MATH1002 Linear Algebra and MATH1003 Integral Calculus and Modelling. Basic knowledge of differentiation & integration, differential equations, and linear algebra. **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to teach some of the basic properties of many engineering signals and systems and the necessary mathematical tools that aid in this process. The particular emphasis is on the time and frequency domain modeling of linear time invariant systems. The concepts learnt in this unit will be heavily used in many units of study (in later years) in the areas of communication, control, power systems and signal processing. A basic knowledge of differentiation and integration, differential equations, and linear algebra is assumed.

ELEC2602
Digital Logic

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week; Laboratory pre-work 2 hrs/week. **Assumed knowledge:** ELEC1601. This unit of study assumes some knowledge of digital data representation and basic computer organisation **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The purpose of this unit is to equip the students with the skills to design simple digital logic circuits which comprise modules of larger digital systems.

The following topics are covered: logic operations, theorems and Boolean algebra, number operations (binary, hex, integer and floating point), combinational logic analysis and synthesis, sequential logic, registers, counters, bus systems, state machines, simple CAD tools for logic design, and the design of a simple computer.

MATH2061
Linear Mathematics and Vector Calculus

Credit points: 6 **Session:** Semester 1, Summer Main **Classes:** Three 1 hour lectures, one 1 hour tutorial and one 1 hour practice class per week. **Prerequisites:** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **Prohibitions:** MATH2961, MATH2067, MATH2901, MATH2902, MATH2001, MATH2002 **Assessment:** One 2 hour exam, assignments, quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit starts with an investigation of linearity: linear functions, general principles relating to the solution sets of homogeneous and inhomogeneous linear equations (including differential equations), linear independence and the dimension of a linear space. The study of eigenvalues and eigenvectors, begun in junior level linear algebra, is extended and developed. The unit then moves on to topics from vector calculus, including vector-valued functions (parametrised curves and surfaces; vector fields; div, grad and curl; gradient fields and potential functions), line integrals (arc length; work; path-independent integrals and conservative fields; flux across a curve), iterated integrals (double and triple integrals; polar, cylindrical and spherical coordinates; areas, volumes and mass; Green's Theorem), flux integrals (flow through a surface; flux integrals through a surface defined by a function of two variables, though cylinders, spheres and parametrised surfaces), Gauss' Divergence Theorem and Stokes' Theorem.

PHYS2213
Physics 2EE

Credit points: 6 **Session:** Semester 2 **Classes:** Three 1 hour lectures per week; one 2 hour computational laboratory per week for 10 weeks. **Prerequisites:** (PHYS1001 or PHYS1901) and (PHYS1003 or PHYS1902) **Prohibitions:** PHYS2902, PHYS2011, PHYS2203, PHYS2002, PHYS2901, PHYS2012, PHYS2001, PHYS2912, PHYS2911 **Assumed knowledge:** (MATH1001 or MATH1901) and (MATH1002 or MATH1902) and (MATH1003 or MATH1903). MATH1005 or MATH1905 would also be useful **Assessment:** One 3 hour exam, one 1-hour computational test, assignments, computational lab work (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is designed to build on the knowledge gained in Junior Physics, to provide Electrical Engineering students with the knowledge of relevant topics of Physics at the Intermediate level, and with associated skills. Completion of the unit provides a solid foundation for further studies in Electrical Engineering and related engineering areas. The aims of this unit are linked to the generic attributes required of graduates of the University in knowledge skills, thinking skills, personal skills and attributes, and practical skills. By the end of this unit of study, students will be able to describe and apply concepts in optics, electromagnetism and basic solid state physics and technology at the Intermediate level. They will be able to use computational techniques to analyze optics problems. The modules in this unit of study are: Optics (13 lectures): The wave nature of light, optical phenomena and the interaction of light with matter: interference and diffraction effects; fundamental limits to resolution of optical instruments; polarisation; dispersion; coherence. These are presented

within the context of several key optical technologies including lasers, CD/DVD players, optical fibre communication systems, gratings and Mach Zehnder modulation. Electromagnetic Properties of Matter (12 lectures): Electric and magnetic effects in materials; the combination of electric and magnetic fields to produce light and other electromagnetic waves in vacuum and matter. Solid State and Device Physics (13 lectures): Introduction to quantum mechanics, Fermi-Dirac statistics, electronic properties of solids (metal, semiconductors & insulators), doping and the semiconductor PN junction; introduction to nanotechnology; fabrication technologies, nano-imaging technologies, nanoelectronics. Computational Physics (10 sessions of 2 hours each): In a computing laboratory students use Matlab-based simulation software to conduct virtual experiments in optics, which illustrate and extend the relevant lectures. Students also gain experience in the use of computers to solve problems in physics.

Textbooks

Notes published by the School of Physics: - Physics 2EE Computational Physics Optics Notes - Physics 2EE Electromagnetic Properties of Matter Notes - Physics 2EE Solid State and Device Physics Notes Other relevant texts: see the Unit of Study outline.

COMP2129
Operating Systems and Machine Principles

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1103. **Assumed knowledge:** INFO1105 OR INFO1905. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

In this unit of study elementary methods for developing robust, efficient, and re-usable software will be covered. The unit is taught in C, in a Unix environment. Specific coding topics include memory management, the pragmatic aspects of implementing data structures such as lists and hash tables and managing concurrent threads. Debugging tools and techniques are discussed and common programming errors are considered along with defensive programming techniques to avoid such errors. Emphasis is placed on using common Unix tools to manage aspects of the software construction process, such as version control and regression testing. The subject is taught from a practical viewpoint and it includes a considerable amount of programming practice.

Third year

ELEC3203
Electricity Networks

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** This unit of study assumes a competence in first year mathematics (in particular, the ability to work with complex numbers), in elementary circuit theory and in basic electromagnetics. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study provides an introduction to electrical power engineering and lays the groundwork for more specialised units. It assumes a competence in first year mathematics (in particular, the ability to work with complex numbers), in elementary circuit theory and in elements of introductory physics. A revision will be carried out of the use of phasors in steady state ac circuit analysis and of power factor and complex power. The unit comprises an overview of modern electric power system with particular emphasis on generation and transmission. The following specific topics are covered. The use of three phase systems and their analysis under balanced conditions. Transmission lines: calculation of parameters, modelling, analysis. Transformers: construction, equivalent circuits. Generators: construction, modelling for steady state operation. The use of per unit system. The analysis of systems with a number of voltage levels. The load flow problem: bus and impedance matrices, solution methods. Power system transient stability. The control of active and reactive power. Electricity markets, market structures and economic dispatch. Types of electricity grids, radial, mesh, networks. Distribution systems and smart grids.

ELEC3204
Power Electronics and Applications

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs/week; Project Work - own time 2 hrs/week. **Prerequisites:** ELEC2104 **Assumed knowledge:** 1. Differential equations, linear algebra, complex variables, analysis of linear circuits. 2. Fourier theory applied to periodic and non-periodic signals. 3. Software such as MATLAB to perform signal analysis and filter design. 4. Familiarity with the use of basic laboratory equipment such as oscilloscope, function generator, power supply, etc. 5. Basic electric circuit theory and analysis **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to teach the fundamentals of advanced energy conversion systems based on power electronics. It provides description of the operation principles and control of these blocks. Through analysis and design methodologies, it delivers an in depth understanding of modern enabling technologies associated with energy conversion. Through laboratory hands-on experience on actual industrial systems, such electrical motor drives, robotic arms, and power supplies, it enhances the link between the theory and the "real" engineering world. The unit clarifies unambiguously the role these imperative technologies play in every human activity; from mobile telephone chargers to energy electricity grids; from electric vehicles and industrial automation to wind energy conversion to name just few.

The following topics are covered:

Introduction to power electronic converters and systems; applications of power electronic converters; power semiconductor devices; uncontrolled rectifiers: single- and three-phase; non-isolated dc-dc converters: buck, boost and buck-boost; isolated dc-dc converters; inverters: single- and three-phase; uninterruptible power supplies; battery chargers and renewable energy systems; electric and hybrid electric vehicles technologies, design of converters and systems.

ELEC3206
Electrical Energy Conversion Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs; Laboratory 3 hrs; Project Work - own time 3 hrs. **Assumed knowledge:** Following concepts are assumed knowledge for this unit of study: familiarity with circuit theory, electronic devices, ac power, capacitors and inductors, and electric circuits such as three-phase circuits and circuits with switches, the use of basic laboratory equipment such as oscilloscope and power supply. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to give students a good understanding of electrical energy conversion techniques and equipment.

Students who successfully complete this unit will

1) have a broad view of electrical energy conversion systems including transformers, DC machines, induction machines and synchronous machines;

2) be able to analyze and solve problems in transformers and electric machines;

3) have gained confidence in their ability to undertake more advanced study in the power area.

The following specific topics are covered: magnetic circuits, inductance, sinusoidal excitation, hysteresis and eddy current loss, permanent magnets, electromechanical energy conversion, singly-excited and doubly-excited systems, transformers, single-phase, equivalent circuit parameters, three-phase transformers, autotransformers, DC machines, separate excitation, shunt excitation, series excitation, and compound excitation, efficiency, armature reaction, induction machines, revolving field, equivalent circuit, squirrel cage machines, measurements of the parameters, DC resistance test, no-load test, blocked-rotor test, synchronous machines, field relationships, power-angle relationships, salient pole machines.

ELEC3304
Control

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs. **Prerequisites:** MATH2061 and ELEC2302 **Prohibitions:** AMME3500 **Assumed knowledge:** Specifically the following concepts are assumed knowledge for this unit: familiarity with basic Algebra, Differential and Integral Calculus, Physics; solution of linear differential equations, Matrix Theory, eigenvalues and eigenvectors; linear electrical circuits, ideal op-amps; continuous linear time-invariant systems and their time and frequency domain representations, Laplace transform, Fourier transform. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit is mainly concerned with the application of feedback control to continuous-time, linear time-invariant systems. It aims to give the students an appreciation of the possibilities in the design of control and automation in a range of application areas. The concepts learnt in this unit will be made use of heavily in many units of study in the areas of communication, control, electronics, and signal processing.

The following specific topics are covered: Modelling of physical systems using state space, differential equations, and transfer functions, dynamic response of linear time invariant systems and the role of system poles and zeros on it, simplification of complex systems, stability of feedback systems and their steady state performance, Routh-Hurwitz stability criterion, sketching of root locus and controller design using the root locus, Proportional, integral and derivative control, lead and lag compensators, frequency response techniques, Nyquist stability criterion, gain and phase margins, compensator design in the frequency domain, state space design for single input single-output systems, pole placement state variable feedback control and observer design.

Fourth year

ELEC4702
Practical Experience

Session: Semester 1, Semester 2 **Classes:** Practical Experience, **Prerequisites:** 24 CP of senior or senior advanced units of study. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Professional practice

The Bachelor of Engineering degree requires students to obtain industrial work experience of twelve weeks (60 working days) duration towards satisfying the requirements for award of the degree. Students may undertake their work experience after completion of a minimum of 24 credit points of Year 3 units of study when they have built up a sufficient background of engineering. In general, the type of job that is acceptable for work experience should be in an engineering environment but not necessarily in the same discipline of the degree the student is pursuing. The student is required to inform the School of any work arrangements made by email.

Assessment in this unit is by the submission of a written report of about 4-6 pages on the industrial experience undertaken. The report is to describe the overall structure of the company, the areas that the student became familiar with and their relationship to the firm and, finally, what the student did. A certificate from the company stating the period of employment and the type of work you have undertaken should be attached to your report. The student should inform the company that a short report on the work experience is to be submitted to the School.

The report is to be submitted to the School electronically (see details on the course website http://www.eelab.usyd.edu.au/eLearning/elec4702.html). There is no deadline for submission of the report but it is a good practice to submit it in the first two weeks after the new semester started.

ELEC5204
Power Systems Analysis and Protection

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Laboratory 2 hrs/week. **Assumed knowledge:** The unit assumes basic knowledge of circuits, familiarity with basic mathematics, competence with basic circuit theory and an understanding of three phase systems, transformers, transmission lines and associated modeling and operation of such equipment. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides the basis for the analysis of electricity grids using symmetrical components theory. Such analysis theory is the basis for the understanding of electrical faults and the design of protection strategies to safeguard the electrical equipment, and maintain safety of the plant at the highest possible level.

The following specific topics are covered: The types and causes of power system faults; balanced faults and short circuit levels; an introduction to fault current transients in machines; symmetric components, sequence impedances and networks; the analysis of unsymmetrical faults. Review of the impact of faults on power system behaviour; issues affecting protection scheme characteristics and clearance times; the security and reliability of protection schemes; the need for protection redundancy and its implementation as local or remote backup; zones of protection and the need for zones to overlap; the analysis and application of over-current and distance relay protection schemes with particular reference to the protection of transmission lines.

ELEC5205
High Voltage Engineering

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial - Laboratory 2 hrs/week; Project Work - in class 2 hrs. **Prerequisites:** ELEC3203 OR ELEC9203 **Assumed knowledge:** The following previous knowledge is assumed for this unit. Circuit analysis techniques, electricity networks, power system fundamentals. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit provides advanced knowledge associated with high voltage engineering methods, techniques and equipment. It is divided into two sections. The first section presents fundamentals of the failure mechanisms of solid, liquid and gaseous insulation at high voltages. It also discusses consequent design principles for high-voltage equipment; of the generation of high direct, alternating and impulse voltages for testing high-voltage equipment; and of methods for monitoring and assessing the condition of high-voltage equipment such as dissolved gas analysis for oil-filled transformers and partial discharge in cables. The second section presents in detail all the high-voltage equipment and in particular underground cables, overhead transmission lines, transformers, bushings and switchgear. It finally offers asset management solutions for modern transmission and distribution electricity networks.

Students must enrol in 12 credit points of Thesis units.

ELEC4712
Honours Thesis A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Project Work - own time 12 hrs/week. **Prerequisites:** 36 credits of 3rd year units of study **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: Note that students require permission from the HOS to do both A and B units in the same Semester, and will have an accelerated assessment schedule. Note also that entry to Honours Thesis is by permission.

Students will work individually or in groups on an assigned project for the Semester. The concepts covered depend on the nature of the project, but broadly cover research and inquiry, and information literacy. While recognising that some projects can be interdisciplinary in nature, it is the normal expectation that the students would do the project in their chosen area of specialisation, i.e. Power Engineering, Telecommunications Engineering, Computer Engineering, and Software Engineering students would do projects in the general area of Power, Telecommunications, Computer, and Software respectively.

ELEC4713
Honours Thesis B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Project Work - own time 12 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: Note that students require permission from the HOS to do both A and B units in the same Semester, and will have an accelerated assessment schedule. Note also that entry to Honours Thesis is by permission.

Students will work individually or in groups on an assigned project for the Semester. The concepts covered depend on the nature of the project, but broadly cover research and inquiry, and information literacy.

Notes

1. The Mathematics, Physics and Information Technology units of study may be replaced by equivalent advanced level units of study (if available) subject to prerequisite conditions being met.2. Students whose EWAM is less than 65 before enrolling in ELEC4712 & ELEC4713, or at the end of their degree requirements, will receive a Pass degree.

For a standard enrolment plan for Electrical(Power) Engineering visit http://cusp.sydney.edu.au/students/view-degree-page/name/BE(Elec)(Power)

Bachelor of Engineering Honours (Software Engineering)

Course Overview

The Bachelor of Engineering Honours (Software) will prepare you for a role as a senior software engineer, development manager, applications programmer, analyst, consultant or software innovator. You will learn about all aspects of software production, from strategy and design to coding, quality and management.

Software engineers design and develop computer games, business applications, operating systems and network control systems. They must be experts in the theory of computing systems, the structure of software, and the nature and limitations of hardware to ensure that the underlying systems will work properly. The tasks performed by software engineers evolve quickly, reflecting changes in technology and new areas of specialisation, as well as the changing practices of employers and industry.

Course Requirements

To meet requirements for the Bachelor of Engineering Honours (Software), a candidate must successfully complete 192 credit points, comprising:

1. core and elective units of study relating to the specialist stream, as prescribed by the table of units of study for the stream; and
2. any additional free elective units of study as may be necessary to gain credit to complete the award.

For a standard enrolment plan for Software Engineering visit http://cusp.sydney.edu.au/students/view-degree-page/name/BE(Soft)

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Bachelor of Engineering Honours (Software)			
All candidates for the Bachelor of Engineering Honours (Software) (including those enrolled in a combined degree) must satisfy the requirements described in the table of core units of study. Candidates will also need to choose a number of recommended units of study for Software Engineering, which consist of: - all level 1, 2, 3, 4 and 5 EIE and SIT units which do not appear in the table of core units; - the units of study listed in the table of additional recommended units of study; and - such other units of study as may be so designated by the Head of School.			
Requirements of the Bachelor of Engineering Honours (Software)			
Candidates for the Bachelor of Engineering Honours (Software) are required to complete a total of not less than 192 credit points including at least 168 credit points made up of units from the table of core units and recommended units of study with no more than 18 credit points of recommended elective units from level 1, and 2. The additional 24 credit points may consist, in whole or in part, of free elective units of study approved by the Head of School.			
Requirements of the Bachelor of Engineering Honours (Software) in a combined degree			
Candidates for the Bachelor of Engineering Honours (Software) combined with the Bachelor of Commerce, Bachelor of Project Management or Bachelor of Laws are required to complete at least 144 credit points made up of units from the table of core units and recommended units of study with no more than 18 credit points of recommended elective units from level 1, and 2. Candidates for the Bachelor of Engineering Honours (Software) combined with the Bachelor of Science or Bachelor of Arts are required to complete at least 156 credit points made up of units from the table of core units and recommended units of study with no more than 18 credit points of recommended elective units from level 1, and 2. Candidates for the Bachelor of Engineering Honours (Software) combined with the Bachelor of Medical Science are required to complete at least 156 credit points made up of units from the table of core units and recommended units of study with no more than 18 credit points of recommended elective units from level 1, and 2, but may choose to replace up to 12 credit points of recommended units with CHEM1101 Chemistry 1A and BIOL1001 Concepts in Biology. Candidates in all combined degree courses shall also satisfy such other requirements for the combined course as are prescribed in the joint resolutions of the Faculty of Engineering and Information Technologies and the second faculty concerned.			
Software Engineering core units of study			
First year			
ELEC1601 **Foundations of Computer Systems**	6	**A** HSC Mathematics extension 1 or 2	Semester 2
ENGG1805 **Professional Engineering and IT**	6		Semester 1
MATH1001 **Differential Calculus**	3	**A** HSC Mathematics Extension 1 **N** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001	Semester 1 Summer Main
MATH1002 **Linear Algebra**	3	**A** HSC Mathematics or MATH1111 **N** MATH1902, MATH1012, MATH1014	Semester 1 Summer Main
MATH1003 **Integral Calculus and Modelling**	3	**A** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **N** MATH1013, MATH1903, MATH1907	Semester 2 Summer Main
MATH1005 **Statistics**	3	**A** HSC Mathematics **N** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021	Semester 2 Summer Main Winter Main
INFO1103 **Introduction to Programming**	6		Semester 1 Semester 2
INFO1105 **Data Structures**	6	**P** INFO1003 or INFO1103 or INFO1903 or INFS1000	Semester 2
Second year			
INFO2110 **Systems Analysis and Modelling**	6	**A** Experience with a data model as in INFO1003 or INFO1103 or INFS1000	Semester 2
INFO2120 **Database Systems 1**	6	**P** INFO1003 OR INFO1103 OR INFO1903 OR INFS1000 OR DECO1012. **N** INFO2820, INFO2905, COMP5138	Semester 1
INFO2315 **Introduction to IT Security**	6	**A** In order to enter this unit, students should have at least one semester of tertiary study of IT. In particular, we assume familiarity with the value of information, and with the varied uses of IT in business and personal activities. We also assume an introductory level of skill in using a computer (for example, creating and moving files and folders, downloading and installing files, etc). The assumed background would be achieved by completing INFO1003 Foundations of IT. We also assume previous instruction in verbal presentations and teamwork.	Semester 2
MATH2069 **Discrete Mathematics and Graph Theory**	6	**P** 6 credit points of Junior level Mathematics **N** MATH2011, MATH2009, MATH2969	Semester 1
COMP2007 **Algorithms and Complexity**	6	**A** MATH1004 **P** INFO1105 OR INFO1905.	Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
COMP2129 **Operating Systems and Machine Principles**	6	**A** INFO1105 OR INFO1905. **P** INFO1103.	Semester 1
Select one of the following units			
MATH2061 **Linear Mathematics and Vector Calculus**	6	**P** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **N** MATH2961, MATH2067, MATH2901, MATH2902, MATH2001, MATH2002	Semester 1 Summer Main
ELEC2602 **Digital Logic**	6	**A** ELEC1601. This unit of study assumes some knowledge of digital data representation and basic computer organisation	Semester 1
Select one of the following units			
ELEC2103 **Simulation & Numerical Solutions in Eng**	6	**A** ELEC1103. Understanding of the fundamental concepts and building blocks of electrical and electronics circuits and aspects of professional project management, teamwork, and ethics. **N** COSC1901, COSC1001	Semester 2
ELEC2104 **Electronic Devices and Circuits**	6	**A** Knowledge: ELEC1103. Ohm's Law and Kirchoff's Laws; action of Current and Voltage sources; network analysis and the superposition theorem; Thevenin and Norton equivalent circuits; inductors and capacitors, transient response of RL, RC and RLC circuits; the ability to use power supplies, oscilloscopes, function generators, meters, etc.	Semester 2
ELEC2302 **Signals and Systems**	6	**A** MATH1001 Differential Calculus and MATH1002 Linear Algebra and MATH1003 Integral Calculus and Modelling. Basic knowledge of differentiation & integration, differential equations, and linear algebra.	Semester 2
PHYS2213 **Physics 2EE**	6	**A** (MATH1001 or MATH1901) and (MATH1002 or MATH1902) and (MATH1003 or MATH1903). MATH1005 or MATH1905 would also be useful **P** (PHYS1001 or PHYS1901) and (PHYS1003 or PHYS1902) **N** PHYS2902, PHYS2011, PHYS2203, PHYS2002, PHYS2901, PHYS2012, PHYS2001, PHYS2912, PHYS2911	Semester 2
Third year			
COMP3615 **Software Development Project**	6	**P** INFO3402 AND COMP2129 AND (COMP2007 OR COMP2907 OR COMP2121) **N** INFO3600	Semester 2
ELEC3609 **Internet Software Platforms**	6	**P** INFO1103, INFO2110, (INFO2120 or INFO2820) **N** EBUS4001	Semester 2
INFO3220 **Object Oriented Design**	6	**P** INFO2110 and COMP2129	Semester 1
INFO3315 **Human-Computer Interaction**	6	**A** Background in programming and operating systems that is sufficient for the student to independently learn new programming tools from standard online technical materials. Ability to conduct a literature search. Ability to write reports of work done.	Semester 2
INFO3402 **Management of IT Projects and Systems**	6	**A** INFO2110 or INFO2810 or INFO2900	Semester 1
Fourth year			
COMP5348 **Enterprise Scale Software Architecture**	6	**A** Programming competence in Java or similar OO language. Capacity to master novel technologies (especially to program against novel APIs) using manuals, tutorial examples, etc.	Semester 1
ELEC4702 **Practical Experience**		**P** 24 CP of senior or senior advanced units of study.	Semester 1 Semester 2
ELEC5618 **Software Quality Engineering**	6	**A** You are capable of writing programs with multiple functions or methods in multiple files. You are capable of design complex data structures and combine them in non trivial algorithms. You know how to use an integrated development environment. You are familiar and have worked previously with software version control systems. You know how to distribute the workload derived from the unit of study effectively throughoug the week and make sure that time is truly productive.	Semester 1
ELEC5619 **Object Oriented Application Frameworks**	6	**A** Java programming, and some web development experience are essential. Databases strongly recommended	Semester 2
Students must enrol in 12 credit points of Thesis units			
ELEC4712 **Honours Thesis A**	6	**P** 36 credits of 3rd year units of study *Note: Department permission required for enrolment* *Note that students require permission from the HOS to do both A and B units in the same Semester, and will have an accelerated assessment schedule. Note also that entry to Honours Thesis is by permission.*	Semester 1 Semester 2
ELEC4713 **Honours Thesis B**	6	*Note: Department permission required for enrolment* *Note that students require permission from the HOS to do both A and B units in the same Semester, and will have an accelerated assessment schedule. Note also that entry to Honours Thesis is by permission.*	Semester 1 Semester 2

Notes

1. The Mathematics, Physics and Information Technology units of study may be replaced by equivalent advanced level units of study (if available) subject to prerequisite conditions being met.

2. Students whose EWAM is less than 65 before enrolling in ELEC4712 & ELEC4713, or at the end of their degree requirements, will receive a Pass degree.

For a standard enrolment plan for Software Engineering visit http://cusp.sydney.edu.au/students/view-degree-page/name/BE(Soft)

Unit of Study Descriptions

Bachelor of Engineering Honours (Software)

All candidates for the Bachelor of Engineering Honours (Software) (including those enrolled in a combined degree) must satisfy the requirements described in the table of core units of study.Candidates will also need to choose a number of recommended units of study for Software Engineering, which consist of:- all level 1, 2, 3, 4 and 5 EIE and SIT units which do not appear in the table of core units;- the units of study listed in the table of additional recommended units of study; and - such other units of study as may be so designated by the Head of School.

Requirements of the Bachelor of Engineering Honours (Software)

Candidates for the Bachelor of Engineering Honours (Software) are required to complete a total of not less than 192 credit points including at least 168 credit points made up of units from the table of core units and recommended units of study with no more than 18 credit points of recommended elective units from level 1, and 2. The additional 24 credit points may consist, in whole or in part, of free elective units of study approved by the Head of School.

Requirements of the Bachelor of Engineering Honours (Software) in a combined degree

Candidates for the Bachelor of Engineering Honours (Software) combined with the Bachelor of Commerce, Bachelor of Project Management or Bachelor of Laws are required to complete at least 144 credit points made up of units from the table of core units and recommended units of study with no more than 18 credit points of recommended elective units from level 1, and 2.Candidates for the Bachelor of Engineering Honours (Software) combined with the Bachelor of Science or Bachelor of Arts are required to complete at least 156 credit points made up of units from the table of core units and recommended units of study with no more than 18 credit points of recommended elective units from level 1, and 2.Candidates for the Bachelor of Engineering Honours (Software) combined with the Bachelor of Medical Science are required to complete at least 156 credit points made up of units from the table of core units and recommended units of study with no more than 18 credit points of recommended elective units from level 1, and 2, but may choose to replace up to 12 credit points of recommended units with CHEM1101 Chemistry 1A and BIOL1001 Concepts in Biology.Candidates in all combined degree courses shall also satisfy such other requirements for the combined course as are prescribed in the joint resolutions of the Faculty of Engineering and Information Technologies and the second faculty concerned.

Software Engineering core units of study

First year

ELEC1601
Foundations of Computer Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** HSC Mathematics extension 1 or 2 **Assessment:** Through semester assessment (61%) Final Exam (39%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study introduces the fundamental digital concepts upon which the design and operation of modern digital computers are based. A prime aim of the unit is to develop a professional view of, and a capacity for inquiry into, the field of computing.

Topics covered include: data representation, basic computer organisation, the CPU, elementary gates and logic, peripheral devices, software organisation, machine language, assembly language, operating systems, data communications and computer networks.

ENGG1805
Professional Engineering and IT

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week; Project Work - own time 2 hrs. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

ENGG1805 aims to introduce students to the fundamental principles that underlie the study of engineering and information technologies. It lays the foundation for later studies, and presents to the students challenges common to a multidisciplinary engineering environment. The subject also provides students with the opportunity to develop an understanding of engineering ethics and of working as a part of a team.

Professional Engineering and IT (6CP) is composed from the following five parts: (a) Introduction to engineering: the engineer as problem solver, critical analysis of greatest engineering achievements and failure. (b) Introduction to common engineering software tools: word processors, project management tools (c) Ethics and workplace health and safety. (d) Testing - concepts of destructive and not destructive tests will be given on samples. (e) "Meet the professionals" - A selection of guest speakers will address students on the most important aspects of the engineering profession. (f) Design Process - The process of design synthesis as an important part of engineering: students will be required to complete an engineering design (from conception, to implementation and testing) maintaining proper lab notes.

MATH1001
Differential Calculus

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001 **Assumed knowledge:** HSC Mathematics Extension 1 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1001 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study looks at complex numbers, functions of a single variable, limits and continuity, vector functions and functions of two variables. Differential calculus is extended to functions of two variables. Taylor's theorem as a higher order mean value theorem.

Textbooks
As set out in the Junior Mathematics Handbook.

MATH1002
Linear Algebra

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1902, MATH1012, MATH1014 **Assumed knowledge:** HSC Mathematics or MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1002 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study introduces vectors and vector algebra, linear algebra including solutions of linear systems, matrices, determinants, eigenvalues and eigenvectors.

Textbooks

As set out in the Junior Mathematics Handbook

MATH1003
Integral Calculus and Modelling

Credit points: 3 **Session:** Semester 2, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1013, MATH1903, MATH1907 **Assumed knowledge:** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1003 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.This unit of study first develops the idea of the definite integral from Riemann sums, leading to the Fundamental Theorem of Calculus. Various techniques of integration are considered, such as integration by parts.The second part is an introduction to the use of first and second order differential equations to model a variety of scientific phenomena.

Textbooks

As set out in the Junior Mathematics Handbook

MATH1005
Statistics

Credit points: 3 **Session:** Semester 2, Summer Main, Winter Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021 **Assumed knowledge:** HSC Mathematics **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1005 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit offers a comprehensive introduction to data analysis, probability, sampling, and inference including t-tests, confidence intervals and chi-squared goodness of fit tests.

Textbooks

As set out in the Junior Mathematics Handbook

INFO1103
Introduction to Programming

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Laboratory 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Programming in a legible, maintainable, reusable way is essential to solve complex problems in the pervasive computing environments. This unit will equip students with foundation of programming concepts that are common to widely used programming languages. The "fundamentals-first & objects-later" strategy is used to progressively guide this introductory unit from necessary and important building blocks of programming to the object-oriented approach. Java, one of the most popular programming languages, is used in this unit. It provides interdisciplinary approaches, applications and examples to support students from broad backgrounds such as science, engineering, and mathematics.

INFO1105
Data Structures

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1003 or INFO1103 or INFO1903 or INFS1000 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will teach some powerful ideas that are central to quality software: data abstraction and recursion. It will also show how one can analyse the scalability of algorithms using mathematical tools of asymptotic notation. Contents include: both external "interface" view, and internal "implementation" details, for commonly used data structures, including lists, stacks, queues, priority queues, search trees, hash tables, and graphs; asymptotic analysis of algorithm scalability, including use of recurrence relations to analyse recursive code. This unit covers the way information is represented in each structure, algorithms for manipulating the structure, and analysis of asymptotic complexity of the operations. Outcomes include: ability to write code that recursively performs an operation on a data structure; experience designing an algorithmic solution to a problem using appropriate data structures, coding the solution, and analysing its complexity.

Second year

INFO2110
Systems Analysis and Modelling

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Experience with a data model as in INFO1003 or INFO1103 or INFS1000 **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides a comprehensive introduction to the analysis of complex systems. Key topics are the determination and expression of system requirements (both functional and on-functional), and the representation of structural and behavioural models of the system in UML notations. Students will be expected to evaluate requirements documents and models as well as producing them. This unit covers essential topics from the ACM/IEEE SE2004 curriculum, especially from MAA Software Modelling and Analysis.

INFO2120
Database Systems 1

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week; Project Work - own time 3 hrs/week. **Prerequisites:** INFO1003 OR INFO1103 OR INFO1903 OR INFS1000 OR DECO1012. **Prohibitions:** INFO2820, INFO2905, COMP5138 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The ubiquitous use of information technology leaves us facing a tsunami of data produced by users, IT systems and mobile devices. The proper management of data is hence essential for all applications and for effective decision making within organizations.

This unit of study will introduce the basic concepts of database designs at the conceptual, logical and physical levels. We will place particular emphasis on introducing integrity constraints and the concept of data normalization which prevents data from being corrupted or duplicated in different parts of the database. This in turn helps in the data remaining consistent during its lifetime. Once a database design is in place, the emphasis shifts towards querying the data in order to extract useful information. The unit will introduce different query languages with a particular emphasis on SQL, which is industry standard. Other topics covered will include the important concept of transaction management, application development with a backend database, an overview of data warehousing and OLAP, and the use of XML as a data integration language.

INFO2315
Introduction to IT Security

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 1 hr/week. **Assumed knowledge:** In order to enter this unit, students should have at least one semester of tertiary study of IT. In particular, we assume familiarity with the value of information, and with the varied uses of IT in business and personal activities. We also assume an introductory level of skill in using a computer (for example, creating and moving files and folders, downloading and installing files, etc). The assumed background would be achieved by completing INFO1003 Foundations of IT. We also assume previous instruction in verbal presentations and teamwork. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides a broad introduction to the field of IT security. We examine secure and insecure programs, secure and insecure information, secure and insecure computers, and secure and insecure network infrastructure. Key content includes the main threats to security; how to analyse risks; the role in reducing risk that can be played by technical tools (such as encryption, signatures, access control, firewalls, etc); the limitations of technical defences; and the simple process and behavioural changes that can reduce risk.

MATH2069
Discrete Mathematics and Graph Theory

Credit points: 6 **Session:** Semester 1 **Classes:** Three 1 hour lectures, one 1 hour tutorial and one 1 hour practice class per week. **Prerequisites:** 6 credit points of Junior level Mathematics **Prohibitions:** MATH2011, MATH2009, MATH2969 **Assessment:** One 2 hour exam, assignments, quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces students to several related areas of discrete mathematics, which serve their interests for further study in pure and applied mathematics, computer science and engineering. Topics to be covered in the first part of the unit include recursion and induction, generating functions and recurrences, combinatorics. Topics covered in the second part of the unit include Eulerian and Hamiltonian graphs, the theory of trees (used in the study of data structures), planar graphs, the study of chromatic polynomials (important in scheduling problems).

COMP2007
Algorithms and Complexity

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** INFO1105 OR INFO1905. **Assumed knowledge:** MATH1004 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides an introduction to the design and analysis of algorithms. The main aims are (i) to learn how to develop algorithmic solutions to computational problem and (ii) to develop understanding of algorithm efficiency and the notion of computational hardness.

COMP2129
Operating Systems and Machine Principles

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1103. **Assumed knowledge:** INFO1105 OR INFO1905. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

In this unit of study elementary methods for developing robust, efficient, and re-usable software will be covered. The unit is taught in C, in a Unix environment. Specific coding topics include memory management, the pragmatic aspects of implementing data structures such as lists and hash tables and managing concurrent threads. Debugging tools and techniques are discussed and common programming errors are considered along with defensive programming techniques to avoid such errors. Emphasis is placed on using common Unix tools to manage aspects of the software construction process, such as version control and regression testing. The subject is taught from a practical viewpoint and it includes a considerable amount of programming practice.

Select one of the following units

MATH2061
Linear Mathematics and Vector Calculus

Credit points: 6 **Session:** Semester 1, Summer Main **Classes:** Three 1 hour lectures, one 1 hour tutorial and one 1 hour practice class per week. **Prerequisites:** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **Prohibitions:** MATH2961, MATH2067, MATH2901, MATH2902, MATH2001, MATH2002 **Assessment:** One 2 hour exam, assignments, quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit starts with an investigation of linearity: linear functions, general principles relating to the solution sets of homogeneous and inhomogeneous linear equations (including differential equations), linear independence and the dimension of a linear space. The study of eigenvalues and eigenvectors, begun in junior level linear algebra, is extended and developed. The unit then moves on to topics from vector calculus, including vector-valued functions (parametrised curves and surfaces; vector fields; div, grad and curl; gradient fields and potential functions), line integrals (arc length; work; path-independent integrals and conservative fields; flux across a curve), iterated integrals (double and triple integrals; polar, cylindrical and spherical coordinates; areas, volumes and mass; Green's Theorem), flux integrals (flow through a surface; flux integrals through a surface defined by a function of two variables, though cylinders, spheres and parametrised surfaces), Gauss' Divergence Theorem and Stokes' Theorem.

ELEC2602
Digital Logic

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week; Laboratory pre-work 2 hrs/week. **Assumed knowledge:** ELEC1601. This unit of study assumes some knowledge of digital data representation and basic computer organisation **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The purpose of this unit is to equip the students with the skills to design simple digital logic circuits which comprise modules of larger digital systems.

The following topics are covered: logic operations, theorems and Boolean algebra, number operations (binary, hex, integer and floating point), combinational logic analysis and synthesis, sequential logic, registers, counters, bus systems, state machines, simple CAD tools for logic design, and the design of a simple computer.

Select one of the following units

ELEC2103
Simulation & Numerical Solutions in Eng

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 1 hr/week; Laboratory 3 hrs/week; Project Work - own time 3 hrs/week. **Prohibitions:** COSC1901, COSC1001 **Assumed knowledge:** ELEC1103. Understanding of the fundamental concepts and building blocks of electrical and electronics circuits and aspects of professional project management, teamwork, and ethics. **Assessment:** Through semester assessment (25%) Final Exam (75%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Objectives:

* How to apply the software package Matlab to achieve engineering solutions

* Critical assessment of various computer numerical techniques

* Professional project management, teamwork, ethics

This unit assumes an understanding of the fundamental concepts and building blocks of electrical and electronics circuits. As well as covering the specific topics described in the following paragraphs, it aims to develop skills in professional project management and teamwork and promote an understanding of ethics.

Basic features of Matlab. The Matlab desktop. Interactive use with the command window. Performing arithmetic, using complex numbers and mathematical functions. Writing script and function m-files. Matrix manipulations. Control flow. Two dimensional graphics. Application of Matlab to simple problems from circuit theory, electronics, signals and systems and control. Investigation of the steady state and transient behaviour of LCR circuits.

Matlab based numerical solutions applicable to numerical optimization, ordinary differential equations, and data fitting. Introduction to symbolic mathematics in Matlab. Applications, including the derivation of network functions for simple problems in circuit analysis. Introduction to the use of Simulink for system modelling and simulation.

ELEC2104
Electronic Devices and Circuits

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/fortnight; Laboratory 3 hrs/fortnight **Assumed knowledge:** Knowledge: ELEC1103. Ohm's Law and Kirchoff's Laws; action of Current and Voltage sources; network analysis and the superposition theorem; Thevenin and Norton equivalent circuits; inductors and capacitors, transient response of RL, RC and RLC circuits; the ability to use power supplies, oscilloscopes, function generators, meters, etc. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Modern Electronics has come to be known as microelectronics which refers to the Integrated Circuits (ICs) containing millions of discrete devices. This course introduces some of the basic electronic devices like diodes and different types of transistors. It also aims to introduce students the analysis and design techniques of circuits involving these discrete devices as well as the integrated circuits.

Completion of this course is essential to specialize in Electrical, Telecommunication or Computer Engineering stream. The knowledge of ELEC1103 is assumed.

ELEC2302
Signals and Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/week; E-Learning 1 hr/week. **Assumed knowledge:** MATH1001 Differential Calculus and MATH1002 Linear Algebra and MATH1003 Integral Calculus and Modelling. Basic knowledge of differentiation & integration, differential equations, and linear algebra. **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to teach some of the basic properties of many engineering signals and systems and the necessary mathematical tools that aid in this process. The particular emphasis is on the time and frequency domain modeling of linear time invariant systems. The concepts learnt in this unit will be heavily used in many units of study (in later years) in the areas of communication, control, power systems and signal processing. A basic knowledge of differentiation and integration, differential equations, and linear algebra is assumed.

PHYS2213
Physics 2EE

Credit points: 6 **Session:** Semester 2 **Classes:** Three 1 hour lectures per week; one 2 hour computational laboratory per week for 10 weeks. **Prerequisites:** (PHYS1001 or PHYS1901) and (PHYS1003 or PHYS1902) **Prohibitions:** PHYS2902, PHYS2011, PHYS2203, PHYS2002, PHYS2901, PHYS2012, PHYS2001, PHYS2912, PHYS2911 **Assumed knowledge:** (MATH1001 or MATH1901) and (MATH1002 or MATH1902) and (MATH1003 or MATH1903). MATH1005 or MATH1905 would also be useful **Assessment:** One 3 hour exam, one 1-hour computational test, assignments, computational lab work (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is designed to build on the knowledge gained in Junior Physics, to provide Electrical Engineering students with the knowledge of relevant topics of Physics at the Intermediate level, and with associated skills. Completion of the unit provides a solid foundation for further studies in Electrical Engineering and related engineering areas. The aims of this unit are linked to the generic attributes required of graduates of the University in knowledge skills, thinking skills, personal skills and attributes, and practical skills. By the end of this unit of study, students will be able to describe and apply concepts in optics, electromagnetism and basic solid state physics and technology at the Intermediate level. They will be able to use computational techniques to analyze optics problems. The modules in this unit of study are: Optics (13 lectures): The wave nature of light, optical phenomena and the interaction of light with matter: interference and diffraction effects; fundamental limits to resolution of optical instruments; polarisation; dispersion; coherence. These are presented within the context of several key optical technologies including lasers, CD/DVD players, optical fibre communication systems, gratings and Mach Zehnder modulation. Electromagnetic Properties of Matter (12 lectures): Electric and magnetic effects in materials; the combination of electric and magnetic fields to produce light and other electromagnetic waves in vacuum and matter. Solid State and Device Physics (13 lectures): Introduction to quantum mechanics, Fermi-Dirac statistics, electronic properties of solids (metal, semiconductors & insulators), doping and the semiconductor PN junction; introduction to nanotechnology; fabrication technologies, nano-imaging technologies, nanoelectronics. Computational Physics (10 sessions of 2 hours each): In a computing laboratory students use Matlab-based simulation software to conduct virtual experiments in optics, which illustrate and extend the relevant lectures. Students also gain experience in the use of computers to solve problems in physics.

Textbooks

Notes published by the School of Physics: - Physics 2EE Computational Physics Optics Notes - Physics 2EE Electromagnetic Properties of Matter Notes - Physics 2EE Solid State and Device Physics Notes Other relevant texts: see the Unit of Study outline.

Third year

COMP3615
Software Development Project

Credit points: 6 **Session:** Semester 2 **Classes:** Project Work - in class 2 hrs/week; Site Visit 1 hr/week; Project Work - own time 8 hrs/week; Meeting 1 hr/week. **Prerequisites:** INFO3402 AND COMP2129 AND (COMP2007 OR COMP2907 OR COMP2121) **Prohibitions:** INFO3600 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will provide students an opportunity to apply the knowledge and practise the skills acquired in the prerequisite and qualifying units, in the context of designing and building a substantial software development system in diverse application domains including life sciences. Working in groups for an external client combined with academic supervision, students will need to carry out the full range of activities including requirements capture, analysis and design, coding, testing and documentation. Students will use the XP methodology and make use of professional tools for the management of their project.

ELEC3609
Internet Software Platforms

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Project Work - own time 4 hrs. **Prerequisites:** INFO1103, INFO2110, (INFO2120 or INFO2820) **Prohibitions:** EBUS4001 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study will focus on the design, the architecture and the development of web applications using technologies currently popular in the marketplace including Java and .NET environments. There are three key themes examined in the unit: Presentation layer, Persistence layer, and Interoperability. The unit will examine practical technologies such as JSP and Servlets, the model-view-controller (MVC) architecture, database programming with ADO.NET and JDBC, advanced persistence using ORM, XML for interoperability, and XML-based SOAP services and Ajax, in support of the theoretical themes identified.

On completion the students should be able to:

- Compare Java/J2EE web application development with Microsoft .NET web application development.
- Exposure to relevant developer tools (e.g. Eclipse and VS.NET)
- Be able to develop a real application on one of those environments.
- Use XML to implement simple web services and AJAX applications.

INFO3220
Object Oriented Design

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Project Work - own time 2 hrs. **Prerequisites:** INFO2110 and COMP2129 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit covers essential design methods and language mechanisms for successful object-oriented design and programming. C++ is used as the implementation language and a special emphasis is placed on those features of C++ that are important for solving real-world problems. Advanced software engineering features, including exceptions and name spaces are thoroughly covered.

INFO3315
Human-Computer Interaction

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Assumed knowledge:** Background in programming and operating systems that is sufficient for the student to independently learn new programming tools from standard online technical materials. Ability to conduct a literature search. Ability to write reports of work done. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is a course in HCI, Human Computer Interaction, with a focus on web-based Computing. It introduces the key aspects of HCI and web-based system design.

INFO3402
Management of IT Projects and Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Project Work - own time 2 hrs. **Assumed knowledge:** INFO2110 or INFO2810 or INFO2900 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course introduces the basic processes and techniques for managing IT projects, systems and services, throughout the IT lifecycle. It addresses both the technical and behavioural aspects of IT management at the enterprise level. Major topics include: IT planning, project planning and scheduling, project tracking, resource estimation, team management, software testing, change and problem management, and quality assurance.

Fourth year

COMP5348
Enterprise Scale Software Architecture

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 1 hr/week. **Assumed knowledge:** Programming competence in Java or similar OO language. Capacity to master novel technologies (especially to program against novel APIs) using manuals, tutorial examples, etc. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit covers topics on software architecture for large-scale enterprises. Computer systems for large-scale enterprises handle critical business processes, interact with computer systems of other organisations, and have to be highly reliable, available and scalable. This class of systems are built up from several application components, incorporating existing "legacy" code and data stores as well as linking these through middleware technologies, such as distributed transaction processing, remote objects, message-queuing, publish-subscribe, and clustering. The choice of middleware can decide whether the system achieves essential non- functional requirements such as performance and availability. The objective of this unit of study is to educate students for their later professional career and it covers Software Architecture topics of the ACM/IEEE Software Engineering curriculum. Objective: The objective of this unit of study is to educate students for their later professional career and it covers topics of the ACM/IEEE Software Engineering curriculum.

ELEC4702
Practical Experience

Session: Semester 1, Semester 2 **Classes:** Practical Experience, **Prerequisites:** 24 CP of senior or senior advanced units of study. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Professional practice

The Bachelor of Engineering degree requires students to obtain industrial work experience of twelve weeks (60 working days) duration towards satisfying the requirements for award of the degree. Students may undertake their work experience after completion of a minimum of 24 credit points of Year 3 units of study when they have built up a sufficient background of engineering. In general, the type of job that is acceptable for work experience should be in an engineering environment but not necessarily in the same discipline of the degree the student is pursuing. The student is required to inform the School of any work arrangements made by email.

Assessment in this unit is by the submission of a written report of about 4-6 pages on the industrial experience undertaken. The report is to describe the overall structure of the company, the areas that the student became familiar with and their relationship to the firm and, finally, what the student did. A certificate from the company stating the period of employment and the type of work you have undertaken should be attached to your report. The student should inform the company that a short report on the work experience is to be submitted to the School.

The report is to be submitted to the School electronically (see details on the course website http://www.eelab.usyd.edu.au/eLearning/elec4702.html). There is no deadline for submission of the report but it is a good practice to submit it in the first two weeks after the new semester started.

ELEC5618
Software Quality Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** You are capable of writing programs with multiple functions or methods in multiple files. You are capable of design complex data structures and combine them in non trivial algorithms. You know how to use an integrated development environment. You are familiar and have worked previously with software version control systems. You know how to distribute the workload derived from the unit of study effectively throughoug the week and make sure that time is truly productive. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will cover software quality planning, validation and verification methods and techniques, risk analysis, software review techniques, software standards and software process improvement and software reliability.

Students who successfully complete this unit will understand the fundamental concepts of software quality engineering and be able to define software quality requirements, assess the quality of a software design, explain specific methods of building software quality, understand software reliability models and metrics, develop a software quality plan, understand quality assurance and control activities and techniques, understand various testing techniques including being able to verify and test a unit of code and comprehend ISO standards, SPICE, CMM and CMMI.

ELEC5619
Object Oriented Application Frameworks

Credit points: 6 **Session:** Semester 2 **Classes:** Project Work - in class 3 hrs; Project Work - own time 6 hrs; Presentation 2 hrs; Tutorial 3 hrs. **Assumed knowledge:** Java programming, and some web development experience are essential. Databases strongly recommended **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to introduce students to the main issues involved in producing large Internet systems by using and building application frameworks. Frameworks allow great reuse so developers do not have to design and implement applications from scratch, as students have done in ELEC3610 The unit lays down the basic concepts and hands on experience on the design and development of enterprise systems, emphasizing the development of systems using design patterns and application frameworks.

A project-based approach will introduce the problems often found when building such systems, and will require students to take control of their learning. A project-based approach will introduce the problems often found when building such systems, and will require students to take control of their learning. Several development Java frameworks will be used, including Spring, Hibernate, and others. Principles of design patterns will also be studied.

Students must enrol in 12 credit points of Thesis units

ELEC4712
Honours Thesis A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Project Work - own time 12 hrs/week. **Prerequisites:** 36 credits of 3rd year units of study **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: Note that students require permission from the HOS to do both A and B units in the same Semester, and will have an accelerated assessment schedule. Note also that entry to Honours Thesis is by permission.

Students will work individually or in groups on an assigned project for the Semester. The concepts covered depend on the nature of the project, but broadly cover research and inquiry, and information literacy. While recognising that some projects can be interdisciplinary in nature, it is the normal expectation that the students would do the project in their chosen area of specialisation, i.e. Power Engineering, Telecommunications Engineering, Computer Engineering, and Software Engineering students would do projects in the general area of Power, Telecommunications, Computer, and Software respectively.

ELEC4713
Honours Thesis B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Project Work - own time 12 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: Note that students require permission from the HOS to do both A and B units in the same Semester, and will have an accelerated assessment schedule. Note also that entry to Honours Thesis is by permission.

Students will work individually or in groups on an assigned project for the Semester. The concepts covered depend on the nature of the project, but broadly cover research and inquiry, and information literacy.

Notes

1. The Mathematics, Physics and Information Technology units of study may be replaced by equivalent advanced level units of study (if available) subject to prerequisite conditions being met.2. Students whose EWAM is less than 65 before enrolling in ELEC4712 & ELEC4713, or at the end of their degree requirements, will receive a Pass degree.
For a standard enrolment plan for Software Engineering visit http://cusp.sydney.edu.au/students/view-degree-page/name/BE(Soft)

Bachelor of Engineering Honours (Electrical) (Telecommunications)

Course Overview

In the Bachelor of Engineering Honours (Electrical) (Telecommunications) you will learn about the design, planning, commissioning and monitoring of complex telecommunications networks and broadcasting equipment.

The discipline of telecommunications engineering is concerned with all aspects of theory and application for a broad range of systems such as telephone and data networks, radio and television broadcasting, satellite and deep space applications. It is also connected to digital communications, microwaves and antennas, optical communications, the design and manufacture of lasers and optical fibres, signal and information processing and satellite mobile communications.

Today's telecommunications engineer can expect to deal with a wide range of exciting modern technologies, including mobile and wireless communications, fixed and mobile internet, mobile social networking and data transmissions.

Our telecommunications engineering degree will give you a thorough grounding in information and communications technology (ICT), which is at the heart of operations in many industries, including banking and finance, power generation, TV broadcasting, telecommunications and equipment development.

Course Requirements

To meet requirements for the Bachelor of Engineering Honours(Electrical) (Telecommunications), a candidate must successfully complete 192 credit points, comprising:

1. core and elective units of study relating to the specialist stream, as prescribed by the table of units of study for the stream; and
2. any additional free elective units of study as may be necessary to gain credit to complete the award.

For a standard enrolment plan for Electrical(Telecommunications) Engineering visit http://cusp.sydney.edu.au/students/view-degree-page/name/BE(Elec)(Telecom)

Unit of Study Table

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
Bachelor of Engineering Honours (Electrical) (Telecommunications)			
All candidates for the Bachelor of Engineering Honours (Electrical) (Telecommunications) (including those enrolled in a combined degree) must satisfy the requirements described in the table of core units of study. Candidates will also need to choose a number of recommended units of study for Electrical Engineering (Telecommunications), which consist of: - all level 3, 4 and 5 ELEC units which do not appear in the table of core units; and - such other units of study as may be so designated by the Head of School.			
Requirements of the Bachelor of Engineering Honours (Electrical) (Telecommunications)			
Candidates for the Bachelor of Engineering Honours (Electrical) (Telecommunications) are required to complete a total of not less than 192 credit points including at least 168 credit points made up of units from the table of core units and recommended units of study. The additional 24 credit points may consist, in whole or in part, of free elective units of study approved by the Head of School.			
Bachelor of Engineering Honours (Electrical) (Telecommunications) in a combined degree			
Candidates for the Bachelor of Engineering Honours (Electrical) (Telecommunications) combined with the Bachelor of Commerce, Bachelor of Project Management or Bachelor of Law are required to complete at least 144 credit points made up of units from the table of core units and recommended units of study. Candidates for the Bachelor of Engineering Honours (Electrical) (Telecommunications) combined with the Bachelor of Science or Bachelor of Arts are required to complete at least 156 credit points made up of units from the table of core units and recommended units of study. Candidates for the Bachelor of Engineering Honours (Electrical) (Telecommunications) combined with the Bachelor of Medical Science are required to complete at least 156 credit points made up of units from the table of core units and recommended units of study, but may choose to replace up to 12 credit points of recommended units with CHEM1101 Chemistry 1A and BIOL1001 Concepts in Biology. Candidates in all combined degree courses shall also satisfy such other requirements for the combined course as are prescribed in the joint resolutions of the Faculty of Engineering and Information Technologies and the second faculty concerned.			
Electrical Engineering (Telecommunications) core units of study			
First year			
ELEC1601 **Foundations of Computer Systems**	6	**A** HSC Mathematics extension 1 or 2	Semester 2
ENGG1805 **Professional Engineering and IT**	6		Semester 1
MATH1001 **Differential Calculus**	3	**A** HSC Mathematics Extension 1 **N** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001	Semester 1 Summer Main
MATH1002 **Linear Algebra**	3	**A** HSC Mathematics or MATH1111 **N** MATH1902, MATH1012, MATH1014	Semester 1 Summer Main
MATH1003 **Integral Calculus and Modelling**	3	**A** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **N** MATH1013, MATH1903, MATH1907	Semester 2 Summer Main
MATH1005 **Statistics**	3	**A** HSC Mathematics **N** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021	Semester 2 Summer Main Winter Main
PHYS1001 **Physics 1 (Regular)**	6	**A** HSC Physics **P** HSC Physics with a minimum mark of 65 **N** PHYS1002, EDUH1017, PHYS1901	Semester 1
PHYS1003 **Physics 1 (Technological)**	6	**A** HSC Physics or PHYS1001 or PHYS1002 or PHYS1901 or equivalent. **N** PHYS1902, PHYS1004 *It is recommended that PHYS1001 or PHYS1002 or PHYS1901 be completed before this unit*	Semester 2
INFO1103 **Introduction to Programming**	6		Semester 1 Semester 2
INFO1105 **Data Structures**	6	**P** INFO1003 or INFO1103 or INFO1903 or INFS1000	Semester 2
Second year			
ELEC1103 **Fundamentals of Elec and Electronic Eng**	6	**A** Basic knowledge of differentiation & integration, and HSC Physics	Semester 1
ELEC2103 **Simulation & Numerical Solutions in Eng**	6	**A** ELEC1103. Understanding of the fundamental concepts and building blocks of electrical and electronics circuits and aspects of professional project management, teamwork, and ethics. **N** COSC1901, COSC1001	Semester 2
ELEC2104 **Electronic Devices and Circuits**	6	**A** Knowledge: ELEC1103. Ohm's Law and Kirchoff's Laws; action of Current and Voltage sources; network analysis and the superposition theorem; Thevenin and Norton equivalent circuits; inductors and capacitors, transient response of RL, RC and RLC circuits; the ability to use power supplies, oscilloscopes, function generators, meters, etc.	Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
ELEC2302 **Signals and Systems**	6	**A** MATH1001 Differential Calculus and MATH1002 Linear Algebra and MATH1003 Integral Calculus and Modelling. Basic knowledge of differentiation & integration, differential equations, and linear algebra.	Semester 2
ELEC2602 **Digital Logic**	6	**A** ELEC1601. This unit of study assumes some knowledge of digital data representation and basic computer organisation	Semester 1
MATH2061 **Linear Mathematics and Vector Calculus**	6	**P** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **N** MATH2961, MATH2067, MATH2901, MATH2902, MATH2001, MATH2002	Semester 1 Summer Main
PHYS2213 **Physics 2EE**	6	**A** (MATH1001 or MATH1901) and (MATH1002 or MATH1902) and (MATH1003 or MATH1903). MATH1005 or MATH1905 would also be useful **P** (PHYS1001 or PHYS1901) and (PHYS1003 or PHYS1902) **N** PHYS2902, PHYS2011, PHYS2203, PHYS2002, PHYS2901, PHYS2012, PHYS2001, PHYS2912, PHYS2911	Semester 2
COMP2129 **Operating Systems and Machine Principles**	6	**A** INFO1105 OR INFO1905. **P** INFO1103.	Semester 1
Third year			
ELEC3305 **Digital Signal Processing**	6	**A** Specifically the following concepts are assumed knowledge for this unit: familiarity with basic Algebra, Differential and Integral Calculus, continuous linear time-invariant systems and their time and frequency domain representations, Fourier transform, sampling of continuous time signals. **P** ELEC2302	Semester 1
ELEC3405 **Communications Electronics and Photonics**	6	**A** ELEC2104. A background in basic electronics and circuit theory is assumed.	Semester 2
ELEC3505 **Communications**	6	**A** Confidence in mathematical operation usually needed to handle telecommunications problems such as Fourier transform, fundamental in signals and systems theory, convolution, and similar techniques.	Semester 1
ELEC3506 **Data Communications and the Internet**	6	**N** NETS2150	Semester 2
At least 1 of the following 5 units of study:			
ELEC3104 **Engineering Electromagnetics**	6	**A** Differential calculus, integral calculus, vector integral calculus; electrical circuit theory and analysis using lumped elements; fundamental electromagnetic laws and their use in the calculation of static fields.	Semester 1
ELEC3304 **Control**	6	**A** Specifically the following concepts are assumed knowledge for this unit: familiarity with basic Algebra, Differential and Integral Calculus, Physics; solution of linear differential equations, Matrix Theory, eigenvalues and eigenvectors; linear electrical circuits, ideal op-amps; continuous linear time-invariant systems and their time and frequency domain representations, Laplace transform, Fourier transform. **P** MATH2061 and ELEC2302 **N** AMME3500	Semester 2
ELEC3404 **Electronic Circuit Design**	6	**A** A background in basic electronics and circuit theory is assumed.	Semester 1
ELEC3607 **Embedded Systems**	6	**A** ELEC1601 AND ELEC2602. Logic operations, theorems and Boolean algebra, data representation, number operations (binary, hex, integers and floating point), combinational logic analysis and synthesis, sequential logic, registers, counters, bus systems, state machines, simple CAD tools for logic design, basic computer organisation, the CPU, peripheral devices, software organisation, machine language, assembly language, operating systems, data communications and computer networks. **P** ELEC1601 and ELEC2602	Semester 1
ELEC3702 **Management for Engineers**	6	**N** ENGG3005, MECH3661	Semester 2
Fourth year			
ELEC4505 **Digital Communication Systems**	6	**A** ELEC3505 Communications	Semester 1
ELEC4702 **Practical Experience**		**P** 24 CP of senior or senior advanced units of study.	Semester 1 Semester 2
Students must enrol in 12 credit points of Thesis units.			
ELEC4712 **Honours Thesis A**	6	**P** 36 credits of 3rd year units of study *Note: Department permission required for enrolment* *Note that students require permission from the HOS to do both A and B units in the same Semester, and will have an accelerated assessment schedule. Note also that entry to Honours Thesis is by permission.*	Semester 1 Semester 2
ELEC4713 **Honours Thesis B**	6	*Note: Department permission required for enrolment* *Note that students require permission from the HOS to do both A and B units in the same Semester, and will have an accelerated assessment schedule. Note also that entry to Honours Thesis is by permission.*	Semester 1 Semester 2

Notes

1. The Mathematics, Physics and Information Technology units of study may be replaced by equivalent advanced level units of study (if available) subject to prerequisite conditions being met

2. Students whose EWAM is less than 65 before enrolling in ELEC4712 & ELEC4713, or at the end of their degree requirements, will receive a Pass degree.

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Unit of Study Descriptions

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Electrical Engineering (Telecommunications) core units of study

First year

ELEC1601
Foundations of Computer Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** HSC Mathematics extension 1 or 2 **Assessment:** Through semester assessment (61%) Final Exam (39%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study introduces the fundamental digital concepts upon which the design and operation of modern digital computers are based. A prime aim of the unit is to develop a professional view of, and a capacity for inquiry into, the field of computing.

Topics covered include: data representation, basic computer organisation, the CPU, elementary gates and logic, peripheral devices, software organisation, machine language, assembly language, operating systems, data communications and computer networks.

ENGG1805
Professional Engineering and IT

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week; Project Work - own time 2 hrs. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

ENGG1805 aims to introduce students to the fundamental principles that underlie the study of engineering and information technologies. It lays the foundation for later studies, and presents to the students challenges common to a multidisciplinary engineering environment. The subject also provides students with the opportunity to develop an understanding of engineering ethics and of working as a part of a team.

Professional Engineering and IT (6CP) is composed from the following five parts: (a) Introduction to engineering: the engineer as problem solver, critical analysis of greatest engineering achievements and failure. (b) Introduction to common engineering software tools: word processors, project management tools (c) Ethics and workplace health and safety. (d) Testing - concepts of destructive and not destructive tests will be given on samples. (e) "Meet the professionals" - A selection of guest speakers will address students on the most important aspects of the engineering profession. (f) Design Process - The process of design synthesis as an important part of engineering: students will be required to complete an engineering design (from conception, to implementation and testing) maintaining proper lab notes.

MATH1001
Differential Calculus

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001 **Assumed knowledge:** HSC Mathematics Extension 1 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1001 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study looks at complex numbers, functions of a single variable, limits and continuity, vector functions and functions of two variables. Differential calculus is extended to functions of two variables. Taylor's theorem as a higher order mean value theorem.

Textbooks
As set out in the Junior Mathematics Handbook.

MATH1002
Linear Algebra

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1902, MATH1012, MATH1014 **Assumed knowledge:** HSC Mathematics or MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1002 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study introduces vectors and vector algebra, linear algebra including solutions of linear systems, matrices, determinants, eigenvalues and eigenvectors.

Textbooks

As set out in the Junior Mathematics Handbook

MATH1003
Integral Calculus and Modelling

Credit points: 3 **Session:** Semester 2, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1013, MATH1903, MATH1907 **Assumed knowledge:** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1003 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.This unit of study first develops the idea of the definite integral from Riemann sums, leading to the Fundamental Theorem of Calculus. Various techniques of integration are considered, such as integration by parts.The second part is an introduction to the use of first and second order differential equations to model a variety of scientific phenomena.

Textbooks

As set out in the Junior Mathematics Handbook

MATH1005
Statistics

Credit points: 3 **Session:** Semester 2, Summer Main, Winter Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021 **Assumed knowledge:** HSC Mathematics **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1005 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit offers a comprehensive introduction to data analysis, probability, sampling, and inference including t-tests, confidence intervals and chi-squared goodness of fit tests.

Textbooks

As set out in the Junior Mathematics Handbook

PHYS1001
Physics 1 (Regular)

Credit points: 6 **Session:** Semester 1 **Classes:** Three 1-hour lectures, one 3-hour laboratory per week for 9 weeks and one 1-hour tutorial per week. **Prerequisites:** HSC Physics with a minimum mark of 65 **Prohibitions:** PHYS1002, EDUH1017, PHYS1901 **Assumed knowledge:** HSC Physics **Assessment:** 3 hour exam plus laboratories, assignments and mid-semester tests (100%). **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is for students who gained 65 marks or better in HSC Physics or equivalent.The lecture series contains three modules on the topics of mechanics, thermal physics, and oscillations and waves.

Textbooks

Young & Freedman. University Physics. 13th edition, with Mastering Physics, Addison-Wesley. 2012. Course lab manual.

PHYS1003
Physics 1 (Technological)

Credit points: 6 **Session:** Semester 2 **Classes:** Three 1-hour lectures, one 3-hour laboratory per week for 10 weeks, one 1-hour tutorial per week. **Prohibitions:** PHYS1902, PHYS1004 **Assumed knowledge:** HSC Physics or PHYS1001 or PHYS1002 or PHYS1901 or equivalent. **Assessment:** 3 hour exam plus laboratories, tutorials, and assignments (100%). **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: It is recommended that PHYS1001 or PHYS1002 or PHYS1901 be completed before this unit

This unit of study is designed for students majoring in physical and engineering sciences and emphasis is placed on applications of physical principles to the technological world. The lecture series contains modules on the topics of fluids, electromagnetism, and quantum physics.

Textbooks

Young & Freedman. University Physics. 13th edition, with Mastering Physics. Addison-Wesley. Course lab manual.

INFO1103
Introduction to Programming

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Laboratory 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Programming in a legible, maintainable, reusable way is essential to solve complex problems in the pervasive computing environments. This unit will equip students with foundation of programming concepts that are common to widely used programming languages. The "fundamentals-first & objects-later" strategy is used to progressively guide this introductory unit from necessary and important building blocks of programming to the object-oriented approach. Java, one of the most popular programming languages, is used in this unit. It provides interdisciplinary approaches, applications and examples to support students from broad backgrounds such as science, engineering, and mathematics.

INFO1105
Data Structures

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1003 or INFO1103 or INFO1903 or INFS1000 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will teach some powerful ideas that are central to quality software: data abstraction and recursion. It will also show how one can analyse the scalability of algorithms using mathematical tools of asymptotic notation. Contents include: both external "interface" view, and internal "implementation" details, for commonly used data structures, including lists, stacks, queues, priority queues, search trees, hash tables, and graphs; asymptotic analysis of algorithm scalability, including use of recurrence relations to analyse recursive code. This unit covers the way information is represented in each structure, algorithms for manipulating the structure, and analysis of asymptotic complexity of the operations. Outcomes include: ability to write code that recursively performs an operation on a data structure; experience designing an algorithmic solution to a problem using appropriate data structures, coding the solution, and analysing its complexity.

Second year

ELEC1103
Fundamentals of Elec and Electronic Eng

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Basic knowledge of differentiation & integration, and HSC Physics **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to develop knowledge of the fundamental concepts and building blocks of electrical and electronics circuits.This is a foundation unit in circuit theory. Circuit theory is the electrical engineer's fundamental tool.

The concepts learnt in this unit will be made use of heavily in many units of study (in later years) in the areas of electronics, instrumentation, electrical machines, power systems, communication systems, and signal processing.

Topics: a) Basic electrical and electronic circuit concepts: Circuits, circuit elements, circuit laws, node and mesh analysis, circuit theorems, energy storage, capacitors and inductors, circuits with switches, transient response, sine waves and complex analysis, phasors,

impedance, ac power.; b) Project management, teamwork, ethics; c) Safety issues

ELEC2103
Simulation & Numerical Solutions in Eng

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 1 hr/week; Laboratory 3 hrs/week; Project Work - own time 3 hrs/week. **Prohibitions:** COSC1901, COSC1001 **Assumed knowledge:** ELEC1103. Understanding of the fundamental concepts and building blocks of electrical and electronics circuits and aspects of professional project management, teamwork, and ethics. **Assessment:** Through semester assessment (25%) Final Exam (75%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Objectives:

* How to apply the software package Matlab to achieve engineering solutions

* Critical assessment of various computer numerical techniques

* Professional project management, teamwork, ethics

This unit assumes an understanding of the fundamental concepts and building blocks of electrical and electronics circuits. As well as covering the specific topics described in the following paragraphs, it aims to develop skills in professional project management and teamwork and promote an understanding of ethics.

Basic features of Matlab. The Matlab desktop. Interactive use with the command window. Performing arithmetic, using complex numbers and mathematical functions. Writing script and function m-files. Matrix manipulations. Control flow. Two dimensional graphics. Application of Matlab to simple problems from circuit theory, electronics, signals and systems and control. Investigation of the steady state and transient behaviour of LCR circuits.

Matlab based numerical solutions applicable to numerical optimization, ordinary differential equations, and data fitting. Introduction to symbolic mathematics in Matlab. Applications, including the derivation of network functions for simple problems in circuit analysis. Introduction to the use of Simulink for system modelling and simulation.

ELEC2104
Electronic Devices and Circuits

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/fortnight; Laboratory 3 hrs/fortnight **Assumed knowledge:** Knowledge: ELEC1103. Ohm's Law and Kirchoff's Laws; action of Current and Voltage sources; network analysis and the superposition theorem; Thevenin and Norton equivalent circuits; inductors and capacitors, transient response of RL, RC and RLC circuits; the ability to use power supplies, oscilloscopes, function generators, meters, etc. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Modern Electronics has come to be known as microelectronics which refers to the Integrated Circuits (ICs) containing millions of discrete devices. This course introduces some of the basic electronic devices like diodes and different types of transistors. It also aims to introduce students the analysis and design techniques of circuits involving these discrete devices as well as the integrated circuits.

Completion of this course is essential to specialize in Electrical, Telecommunication or Computer Engineering stream. The knowledge of ELEC1103 is assumed.

ELEC2302
Signals and Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/week; E-Learning 1 hr/week. **Assumed knowledge:** MATH1001 Differential Calculus and MATH1002 Linear Algebra and MATH1003 Integral Calculus and Modelling. Basic knowledge of differentiation & integration, differential equations, and linear algebra. **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to teach some of the basic properties of many engineering signals and systems and the necessary mathematical tools that aid in this process. The particular emphasis is on the time and frequency domain modeling of linear time invariant systems. The concepts learnt in this unit will be heavily used in many units of study (in later years) in the areas of communication, control, power systems and signal processing. A basic knowledge of differentiation and integration, differential equations, and linear algebra is assumed.

ELEC2602
Digital Logic

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week; Laboratory pre-work 2 hrs/week. **Assumed knowledge:** ELEC1601. This unit of study assumes some knowledge of digital data representation and basic computer organisation **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The purpose of this unit is to equip the students with the skills to design simple digital logic circuits which comprise modules of larger digital systems.

The following topics are covered: logic operations, theorems and Boolean algebra, number operations (binary, hex, integer and floating point), combinational logic analysis and synthesis, sequential logic, registers, counters, bus systems, state machines, simple CAD tools for logic design, and the design of a simple computer.

MATH2061
Linear Mathematics and Vector Calculus

Credit points: 6 **Session:** Semester 1, Summer Main **Classes:** Three 1 hour lectures, one 1 hour tutorial and one 1 hour practice class per week. **Prerequisites:** (MATH1011 or MATH1001 or MATH1901 or MATH1906) and (MATH1014 or MATH1002 or MATH1902) and (MATH1003 or MATH1903 or MATH1907) **Prohibitions:** MATH2961, MATH2067, MATH2901, MATH2902, MATH2001, MATH2002 **Assessment:** One 2 hour exam, assignments, quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit starts with an investigation of linearity: linear functions, general principles relating to the solution sets of homogeneous and inhomogeneous linear equations (including differential equations), linear independence and the dimension of a linear space. The study of eigenvalues and eigenvectors, begun in junior level linear algebra, is extended and developed. The unit then moves on to topics from vector calculus, including vector-valued functions (parametrised curves and surfaces; vector fields; div, grad and curl; gradient fields and potential functions), line integrals (arc length; work; path-independent integrals and conservative fields; flux across a curve), iterated integrals (double and triple integrals; polar, cylindrical and spherical coordinates; areas, volumes and mass; Green's Theorem), flux integrals (flow through a surface; flux integrals through a surface defined by a function of two variables, though cylinders, spheres and parametrised surfaces), Gauss' Divergence Theorem and Stokes' Theorem.

PHYS2213
Physics 2EE

Credit points: 6 **Session:** Semester 2 **Classes:** Three 1 hour lectures per week; one 2 hour computational laboratory per week for 10 weeks. **Prerequisites:** (PHYS1001 or PHYS1901) and (PHYS1003 or PHYS1902) **Prohibitions:** PHYS2902, PHYS2011, PHYS2203, PHYS2002, PHYS2901, PHYS2012, PHYS2001, PHYS2912, PHYS2911 **Assumed knowledge:** (MATH1001 or MATH1901) and (MATH1002 or MATH1902) and (MATH1003 or MATH1903). MATH1005 or MATH1905 would also be useful **Assessment:** One 3 hour exam, one 1-hour computational test, assignments, computational lab work (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is designed to build on the knowledge gained in Junior Physics, to provide Electrical Engineering students with the knowledge of relevant topics of Physics at the Intermediate level, and with associated skills. Completion of the unit provides a solid foundation for further studies in Electrical Engineering and related engineering areas. The aims of this unit are linked to the generic attributes required of graduates of the University in knowledge skills, thinking skills, personal skills and attributes, and practical skills. By the end of this unit of study, students will be able to describe and apply concepts in optics, electromagnetism and basic solid state physics and technology at the Intermediate level. They will be able to use computational techniques to analyze optics problems. The modules in this unit of study are: Optics (13 lectures): The wave nature of light, optical phenomena and the interaction of light with matter: interference and diffraction effects; fundamental limits to resolution of optical instruments; polarisation; dispersion; coherence. These are presented

within the context of several key optical technologies including lasers, CD/DVD players, optical fibre communication systems, gratings and Mach Zehnder modulation. Electromagnetic Properties of Matter (12 lectures): Electric and magnetic effects in materials; the combination of electric and magnetic fields to produce light and other electromagnetic waves in vacuum and matter. Solid State and Device Physics (13 lectures): Introduction to quantum mechanics, Fermi-Dirac statistics, electronic properties of solids (metal, semiconductors & insulators), doping and the semiconductor PN junction; introduction to nanotechnology; fabrication technologies, nano-imaging technologies, nanoelectronics. Computational Physics (10 sessions of 2 hours each): In a computing laboratory students use Matlab-based simulation software to conduct virtual experiments in optics, which illustrate and extend the relevant lectures. Students also gain experience in the use of computers to solve problems in physics.

Textbooks

Notes published by the School of Physics: - Physics 2EE Computational Physics Optics Notes - Physics 2EE Electromagnetic Properties of Matter Notes - Physics 2EE Solid State and Device Physics Notes Other relevant texts: see the Unit of Study outline.

COMP2129
Operating Systems and Machine Principles

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1103. **Assumed knowledge:** INFO1105 OR INFO1905. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

In this unit of study elementary methods for developing robust, efficient, and re-usable software will be covered. The unit is taught in C, in a Unix environment. Specific coding topics include memory management, the pragmatic aspects of implementing data structures such as lists and hash tables and managing concurrent threads. Debugging tools and techniques are discussed and common programming errors are considered along with defensive programming techniques to avoid such errors. Emphasis is placed on using common Unix tools to manage aspects of the software construction process, such as version control and regression testing. The subject is taught from a practical viewpoint and it includes a considerable amount of programming practice.

Third year

ELEC3305
Digital Signal Processing

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs; Laboratory 2 hrs; Project Work - own time 1 hr. **Prerequisites:** ELEC2302 **Assumed knowledge:** Specifically the following concepts are assumed knowledge for this unit: familiarity with basic Algebra, Differential and Integral Calculus, continuous linear time-invariant systems and their time and frequency domain representations, Fourier transform, sampling of continuous time signals. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to teach how signals are processed by computers. It describes the key concepts of digital signal processing, including details of various transforms and filter design. Students are expected to implement and test some of these ideas on a digital signal processor (DSP). Completion of the unit will facilitate progression to advanced study in the area and to work in the industrial use of DSP.

The following topics are covered. Review of analog and digital signals. Analog to digital and digital to analog conversion. Some useful digital signals. Difference equations and filtering. Impulse and step response of filters. Convolution representation of filters. The Z-transform. Transfer functions and stability. Discrete time Fourier transform (DTFT) and frequency response of filters. Finite impulse response (FIR) filter design: windowing method. Infinite impulse response (IIR) filter design: Butterworth filters, Chebyshev filters, Elliptic filters and impulse invariant design. Discrete Fourier Transform (DFT): windowing effects. Fast Fourier Transform (FFT): decimation in time algorithm. DSP hardware.

ELEC3405
Communications Electronics and Photonics

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/fortnight; Tutorial 2 hrs/fortnight. **Assumed knowledge:** ELEC2104. A background in basic electronics and circuit theory is assumed. **Assessment:** Through semester assessment (25%) Final Exam (75%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study provides an introduction to the fundamental operation and design of transmitter and receiver subsystems for two broad classes of communications systems: those based on electronic transmission and those based on optical transmission.

In the area of electronic communication subsystems, the course presents transmitter and receiver design. Topics relating to the transmitter comprise electronic oscillator sources, tuned electronic amplifiers, and modulators. Topics relating to receiver design comprise RF and IF frequency selective amplifiers, mixers, demodulators, phase-lock loops, feedback amplifiers, and high frequency RF and microwave communication amplifiers. In the area of optical communication subsystems, the course presents photonic transmitters and receivers. On the transmitter side this focuses on the principles of light generation in optical sources such as semiconductor lasers and light emitting diodes, electro-optic modulation of light, and optical amplifiers. On the receiver side, photodetectors, optical receivers, and front-end circuits are discussed. The principles and design of these subsystems are considered with reference to a basic optoelectronic communication link.

ELEC3505
Communications

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/fortnight; Tutorial 3 hrs/fortnight. **Assumed knowledge:** Confidence in mathematical operation usually needed to handle telecommunications problems such as Fourier transform, fundamental in signals and systems theory, convolution, and similar techniques. **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is an intermediate unit of study in telecommunications following on the general concepts studied in earlier units such as Signal and Systems and leading on to more advanced units such as Digital Communication Systems. Student will learn how to critically design and evaluate digital communication systems including the elements of a digital transmission system, understand the limitations of communications channels, different analog and digital modulation schemes and reasons to use digital techniques instead of analog, and the effect of noise and interference in performance of the digital communication systems. On completion of this unit, students will have sufficient knowledge of the physical channel of a telecommunications network to approach the study of higher layers of the network stack.

The following topics are covered. Introduction to communications systems, random signals and stochastic process, components, signals and channels, sampling, quantization, pulse amplitude modulation (PAM), pulse code modulation (PCM), quantization noise, time division multiplexing, delta modulation. Digital communications: baseband signals, digital PAM, eye diagram, equalization, correlative coding, error probabilities in baseband digital transmission, bandpass transmission, digital amplitude shift keying (ASK), frequency shift keying (FSK), phase shift keying (PSK) and quadrature shift keying (QPSK), error probabilities in bandpass digital transmission, a case study of digital communication systems. Introduction to information theory: fundamental limits in communications, channel capacity and channel coding, signal compression.

ELEC3506
Data Communications and the Internet

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/fortnight; Tutorial 2 hrs/week. **Prohibitions:** NETS2150 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Students undertaking this unit should be familiar with fundamental digital technologies and representations such as bit complement and internal word representation. Students should also have a basic understanding of the physical properties of communication channels, techniques and limitations. Furthermore, students should be able to apply fundamental mathematical skills.

The unit will cover the following specific material: Communication reference models (TCP/IP and OSI). Circuit switched and packet switched communication. Network node functions and building blocks. LAN, MAN, WAN, WLAN technologies. Protocols fundamental mechanisms. The TCP/IP core protocols (IP, ICMP, DHCP, ARP, TCP, UDP etc.). Applications and protocols (FTP, Telnet, SMTP, HTTP etc.), Network Management and Security.

At least 1 of the following 5 units of study:

ELEC3104
Engineering Electromagnetics

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Differential calculus, integral calculus, vector integral calculus; electrical circuit theory and analysis using lumped elements; fundamental electromagnetic laws and their use in the calculation of static fields. **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces students to the broad spectrum of engineering electromagnetics and helps students to develop theoretical and analytical skills in the area of electrical and telecommunications engineering and develop understanding of the basic electromagnetic theory underpinning optical communications, wireless communications and electrical engineering.

ELEC3304
Control

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs. **Prerequisites:** MATH2061 and ELEC2302 **Prohibitions:** AMME3500 **Assumed knowledge:** Specifically the following concepts are assumed knowledge for this unit: familiarity with basic Algebra, Differential and Integral Calculus, Physics; solution of linear differential equations, Matrix Theory, eigenvalues and eigenvectors; linear electrical circuits, ideal op-amps; continuous linear time-invariant systems and their time and frequency domain representations, Laplace transform, Fourier transform. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit is mainly concerned with the application of feedback control to continuous-time, linear time-invariant systems. It aims to give the students an appreciation of the possibilities in the design of control and automation in a range of application areas. The concepts learnt in this unit will be made use of heavily in many units of study in the areas of communication, control, electronics, and signal processing.

The following specific topics are covered: Modelling of physical systems using state space, differential equations, and transfer functions, dynamic response of linear time invariant systems and the role of system poles and zeros on it, simplification of complex systems, stability of feedback systems and their steady state performance, Routh-Hurwitz stability criterion, sketching of root locus and controller design using the root locus, Proportional, integral and derivative control, lead and lag compensators, frequency response techniques, Nyquist stability criterion, gain and phase margins, compensator design in the frequency domain, state space design for single input single-output systems, pole placement state variable feedback control and observer design.

ELEC3404
Electronic Circuit Design

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/fortnight; Laboratory 3 hrs/fortnight. **Assumed knowledge:** A background in basic electronics and circuit theory is assumed. **Assessment:** Through semester assessment (70%) Final Exam (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to teach students analysis and design techniques for electronic systems such as signal amplifiers, differential amplifiers and power amplifiers. Completion of this unit will allow progression to advanced studies or to work in electronics and telecommunication engineering.

Topics covered are as follows. The BJT and MOSFET as an amplifier. Biasing in amplifier circuits. Small signal operation and models. Single stage amplifiers. Internal capacitances and high frequency models. The frequency response of the common-emitter amplifier. Current sources and current mirrors. Differential amplifiers. Output stages and power amplifiers:class A, class B and class AB.

ELEC3607
Embedded Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week. **Prerequisites:** ELEC1601 and ELEC2602 **Assumed knowledge:** ELEC1601 AND ELEC2602. Logic operations, theorems and Boolean algebra, data representation, number operations (binary, hex, integers and floating point), combinational logic analysis and synthesis, sequential logic, registers, counters, bus systems, state machines, simple CAD tools for logic design, basic computer organisation, the CPU, peripheral devices, software organisation, machine language, assembly language, operating systems, data communications and computer networks. **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Embedded systems have become pervasive in modern society. The aim of this unit of study is to teach students about embedded systems architecture, design methodology, interfacing and programming. Topics covered include peripheral devices, interrupts, direct memory access (DMA), assembly language, communications and data acquisition. A major design project is part of this course.

ELEC3702
Management for Engineers

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week. **Prohibitions:** ENGG3005, MECH3661 **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to develop an understanding of the principles and practices of industry, to provide an overview of the various issues facing an industrial organisation, and of the basic approaches to their management, to understand the changing nature and effects of globalisation on Australia`s economic performance, the competitiveness of Australian firms, and the generation of employment and wealth, to gain an insight into the importance of innovation at all levels and functions of all organisations, and of the ways of developing people-skills and organisational styles to promote innovation, to develop the broader skills required by employers of engineers, and to understand the objectives and roles appropriate to governments. The following topics are covered; Engineers and management, Microeconomics, Macroeconomics, Managerial decision analysis, Management science models, Behaviour of people in organisations, Human resource management, Strategic management, Accounting and management, Operations management, Marketing for engineers, Legal environment of business, Industrial relations.

Fourth year

ELEC4505
Digital Communication Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 3 hrs/week. **Assumed knowledge:** ELEC3505 Communications **Assessment:** Through semester assessment (35%) Final Exam (65%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The lecture starts with an overview of major components of a digital communication system and current technology. Then the following knowledge will be covered: efficient coding/representation of information source, channel coding of information to combat noise and interference, optimal received design, principles of incoherent systems, error probability calculations, solutions to problems caused by transmitting a signal through a bandlimited channel and caused by multipath, and spread spectrum systems. The lecture concludes with a discussion of future directions of digital communication systems.

ELEC4702
Practical Experience

Session: Semester 1, Semester 2 **Classes:** Practical Experience, **Prerequisites:** 24 CP of senior or senior advanced units of study. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Professional practice

The Bachelor of Engineering degree requires students to obtain industrial work experience of twelve weeks (60 working days) duration towards satisfying the requirements for award of the degree. Students may undertake their work experience after completion of a minimum of 24 credit points of Year 3 units of study when they have built up a sufficient background of engineering. In general, the type of job that is acceptable for work experience should be in an engineering environment but not necessarily in the same discipline of the degree the student is pursuing. The student is required to inform the School of any work arrangements made by email.

Assessment in this unit is by the submission of a written report of about 4-6 pages on the industrial experience undertaken. The report is to describe the overall structure of the company, the areas that the student became familiar with and their relationship to the firm and, finally, what the student did. A certificate from the company stating the period of employment and the type of work you have undertaken should be attached to your report. The student should inform the company that a short report on the work experience is to be submitted to the School.

The report is to be submitted to the School electronically (see details on the course website http://www.eelab.usyd.edu.au/eLearning/elec4702.html). There is no deadline for submission of the report but it is a good practice to submit it in the first two weeks after the new semester started.

Students must enrol in 12 credit points of Thesis units.

ELEC4712
Honours Thesis A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Project Work - own time 12 hrs/week. **Prerequisites:** 36 credits of 3rd year units of study **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: Note that students require permission from the HOS to do both A and B units in the same Semester, and will have an accelerated assessment schedule. Note also that entry to Honours Thesis is by permission.

Students will work individually or in groups on an assigned project for the Semester. The concepts covered depend on the nature of the project, but broadly cover research and inquiry, and information literacy. While recognising that some projects can be interdisciplinary in nature, it is the normal expectation that the students would do the project in their chosen area of specialisation, i.e. Power Engineering, Telecommunications Engineering, Computer Engineering, and Software Engineering students would do projects in the general area of Power, Telecommunications, Computer, and Software respectively.

ELEC4713
Honours Thesis B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Project Work - own time 12 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: Note that students require permission from the HOS to do both A and B units in the same Semester, and will have an accelerated assessment schedule. Note also that entry to Honours Thesis is by permission.

Students will work individually or in groups on an assigned project for the Semester. The concepts covered depend on the nature of the project, but broadly cover research and inquiry, and information literacy.

Notes

1. The Mathematics, Physics and Information Technology units of study may be replaced by equivalent advanced level units of study (if available) subject to prerequisite conditions being met2. Students whose EWAM is less than 65 before enrolling in ELEC4712 & ELEC4713, or at the end of their degree requirements, will receive a Pass degree.

For a standard enrolment plan for Electrical(Telecommunications) Engineering visit http://cusp.sydney.edu.au/students/view-degree-page/name/BE(Elec)(Telecom)

School of Information Technologies

Computers and technology permeate all aspects of business and social life. They are central to solving many of the big challenges facing society and are capable of affecting the lives of millions of people worldwide in a positive way. Professionals and researchers in these areas find innovative solutions, build scalable infrastructure, develop new products, manage data, improve efficiencies and facilitate communication. With a computational perspective on problem solving, designing systems and understanding human behaviour, they can apply these ideas and techniques to a number of disciplines including business, engineering, natural and social sciences and the humanities.

Our degree programs in computer science and technology prepare you to operate as a professional at the cutting edge of information technology. With a combination of teaching and practical experience, you will be able to create, manage or administer applications, websites and systems for new and established organisations across any industry or, depending on your level of study, move into management roles.

At the undergraduate level, the School of Information Technologies offers the following programs.

Degrees

The School of IT offers the following three degrees:

- The Bachelor of Computer Science and Technology (BCST). Its normal duration is three years (144 Credit Points).
- The BCST (Advanced). The advanced option is for those with substantial programming experience. Its normal duration is three years (144 Credit Points).
- The Bachelor of Information Technology (BIT). Its normal duration is four years (192 Credit Points).

In addition, the school offers the following combined degrees:

- Bachelor of Information Technology and Bachelor of Arts (BIT/BA) (240 Credit Points).
- Bachelor of Information Technology and Bachelor of Commerce (BIT/BCom) (240 Credit Points).
- Bachelor of Information Technology and Bachelor of Law (BIT/LLB) (288 Credit Points).
- Bachelor of Information Technology and Bachelor of Medical Science (BIT/BMedSc) (240 Credit Points).
- Bachelor of Information Technology and Bachelor of Science (BIT/BSc) (240 Credit Points).

Streams

The School of IT offers these streams in the degrees listed above:

- The Computer Science stream concentrates on the fundamental aspects of computing and information processing.
- The Information Systems stream focuses on the application of software design and development to the business domain.

Students enrolled in BCST, BCST (Advanced) or BIT must complete at least one of the two offered streams.

Students enrolled in the BSc or BSc (Advanced) degrees offered by the Faculty of Science can select Computer Science and/or Information Systems as their major in their senior (third) year.

Honours

The School of IT offers three different honours degrees:

1. After completing the requirements for a BCST or a pass degree from the Faculty of Science or a degree equivalent to the BCST from another institution, students can apply for enrolment in the honours degree (normal duration 1 year), and upon successful completion they will be awarded a BCST(Honours).
2. After completing the requirements for a BCST(Adv) or a BSc(Adv) degree from the Faculty of Science or a degree equivalent to the BCST(Adv) from another institution, students can apply for enrolment in the honours degree (normal duration 1 year), and upon successful completion they will be awarded a BCST(Adv)(Honours).
3. In their fourth year (after completing 144 credit points and the requirements of the first three years of study) students enrolled in the BIT degree, can either pursue the coursework option or the honours option. A successful completion of the honours option will result in an award of a BIT (Honours) degree.
   In addition, students who have completed a pass degree of BSc, or equivalent, can apply for enrolment in the BSc(Hons) with honours in Computer Science or in Information Systems, as offered by the Faculty of Science.

Minors

The School of IT offers a *minor in IT*. A 'minor' is defined as at least 18 credit points from SIT coded units (COMP, INFO, ISYS), at the Intermediate level (second year) or above.

The school will issue a certificate to all students who have completed the requirements for a degree of the University of Sydney and who complete the requirements for an IT minor, upon application.

An application form is available at sydney.edu.au/engineering/it/future_students/undergrad/minor.

Bachelor of Computer Science and Technology

Course Overview

The Bachelor of Computer Science and Technology (BCST) will prepare you to work at the cutting edge of information technology. After you have completed core studies in programming, databases, systems analysis, and professional IT practice, you will pursue a course of study along one of two streams: computer science or information systems.

While undertaking your degree, you are encouraged to explore your personal interests by enrolling in units from a range of other disciplines such as psychology, languages, biology, philosophy, geography or commerce. This study experience provides domain-specific knowledge useful to the application of information technologies in that area.

The computer science stream involves the study of computers and computer programs. You will excel in this stream if you're more technically-minded and want to contribute to the future development and support of computer technology.

The information systems stream comprises the study of the direct application of software design and development to the business domain. You will gain an understanding of the principles and techniques involved in the analysis, design, implementation and maintenance of computer systems within a business environment.

Course Requirements

To meet the requirements of the Bachelor of Computer Science and Technology, a candidate must successfully complete 144 credit points, comprising:

1. at least 114 credit points from core and recommended elective units;
2. 18 credit points of selected Mathematics and Statistics units, with at least six credit points at 2000-level or above;
3. a maximum of 30 credit points of free elective units of study for either the Computer Science stream or theInformation Systems stream as shown in the units of study tables for this course;

and ensuring:

1. no more than 72 credit points in junior (1000-level) units of study; and
2. at least 42 credit points in 3000-level units of study.

For a standard enrolment plan for Bachelor of Computer Science and Technology visit CUSP.

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Bachelor of Computer Science and Technology			
Candidates for the degree Bachelor of Computer Science and Technology (BCST) are required to gain credit for 144 credit points from the units of study set out below. The selection of units must satisfy the degree rules in the Resolutions of the Faculty. In particular, all core units must be completed, along with an appropriate amount from the elective units of study as recommended by the Faculty. Candidates for the BCST degree must complete a stream in either Computer Science or Information Systems, or both, as described in the Tables below. Enrolment is subject to the following constraint: 1. At most 72 credit points accumulated from first year units (including core and recommended electives) can be counted for degree completion. Through this Table, candidates may substitute an advanced equivalent for a non- advanced unit mentioned. They may also substitute an appropriate unit from the Advanced Engineering program of the Faculty of Engineering, or the Talented Student Program of the Faculty of Science, if they are eligible to enrol in such units.			
(i) Stream in Computer Science			
First year core units of study for CS stream			
ELEC1601 **Foundations of Computer Systems**	6	**A** HSC Mathematics extension 1 or 2	Semester 2
ENGG1805 **Professional Engineering and IT**	6		Semester 1
INFO1103 **Introduction to Programming**	6		Semester 1 Semester 2
INFO1105 **Data Structures**	6	**P** INFO1003 or INFO1103 or INFO1903 or INFS1000	Semester 2
Note: INFO1905 (advanced version) can be taken as an alternative core unit to INFO1105.			
First year recommended elective units of study for CS stream			
At least 12 cp must be completed from 1000-level Mathematics and/or Statistics units of study			
BUSS1001 **Understanding Business**	6	**N** ECOF1003 *This unit of study is a compulsory part of the Bachelor of Commerce, combined Bachelor of Commerce degrees and the Bachelor of Commerce (Liberal Studies).*	Semester 1 Semester 2
BUSS1002 **The Business Environment**	6	**P** ECOF1003 or BUSS1001 **N** ECOF1004, CISS2001 *This unit of study is a compulsory part of the Bachelor of Commerce, combined Bachelor of Commerce degrees and the Bachelor of Commerce (Liberal Studies).*	Semester 1 Semester 2
ELEC1103 **Fundamentals of Elec and Electronic Eng**	6	**A** Basic knowledge of differentiation & integration, and HSC Physics	Semester 1
INFO1003 **Foundations of Information Technology**	6	**N** INFO1000, ISYS1003, INFO1903, INFS1000	Semester 1 Semester 2
INFO1903 **Informatics (Advanced)**	6	**P** ATAR sufficient to enter BCST(Adv), BIT or BSc(Adv), or portfolio of work suitable for entry *Note: Department permission required for enrolment*	Semester 1
PHIL1012 **Introductory Logic**	6		Semester 2
All 1000-level MATH units of study are recommended electives. A full list of available MATH/STAT units can be obtained from the School of Mathematics and Statistics, who can also advise on the appropriate level of unit for the students preparation. We strongly suggest including some statistics unit among the choices.			
Second year core units of study for CS stream			
COMP2007 **Algorithms and Complexity**	6	**A** MATH1004 **P** INFO1105 OR INFO1905.	Semester 2
Note: COMP2907 (advanced version) can be taken as an alternative core unit to COMP2007.			
COMP2129 **Operating Systems and Machine Principles**	6	**A** INFO1105 OR INFO1905. **P** INFO1103.	Semester 1
INFO2110 **Systems Analysis and Modelling**	6	**A** Experience with a data model as in INFO1003 or INFO1103 or INFS1000	Semester 2
INFO2120 **Database Systems 1**	6	**P** INFO1003 OR INFO1103 OR INFO1903 OR INFS1000 OR DECO1012. **N** INFO2820, INFO2905, COMP5138	Semester 1
Note: INFO2820 (advanced version) can be taken as an alternative core unit to INFO2120.			
Second year recommended elective units of study for CS stream			
Students must complete at least 12 crpts. At least 6 crpts must be completed from 2000-level Mathematics and/or Statistics (we suggest choosing from MATH2069, MATH2063, STAT2012 and/or STAT2912) At least 6 crpts must be completed from (COMP2022, COMP2121)			

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
INFS2020 **Business Process Modelling & Improvement**	6	**A** INFS1000 or equivalent **N** INFS2005	Semester 2
All 2000-level COMP, INFO, ISYS units of study are recommended electives.			
All 2000-level ELEC units of study are recommended electives.			
All 2000-level MATH or STAT units of study are recommended electives.			
Third year core units of study for CS stream			
INFO3220 **Object Oriented Design**	6	**P** INFO2110 and COMP2129	Semester 1
INFO3402 **Management of IT Projects and Systems**	6	**A** INFO2110 or INFO2810 or INFO2900	Semester 1
COMP3615 **Software Development Project**	6	**P** INFO3402 AND COMP2129 AND (COMP2007 OR COMP2907 OR COMP2121) **N** INFO3600	Semester 2
CS & IS double stream: Students enrolled in the double stream must also complete ISYS3401 Analytical Methods and Information Systems and ISYS3400 Information System Project as core units of study, and choose 12 crpts of third year recommended elective units			
Third year recommended elective units of study for CS stream			
Students must complete at least 24 crpts.			
At least 12 crpts must be completed from (COMP3109, COMP3308, COMP3419, COMP3520, COMP3530, COMP3608) if single stream.			
At least 12 crpts must be completed from 3000-level COMP, INFO, ISYS units if double streams.			
INFS3040 **Enterprise Systems & Integrated Business**	6	**A** INFS1000 or equivalent **N** INFS3005	Semester 1
All 3000-level COMP, INFO, ISYS units of study are recommended electives.			
All 3000-level ELEC units of study are recommended electives.			
(ii) Stream in Information Systems			
First year core units of study for IS stream			
ELEC1601 **Foundations of Computer Systems**	6	**A** HSC Mathematics extension 1 or 2	Semester 2
ENGG1805 **Professional Engineering and IT**	6		Semester 1
INFO1103 **Introduction to Programming**	6		Semester 1 Semester 2
INFO1105 **Data Structures**	6	**P** INFO1003 or INFO1103 or INFO1903 or INFS1000	Semester 2
Note: INFO1905 (advanced version) can be taken as an alternative core unit to INFO1105.			
First year recommended elective units of study for IS stream			
At least 12 crpts must be completed from 1000-level Mathematics and/or Statistics.			
BUSS1001 **Understanding Business**	6	**N** ECOF1003 *This unit of study is a compulsory part of the Bachelor of Commerce, combined Bachelor of Commerce degrees and the Bachelor of Commerce (Liberal Studies).*	Semester 1 Semester 2
BUSS1002 **The Business Environment**	6	**P** ECOF1003 or BUSS1001 **N** ECOF1004, CISS2001 *This unit of study is a compulsory part of the Bachelor of Commerce, combined Bachelor of Commerce degrees and the Bachelor of Commerce (Liberal Studies).*	Semester 1 Semester 2
ELEC1103 **Fundamentals of Elec and Electronic Eng**	6	**A** Basic knowledge of differentiation & integration, and HSC Physics	Semester 1
INFO1003 **Foundations of Information Technology**	6	**N** INFO1000, ISYS1003, INFO1903, INFS1000	Semester 1 Semester 2
INFO1903 **Informatics (Advanced)**	6	**P** ATAR sufficient to enter BCST(Adv), BIT or BSc(Adv), or portfolio of work suitable for entry *Note: Department permission required for enrolment*	Semester 1
PHIL1012 **Introductory Logic**	6		Semester 2
All 1000-level MATH units of study are recommended electives. A full list of available MATH/STAT units can be obtained from the School of Mathematics and Statistics, who can also advise on the appropriate level of unit for the students preparation. We strongly suggest including some statistics unit among the choices.			
Second year core units of study for IS stream			
COMP2129 **Operating Systems and Machine Principles**	6	**A** INFO1105 OR INFO1905. **P** INFO1103.	Semester 1
INFO2110 **Systems Analysis and Modelling**	6	**A** Experience with a data model as in INFO1003 or INFO1103 or INFS1000	Semester 2
INFO2120 **Database Systems 1**	6	**P** INFO1003 OR INFO1103 OR INFO1903 OR INFS1000 OR DECO1012. **N** INFO2820, INFO2905, COMP5138	Semester 1
Note: INFO2820 (advanced version) can be taken as an alternative core unit to INFO2120.			
ISYS2140 **Information Systems**	6	**P** INFO1103 OR INFO1903 OR INFS1000 OR INFO1003	Semester 1

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
COMP2007 **Algorithms and Complexity**	6	**A** MATH1004 **P** INFO1105 OR INFO1905.	Semester 2
COMP2907 (advanced version) can be taken as an alternative core unit to COMP2007.			
Second year recommended elective units for IS stream			
Students must complete at least 6 crpts.			
At least 6 crpts must be completed from 2000-level Mathematics and/or Statistics. We strongly suggest STAT2012 or STAT2912.			
INFS2020 **Business Process Modelling & Improvement**	6	**A** INFS1000 or equivalent **N** INFS2005	Semester 2
All 2000-level COMP, INFO, ISYS and ELEC units of study are recommended.			
All 2000-level ELEC units of study are recommended electives.			
All 2000-level MATH or STAT units of study are recommended electives.			
Third year core units of study for IS stream			
INFO3402 **Management of IT Projects and Systems**	6	**A** INFO2110 or INFO2810 or INFO2900	Semester 1
ISYS3400 **Information Systems Project**	6	**P** INFO2110, INFO2120, ISYS2140, INFO3402, ISYS3401 **N** ISYS3207, INFO3600	Semester 2
ISYS3401 **Analytical Methods & Information Systems**	6	**A** INFO2110, ISYS2140	Semester 1
CS & IS double stream: Students enrolled in the double stream must also complete INFO3220 Object Oriented Design and COMP3615 Software Development Project as core units of study			
Third year recommended elective units of study for IS stream			
Student must complete at least 24 crpts. At least 12 crpts must be completed from (INFO3220, INFO3315, INFO3404, INFO3406, INFO3504)			
INFS3040 **Enterprise Systems & Integrated Business**	6	**A** INFS1000 or equivalent **N** INFS3005	Semester 1
All 3000-level COMP, INFO, ISYS units of study are recommended electives.			
All 3000-level ELEC units of study are recommended electives.			
Honours			
Students who have qualified for the BCST degree may apply to enter the BCST(Honours) year. Note that unlike BIT(Honours) or BE(Honours), the Honours in BCST requires an additional 48 credit points of study.			
All BCST(Honours) students must complete the following 24 credit points of core units of study. These units are only available to students enrolled in Honours degrees, those in Research Higher degrees, or those in the Research track in postgraduate coursework degrees. In addition to the core units students must also complete 24 credit points of elective units of study, please refer to units listed in the BIT table Fourth Year Selected Core.			
Fourth year Honours core units of study			
INFO4991 **IT Research Thesis A**	6	**C** INFO5993 *Note: Department permission required for enrolment* *INFO4991 and INFO4992 together form the Honours Research thesis. It is allowed to enrol in one of these units in one semester, and the other the following semester; the same mark and grade is given for both once they have both been completed.*	Semester 1 Semester 2
INFO4992 **IT Research Thesis B**	12	**C** INFO4991 and INFO5993 *Note: Department permission required for enrolment* *INFO4991 and INFO4992 together form the Honours Research thesis. It is allowed to enrol in one of these units in one semester, and the other the following semester; the same mark and grade is given for both once they have both been completed.*	Semester 1 Semester 2
INFO4999 **Computer Science Honours Result**		*Note: Department permission required for enrolment*	Semester 1 Semester 2
INFO5993 **IT Research Methods**	6		Semester 1 Semester 2

For a standard enrolment plan for Bachelor of Computer Science and Technology visit CUSP.

Unit of Study Descriptions

Bachelor of Computer Science and Technology

Candidates for the degree Bachelor of Computer Science and Technology (BCST) are required to gain credit for 144 credit points from the units of study set out below. The selection of units must satisfy the degree rules in the Resolutions of the Faculty. In particular, all core units must be completed, along with an appropriate amount from the elective units of study as recommended by the Faculty. Candidates for the BCST degree must complete a stream in either Computer Science or Information Systems, or both, as described in the Tables below.Enrolment is subject to the following constraint:1. At most 72 credit points accumulated from first year units (including core and recommended electives) can be counted for degree completion.Through this Table, candidates may substitute an advanced equivalent for a non- advanced unit mentioned. They may also substitute an appropriate unit from the Advanced Engineering program of the Faculty of Engineering, or the Talented Student Program of the Faculty of Science, if they are eligible to enrol in such units.

(i) Stream in Computer Science

First year core units of study for CS stream

ELEC1601
Foundations of Computer Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** HSC Mathematics extension 1 or 2 **Assessment:** Through semester assessment (61%) Final Exam (39%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study introduces the fundamental digital concepts upon which the design and operation of modern digital computers are based. A prime aim of the unit is to develop a professional view of, and a capacity for inquiry into, the field of computing.

Topics covered include: data representation, basic computer organisation, the CPU, elementary gates and logic, peripheral devices, software organisation, machine language, assembly language, operating systems, data communications and computer networks.

ENGG1805
Professional Engineering and IT

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week; Project Work - own time 2 hrs. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

ENGG1805 aims to introduce students to the fundamental principles that underlie the study of engineering and information technologies. It lays the foundation for later studies, and presents to the students challenges common to a multidisciplinary engineering environment. The subject also provides students with the opportunity to develop an understanding of engineering ethics and of working as a part of a team.

Professional Engineering and IT (6CP) is composed from the following five parts: (a) Introduction to engineering: the engineer as problem solver, critical analysis of greatest engineering achievements and failure. (b) Introduction to common engineering software tools: word processors, project management tools (c) Ethics and workplace health and safety. (d) Testing - concepts of destructive and not destructive tests will be given on samples. (e) "Meet the professionals" - A selection of guest speakers will address students on the most important aspects of the engineering profession. (f) Design Process - The process of design synthesis as an important part of engineering: students will be required to complete an engineering design (from conception, to implementation and testing) maintaining proper lab notes.

INFO1103
Introduction to Programming

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Laboratory 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Programming in a legible, maintainable, reusable way is essential to solve complex problems in the pervasive computing environments. This unit will equip students with foundation of programming concepts that are common to widely used programming languages. The "fundamentals-first & objects-later" strategy is used to progressively guide this introductory unit from necessary and important building blocks of programming to the object-oriented approach. Java, one of the most popular programming languages, is used in this unit. It provides interdisciplinary approaches, applications and examples to support students from broad backgrounds such as science, engineering, and mathematics.

INFO1105
Data Structures

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1003 or INFO1103 or INFO1903 or INFS1000 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will teach some powerful ideas that are central to quality software: data abstraction and recursion. It will also show how one can analyse the scalability of algorithms using mathematical tools of asymptotic notation. Contents include: both external "interface" view, and internal "implementation" details, for commonly used data structures, including lists, stacks, queues, priority queues, search trees, hash tables, and graphs; asymptotic analysis of algorithm scalability, including use of recurrence relations to analyse recursive code. This unit covers the way information is represented in each structure, algorithms for manipulating the structure, and analysis of asymptotic complexity of the operations. Outcomes include: ability to write code that recursively performs an operation on a data structure; experience designing an algorithmic solution to a problem using appropriate data structures, coding the solution, and analysing its complexity.

Note: INFO1905 (advanced version) can be taken as an alternative core unit to INFO1105.

First year recommended elective units of study for CS stream

At least 12 cp must be completed from 1000-level Mathematics and/or Statistics units of study

BUSS1001
Understanding Business

Credit points: 6 **Teacher/Coordinator:** Professor Marcus O'Connor **Session:** Semester 1, Semester 2 **Classes:** 1x 1.5 hr lecture and 1x 1.5 hr tutorial per week **Prohibitions:** ECOF1003 **Assessment:** participation (15%), essay (20%), case study (20%), and final exam (45%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This unit of study is a compulsory part of the Bachelor of Commerce, combined Bachelor of Commerce degrees and the Bachelor of Commerce (Liberal Studies).

This unit of study is the first of two junior core units aimed at introducing students to the internal and external contexts in which business operates in the twenty-first century. It also aims to lay the foundations for effective communication (written and oral), critical analysis, problem solving, and team work skills, which are essential to achieving program learning goals. In this unit, students will build an understanding of the dynamics of business through the lens of the company and its stakeholders. Business ethics is also introduced as key learning goal.

BUSS1002
The Business Environment

Credit points: 6 **Teacher/Coordinator:** Omer Konakci **Session:** Semester 1, Semester 2 **Classes:** 1x 1.5hr lecture and 1x 1.5hr tutorial per week **Prerequisites:** ECOF1003 or BUSS1001 **Prohibitions:** ECOF1004, CISS2001 **Assessment:** media summary and analyses (55%), tutorial participation (10%), and final exam (35%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This unit of study is a compulsory part of the Bachelor of Commerce, combined Bachelor of Commerce degrees and the Bachelor of Commerce (Liberal Studies).

This unit of study is the second of two junior core units aimed at introducing students to the external and internal contexts in which business operates in the twenty-first century while developing effective problem solving, critical analysis and communication skills. In this unit, students will build an understanding of the economic, political and regulatory, socio-cultural, and technological factors that impact on the external context of the commercial landscape while developing an awareness of potential of risk and change. An awareness of corporate social responsibility and sustainability is also introduced as a key learning goal.

ELEC1103
Fundamentals of Elec and Electronic Eng

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Basic knowledge of differentiation & integration, and HSC Physics **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to develop knowledge of the fundamental concepts and building blocks of electrical and electronics circuits. This is a foundation unit in circuit theory. Circuit theory is the electrical engineer's fundamental tool.

The concepts learnt in this unit will be made use of heavily in many units of study (in later years) in the areas of electronics, instrumentation, electrical machines, power systems, communication systems, and signal processing.

Topics: a) Basic electrical and electronic circuit concepts: Circuits, circuit elements, circuit laws, node and mesh analysis, circuit theorems, energy storage, capacitors and inductors, circuits with switches, transient response, sine waves and complex analysis, phasors, impedance, ac power.; b) Project management, teamwork, ethics; c) Safety issues

INFO1003
Foundations of Information Technology

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 3 hrs/week; Laboratory 2 hrs/week. **Prohibitions:** INFO1000, ISYS1003, INFO1903, INFS1000 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Information technologies (IT) and systems have emerged as the primary platform to support communication, collaboration, research, decision making, and problem solving in contemporary organisations. The essential necessity for all university students to acquire the fundamental knowledge and skills for applying IT effectively for a wide range of tasks is widely recognised. It is an introductory unit of study which prepares students from any academic discipline to develop the necessary knowledge, skills and abilities to be competent in the use of information technology for solving a variety of problems. The main focus of this unit is on modelling and problem solving through the effective use of using IT. Students will learn how to navigate independently to solve their problems on their own, and to be capable of fully applying the power of IT tools in the service of their goals in their own domains while not losing sight of the fundamental concepts of computing.

Students are taught core skills related to general purpose computing involving a range of software tools such as spreadsheets, database management systems, internet search engine, HTML, and JavaScript. Students will undertake practical tasks including authoring an interactive website using HTML, JavaScript and AJAX and building a small scale application for managing information. In addition, the course will address the many social, ethical, and intellectual property issues arising from the wide-spread use of information technology in our society.

INFO1903
Informatics (Advanced)

Credit points: 6 **Session:** Semester 1 **Classes:** Tutorial 3 hrs/week; Lecture 3 hrs/week. **Prerequisites:** ATAR sufficient to enter BCST(Adv), BIT or BSc(Adv), or portfolio of work suitable for entry **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit covers advanced data processing and management, integrating the use of existing productivity software, e.g. spreadsheets and databases, with the development of custom software using the powerful general-purpose Python scripting language. It will focus on skills directly applicable to research in any quantitative domain. The unit will also cover presentation of data through written publications and dynamically generated web pages, visual representations and oral presentation skills. The assessment, a semester long project, involves the demonstration of these skills and techniques for processing and presenting data in a choice of domains.

PHIL1012
Introductory Logic

Credit points: 6 **Session:** Semester 2 **Classes:** 1x2hr lecture/week, 1x1hr tutorial/week **Assessment:** Tutorial participation (10%), 2x assignments (40%) and 1x2hr exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

An introduction to modern logic: the investigation of the laws of truth. One essential aspect of good reasoning or argumentation is that it is valid: it cannot lead from true premises to a false conclusion. In this unit we learn how to identify and construct valid arguments, using techniques such as truth tables, models and truth trees. Apart from being a great aid to clear thinking about any subject, knowledge of logic is essential for understanding many areas not only of contemporary philosophy, but also linguistics, mathematics and computing.

All 1000-level MATH units of study are recommended electives. A full list of available MATH/STAT units can be obtained from the School of Mathematics and Statistics, who can also advise on the appropriate level of unit for the students preparation. We strongly suggest including some statistics unit among the choices.

Second year core units of study for CS stream

COMP2007
Algorithms and Complexity

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** INFO1105 OR INFO1905. **Assumed knowledge:** MATH1004 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides an introduction to the design and analysis of algorithms. The main aims are (i) to learn how to develop algorithmic solutions to computational problem and (ii) to develop understanding of algorithm efficiency and the notion of computational hardness.

Note: COMP2907 (advanced version) can be taken as an alternative core unit to COMP2007.

COMP2129
Operating Systems and Machine Principles

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1103. **Assumed knowledge:** INFO1105 OR

INFO1905. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

In this unit of study elementary methods for developing robust, efficient, and re-usable software will be covered. The unit is taught in C, in a Unix environment. Specific coding topics include memory management, the pragmatic aspects of implementing data structures such as lists and hash tables and managing concurrent threads. Debugging tools and techniques are discussed and common programming errors are considered along with defensive programming techniques to avoid such errors. Emphasis is placed on using common Unix tools to manage aspects of the software construction process, such as version control and regression testing. The subject is taught from a practical viewpoint and it includes a considerable amount of programming practice.

INFO2110
Systems Analysis and Modelling

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Experience with a data model as in INFO1003 or INFO1103 or INFS1000 **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides a comprehensive introduction to the analysis of complex systems. Key topics are the determination and expression of system requirements (both functional and on-functional), and the representation of structural and behavioural models of the system in UML notations. Students will be expected to evaluate requirements documents and models as well as producing them. This unit covers essential topics from the ACM/IEEE SE2004 curriculum, especially from MAA Software Modelling and Analysis.

INFO2120
Database Systems 1

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week; Project Work - own time 3 hrs/week. **Prerequisites:** INFO1003 OR INFO1103 OR INFO1903 OR INFS1000 OR DECO1012. **Prohibitions:** INFO2820, INFO2905, COMP5138 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The ubiquitous use of information technology leaves us facing a tsunami of data produced by users, IT systems and mobile devices. The proper management of data is hence essential for all applications and for effective decision making within organizations.

This unit of study will introduce the basic concepts of database designs at the conceptual, logical and physical levels. We will place particular emphasis on introducing integrity constraints and the concept of data normalization which prevents data from being corrupted or duplicated in different parts of the database. This in turn helps in the data remaining consistent during its lifetime. Once a database design is in place, the emphasis shifts towards querying the data in order to extract useful information. The unit will introduce different query languages with a particular emphasis on SQL, which is industry standard. Other topics covered will include the important concept of transaction management, application development with a backend database, an overview of data warehousing and OLAP, and the use of XML as a data integration language.

Note: INFO2820 (advanced version) can be taken as an alternative core unit to INFO2120.

Second year recommended elective units of study for CS stream

Students must complete at least 12 crpts.At least 6 crpts must be completed from 2000-level Mathematics and/or Statistics (we suggest choosing from MATH2069, MATH2063, STAT2012 and/or STAT2912)At least 6 crpts must be completed from (COMP2022, COMP2121)

INFS2020
Business Process Modelling & Improvement

Credit points: 6 **Teacher/Coordinator:** TBA **Session:** Semester 2 **Classes:** 1 x 3 hr seminar per week **Prohibitions:** INFS2005 **Assumed knowledge:** INFS1000 or equivalent **Assessment:** individual assignment (30%), group project (30%), and final examination (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides you with an in depth understanding of the role of business process management (BPM) and process architectures in a business environment. You will gain essential skills of the entire BPM lifecycle, from process identification to process monitoring, including process modelling, analysis, redesign and automation required to achieve high performing business processes in a service oriented business environment. In this unit, you will attain considerable hands-on skills with BPM tools, by documenting, analysing, and simulating current and improved processes.

All 2000-level COMP, INFO, ISYS units of study are recommended electives.All 2000-level ELEC units of study are recommended electives.All 2000-level MATH or STAT units of study are recommended electives.

Third year core units of study for CS stream

INFO3220
Object Oriented Design

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Project Work - own time 2 hrs. **Prerequisites:** INFO2110 and COMP2129 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit covers essential design methods and language mechanisms for successful object-oriented design and programming. C++ is used as the implementation language and a special emphasis is placed on those features of C++ that are important for solving real-world problems. Advanced software engineering features, including exceptions and name spaces are thoroughly covered.

INFO3402
Management of IT Projects and Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Project Work - own time 2 hrs. **Assumed knowledge:** INFO2110 or INFO2810 or INFO2900 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course introduces the basic processes and techniques for managing IT projects, systems and services, throughout the IT lifecycle. It addresses both the technical and behavioural aspects of IT management at the enterprise level. Major topics include: IT planning, project planning and scheduling, project tracking, resource estimation, team management, software testing, change and problem management, and quality assurance.

COMP3615
Software Development Project

Credit points: 6 **Session:** Semester 2 **Classes:** Project Work - in class 2 hrs/week; Site Visit 1 hr/week; Project Work - own time 8 hrs/week; Meeting 1 hr/week. **Prerequisites:** INFO3402 AND COMP2129 AND (COMP2007 OR COMP2907 OR COMP2121) **Prohibitions:** INFO3600 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will provide students an opportunity to apply the knowledge and practise the skills acquired in the prerequisite and qualifying units, in the context of designing and building a substantial software development system in diverse application domains including life sciences. Working in groups for an external client combined with academic supervision, students will need to carry out the full range of activities including requirements capture, analysis and design, coding, testing and documentation. Students will use the XP methodology and make use of professional tools for the management of their project.

CS & IS double stream: Students enrolled in the double stream must also complete ISYS3401 Analytical Methods and Information Systems and ISYS3400 Information System Project as core units of study, and choose 12 crpts of third year recommended elective units

Third year recommended elective units of study for CS stream

Students must complete at least 24 crpts.At least 12 crpts must be completed from (COMP3109, COMP3308, COMP3419, COMP3520, COMP3530, COMP3608) if single stream.At least 12 crpts must be completed from 3000-level COMP, INFO, ISYS units if double streams.

INFS3040
Enterprise Systems & Integrated Business

Credit points: 6 **Teacher/Coordinator:** TBA **Session:** Semester 1 **Classes:** 1x 3hr seminar per week **Prohibitions:** INFS3005 **Assumed knowledge:** INFS1000 or equivalent **Assessment:** mid-semester test (35%); individual enterprise system portfolio (35%), and group project (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides you with an in depth understanding of the way in which implementation and use of large scale integrated Enterprise Systems change the nature of organisational capabilities, processes, and roles.You will understand the strategic role of Enterprise Systems in providing a platform for improved business operations and designing information infrastructures. You will gain considerable hands on experience with an enterprise wide system, such as SAP, concentrating on the way in which such systems support integrated business processes.Through a combination of discussion and practical work, you will gain strong knowledge in both the organisational and technical aspects of Enterprise Systems You will also explore the emergence and implications of cloud-based Enterprise Systems and the implementation process.

All 3000-level COMP, INFO, ISYS units of study are recommended electives.All 3000-level ELEC units of study are recommended electives.

(ii) Stream in Information Systems

First year core units of study for IS stream

ELEC1601
Foundations of Computer Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** HSC Mathematics extension 1 or 2 **Assessment:** Through semester assessment (61%) Final Exam (39%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study introduces the fundamental digital concepts upon which the design and operation of modern digital computers are based. A prime aim of the unit is to develop a professional view of, and a capacity for inquiry into, the field of computing.

Topics covered include: data representation, basic computer organisation, the CPU, elementary gates and logic, peripheral devices, software organisation, machine language, assembly language, operating systems, data communications and computer networks.

ENGG1805
Professional Engineering and IT

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week; Project Work - own time 2 hrs. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

ENGG1805 aims to introduce students to the fundamental principles that underlie the study of engineering and information technologies. It lays the foundation for later studies, and presents to the students challenges common to a multidisciplinary engineering environment. The subject also provides students with the opportunity to develop an understanding of engineering ethics and of working as a part of a team.

Professional Engineering and IT (6CP) is composed from the following five parts: (a) Introduction to engineering: the engineer as problem solver, critical analysis of greatest engineering achievements and failure. (b) Introduction to common engineering software tools: word processors, project management tools (c) Ethics and workplace health and safety. (d) Testing - concepts of destructive and not destructive tests will be given on samples. (e) "Meet the professionals" - A selection of guest speakers will address students on the most important aspects of the engineering profession. (f) Design Process - The process of design synthesis as an important part of engineering: students will be required to complete an engineering design (from conception, to implementation and testing) maintaining proper lab notes.

INFO1103
Introduction to Programming

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Laboratory 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Programming in a legible, maintainable, reusable way is essential to solve complex problems in the pervasive computing environments. This unit will equip students with foundation of programming concepts that are common to widely used programming languages. The "fundamentals-first & objects-later" strategy is used to progressively guide this introductory unit from necessary and important building blocks of programming to the object-oriented approach. Java, one of the most popular programming languages, is used in this unit. It provides interdisciplinary approaches, applications and examples to support students from broad backgrounds such as science, engineering, and mathematics.

INFO1105
Data Structures

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1003 or INFO1103 or INFO1903 or INFS1000 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will teach some powerful ideas that are central to quality software: data abstraction and recursion. It will also show how one can analyse the scalability of algorithms using mathematical tools of asymptotic notation. Contents include: both external "interface" view, and internal "implementation" details, for commonly used data structures, including lists, stacks, queues, priority queues, search trees, hash tables, and graphs; asymptotic analysis of algorithm scalability, including use of recurrence relations to analyse recursive code. This unit covers the way information is represented in each structure, algorithms for manipulating the structure, and analysis of asymptotic complexity of the operations. Outcomes include: ability to write code that recursively performs an operation on a data structure; experience designing an algorithmic solution to a problem using appropriate data structures, coding the solution, and analysing its complexity.

Note: INFO1905 (advanced version) can be taken as an alternative core unit to INFO1105.

First year recommended elective units of study for IS stream

At least 12 crpts must be completed from 1000-level Mathematics and/or Statistics.

BUSS1001
Understanding Business

Credit points: 6 **Teacher/Coordinator:** Professor Marcus O'Connor **Session:** Semester 1, Semester 2 **Classes:** 1x 1.5 hr lecture and 1x 1.5 hr tutorial per week **Prohibitions:** ECOF1003 **Assessment:** participation (15%), essay (20%), case study (20%), and final exam (45%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This unit of study is a compulsory part of the Bachelor of Commerce, combined Bachelor of Commerce degrees and the Bachelor of Commerce (Liberal Studies).

This unit of study is the first of two junior core units aimed at introducing students to the internal and external contexts in which business operates in the twenty-first century. It also aims to lay the foundations for effective communication (written and oral), critical analysis, problem solving, and team work skills, which are essential to achieving program learning goals. In this unit, students will build an understanding of the dynamics of business through the lens of the company and its stakeholders. Business ethics is also introduced as key learning goal.

BUSS1002
The Business Environment

Credit points: 6 **Teacher/Coordinator:** Omer Konakci **Session:** Semester 1, Semester 2 **Classes:** 1x 1.5hr lecture and 1x 1.5hr tutorial per week **Prerequisites:** ECOF1003 or BUSS1001 **Prohibitions:** ECOF1004, CISS2001 **Assessment:** media summary and analyses (55%), tutorial participation (10%), and final exam (35%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This unit of study is a compulsory part of the Bachelor of Commerce, combined Bachelor of Commerce degrees and the Bachelor of Commerce (Liberal Studies).

This unit of study is the second of two junior core units aimed at introducing students to the external and internal contexts in which business operates in the twenty-first century while developing effective problem solving, critical analysis and communication skills. In this unit, students will build an understanding of the economic, political and regulatory, socio-cultural, and technological factors that impact on the external context of the commercial landscape while developing an awareness of potential of risk and change. An awareness of corporate social responsibility and sustainability is also introduced as a key learning goal.

ELEC1103
Fundamentals of Elec and Electronic Eng

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Basic knowledge of differentiation & integration, and HSC Physics **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to develop knowledge of the fundamental concepts and building blocks of electrical and electronics circuits. This is a foundation unit in circuit theory. Circuit theory is the electrical engineer's fundamental tool.

The concepts learnt in this unit will be made use of heavily in many units of study (in later years) in the areas of electronics, instrumentation, electrical machines, power systems, communication systems, and signal processing.

Topics: a) Basic electrical and electronic circuit concepts: Circuits, circuit elements, circuit laws, node and mesh analysis, circuit theorems, energy storage, capacitors and inductors, circuits with switches, transient response, sine waves and complex analysis, phasors, impedance, ac power.; b) Project management, teamwork, ethics; c) Safety issues

INFO1003
Foundations of Information Technology

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 3 hrs/week; Laboratory 2 hrs/week. **Prohibitions:** INFO1000, ISYS1003, INFO1903, INFS1000 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Information technologies (IT) and systems have emerged as the primary platform to support communication, collaboration, research, decision making, and problem solving in contemporary organisations. The essential necessity for all university students to acquire the fundamental knowledge and skills for applying IT effectively for a wide range of tasks is widely recognised. It is an introductory unit of study which prepares students from any academic discipline to develop the necessary knowledge, skills and abilities to be competent in the use of information technology for solving a variety of problems. The main focus of this unit is on modelling and problem solving through the effective use of using IT. Students will learn how to navigate independently to solve their problems on their own, and to be capable of fully applying the power of IT tools in the service of their goals in their own domains while not losing sight of the fundamental concepts of computing.

Students are taught core skills related to general purpose computing involving a range of software tools such as spreadsheets, database management systems, internet search engine, HTML, and JavaScript. Students will undertake practical tasks including authoring an interactive website using HTML, JavaScript and AJAX and building a small scale application for managing information. In addition, the course will address the many social, ethical, and intellectual property issues arising from the wide-spread use of information technology in our society.

INFO1903
Informatics (Advanced)

Credit points: 6 **Session:** Semester 1 **Classes:** Tutorial 3 hrs/week; Lecture 3 hrs/week. **Prerequisites:** ATAR sufficient to enter BCST(Adv), BIT or BSc(Adv), or portfolio of work suitable for entry **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit covers advanced data processing and management, integrating the use of existing productivity software, e.g. spreadsheets and databases, with the development of custom software using the powerful general-purpose Python scripting language. It will focus on skills directly applicable to research in any quantitative domain. The unit will also cover presentation of data through written publications and dynamically generated web pages, visual representations and oral presentation skills. The assessment, a semester long project, involves the demonstration of these skills and techniques for processing and presenting data in a choice of domains.

PHIL1012
Introductory Logic

Credit points: 6 **Session:** Semester 2 **Classes:** 1x2hr lecture/week, 1x1hr tutorial/week **Assessment:** Tutorial participation (10%), 2x assignments (40%) and 1x2hr exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

An introduction to modern logic: the investigation of the laws of truth. One essential aspect of good reasoning or argumentation is that it is valid: it cannot lead from true premises to a false conclusion. In this unit we learn how to identify and construct valid arguments, using techniques such as truth tables, models and truth trees. Apart from being a great aid to clear thinking about any subject, knowledge of logic is essential for understanding many areas not only of contemporary philosophy, but also linguistics, mathematics and computing.

All 1000-level MATH units of study are recommended electives. A full list of available MATH/STAT units can be obtained from the School of Mathematics and Statistics, who can also advise on the appropriate level of unit for the students preparation. We strongly suggest including some statistics unit among the choices.

Second year core units of study for IS stream

COMP2129
Operating Systems and Machine Principles

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1103. **Assumed knowledge:** INFO1105 OR INFO1905. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

In this unit of study elementary methods for developing robust, efficient, and re-usable software will be covered. The unit is taught in C, in a Unix environment. Specific coding topics include memory management, the pragmatic aspects of implementing data structures such as lists and hash tables and managing concurrent threads. Debugging tools and techniques are discussed and common programming errors are considered along with defensive programming techniques to avoid such errors. Emphasis is placed on using common Unix tools to manage aspects of the software construction process, such as version control and regression testing. The subject is taught from a practical viewpoint and it includes a considerable amount of programming practice.

INFO2110
Systems Analysis and Modelling

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Experience with a data model as in INFO1003 or INFO1103 or INFS1000 **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides a comprehensive introduction to the analysis of complex systems. Key topics are the determination and expression of system requirements (both functional and on-functional), and the representation of structural and behavioural models of the system in UML notations. Students will be expected to evaluate requirements documents and models as well as producing them. This unit covers essential topics from the ACM/IEEE SE2004 curriculum, especially from MAA Software Modelling and Analysis.

INFO2120
Database Systems 1

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week; Project Work - own time 3 hrs/week. **Prerequisites:** INFO1003 OR INFO1103 OR INFO1903 OR INFS1000 OR DECO1012. **Prohibitions:** INFO2820, INFO2905, COMP5138 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The ubiquitous use of information technology leaves us facing a tsunami of data produced by users, IT systems and mobile devices. The proper management of data is hence essential for all applications and for effective decision making within organizations.

This unit of study will introduce the basic concepts of database designs at the conceptual, logical and physical levels. We will place particular emphasis on introducing integrity constraints and the concept of data normalization which prevents data from being corrupted or duplicated in different parts of the database. This in turn helps in the data remaining consistent during its lifetime. Once a database design is in place, the emphasis shifts towards querying the data in order to extract useful information. The unit will introduce different query languages with a particular emphasis on SQL, which is industry standard. Other topics covered will include the important concept of transaction management, application development with a backend database, an overview of data warehousing and OLAP, and the use of XML as a data integration language.

Note: INFO2820 (advanced version) can be taken as an alternative core unit to INFO2120.

ISYS2140
Information Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Prerequisites:** INFO1103 OR INFO1903 OR INFS1000 OR INFO1003 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will provide a comprehensive conceptual and practical introduction to information systems (IS) in contemporary organisations. Key topics covered include:

* Basic concepts of information systems

* Network fundamentals and applications

* E-business and e-commerce

* Information systems for competitive advantage

* Functional and enterprise systems

* Business intelligence

* Information systems acquisition

* Information security, ethics, and privacy

COMP2007
Algorithms and Complexity

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** INFO1105 OR INFO1905. **Assumed knowledge:** MATH1004 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides an introduction to the design and analysis of algorithms. The main aims are (i) to learn how to develop algorithmic solutions to computational problem and (ii) to develop understanding of algorithm efficiency and the notion of computational hardness.

COMP2907 (advanced version) can be taken as an alternative core unit to COMP2007.

Second year recommended elective units for IS stream

Students must complete at least 6 crpts.At least 6 crpts must be completed from 2000-level Mathematics and/or Statistics. We strongly suggest STAT2012 or STAT2912.

INFS2020
Business Process Modelling & Improvement

Credit points: 6 **Teacher/Coordinator:** TBA **Session:** Semester 2 **Classes:** 1 x 3 hr seminar per week **Prohibitions:** INFS2005 **Assumed knowledge:** INFS1000 or equivalent **Assessment:** individual assignment (30%), group project (30%), and final examination (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides you with an in depth understanding of the role of business process management (BPM) and process architectures in a business environment. You will gain essential skills of the entire BPM lifecycle, from process identification to process monitoring, including process modelling, analysis, redesign and automation required to achieve high performing business processes in a service oriented business environment. In this unit, you will attain considerable hands-on skills with BPM tools, by documenting, analysing, and simulating current and improved processes.

All 2000-level COMP, INFO, ISYS and ELEC units of study are recommended.All 2000-level ELEC units of study are recommended electives.All 2000-level MATH or STAT units of study are recommended electives.

Third year core units of study for IS stream

INFO3402
Management of IT Projects and Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Project Work - own time 2 hrs. **Assumed knowledge:** INFO2110 or INFO2810 or INFO2900 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course introduces the basic processes and techniques for managing IT projects, systems and services, throughout the IT lifecycle. It addresses both the technical and behavioural aspects of IT management at the enterprise level. Major topics include: IT planning, project planning and scheduling, project tracking, resource estimation, team management, software testing, change and problem management, and quality assurance.

ISYS3400
Information Systems Project

Credit points: 6 **Session:** Semester 2 **Classes:** Project Work - in class 2 hrs/week; Project Work - own time 6 hrs/week; Site Visit 1 hr/week; Meeting 1 hr/week. **Prerequisites:** INFO2110, INFO2120, ISYS2140, INFO3402, ISYS3401 **Prohibitions:** ISYS3207, INFO3600 **Assessment:** Through semester assessment (80%) Final Exam (20%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will provide students an opportunity to apply the knowledge and practise the skills acquired in the prerequisite and qualifying units, in the context of a substantial information systems research or development project and to experience in a realistic way many aspects of analysing and solving information systems problems. Since information systems projects are often undertaken by small teams, the experience of working in a team is seen as an important feature of the unit. Students often find it difficult to work effectively with others and will benefit from the opportunity provided by this unit to further develop this skill.

ISYS3401
Analytical Methods & Information Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assumed knowledge:** INFO2110, ISYS2140 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Information Systems (IS) professionals in today's organisations are required to play leadership roles in change and development. Your success in this field will be aided by your being able to carry out research-based investigations using suitable methods and mastery over data collection and analysis to assist in managing projects and in decision making. Practical research skills are some of the most important assets you will need in your career.

This unit of study will cover important concepts and skills in practical research for solving and managing important problems. This will also provide you with the skills to undertake the capstone project in the IS project unit of study offered in Semester 2 or other projects. It will also provide hand-on experience of using Microsoft Excel and other tools to perform some of the quantitative analysis.

CS & IS double stream: Students enrolled in the double stream must also complete INFO3220 Object Oriented Design and COMP3615 Software Development Project as core units of study

Third year recommended elective units of study for IS stream

Student must complete at least 24 crpts. At least 12 crpts must be completed from (INFO3220, INFO3315, INFO3404, INFO3406, INFO3504)

INFS3040
Enterprise Systems & Integrated Business

Credit points: 6 **Teacher/Coordinator:** TBA **Session:** Semester 1 **Classes:** 1x 3hr seminar per week **Prohibitions:** INFS3005 **Assumed knowledge:** INFS1000 or equivalent **Assessment:** mid-semester test (35%); individual enterprise system portfolio (35%), and group project (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides you with an in depth understanding of the way in which implementation and use of large scale integrated Enterprise Systems change the nature of organisational capabilities, processes, and roles. You will understand the strategic role of Enterprise Systems in providing a platform for improved business operations and designing information infrastructures. You will gain considerable hands on experience with an enterprise wide system, such as SAP, concentrating on the way in which such systems support integrated business processes. Through a combination of discussion and practical work, you will gain strong knowledge in both the organisational and technical aspects of Enterprise Systems You will also explore the emergence and implications of cloud-based Enterprise Systems and the implementation process.

All 3000-level COMP, INFO, ISYS units of study are recommended electives.All 3000-level ELEC units of study are recommended electives.

Honours

Students who have qualified for the BCST degree may apply to enter the BCST(Honours) year. Note that unlike BIT(Honours) or BE(Honours), the Honours in BCST requires an additional 48 credit points of study.All BCST(Honours) students must complete the following 24 credit points of core units of study. These units are only available to students enrolled in Honours degrees, those in Research Higher degrees, or those in the Research track in postgraduate coursework degrees. In addition to the core units students must also complete 24 credit points of elective units of study, please refer to units listed in the BIT table Fourth Year Selected Core.

Fourth year Honours core units of study

INFO4991
IT Research Thesis A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research 12 hrs/week. **Corequisites:** INFO5993 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: INFO4991 and INFO4992 together form the Honours Research thesis. It is allowed to enrol in one of these units in one semester, and the other the following semester; the same mark and grade is given for both once they have both been completed.

Students enrolled in the Honours programs study various advanced aspects of Information Technology. The program may include lectures, tutorials, seminars and practicals. They will undertake a research project. Assessment will include the project and may include examinations and classwork.

INFO4992
IT Research Thesis B

Credit points: 12 **Session:** Semester 1, Semester 2 **Classes:** Research 24 hrs/week. **Corequisites:** INFO4991 and INFO5993 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: INFO4991 and INFO4992 together form the Honours Research thesis. It is allowed to enrol in one of these units in one semester, and the other the following semester; the same mark and grade is given for both once they have both been completed.

Students enrolled in the Honours programs study various advanced aspects of Information Technology. The program may include lectures, tutorials, seminars and practicals. They will undertake a research project. Assessment will include the project and may include examinations and classwork.

INFO4999
Computer Science Honours Result

Session: Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

All SIT Honours students must enrol in this non assessable unit of study in their final semester.

INFO5993
IT Research Methods

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Seminar 2 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will provide an overview of the different research methods that are used in IT. Students will learn to find and evaluate research on their topic and to present their own research plan or results for evaluation by others. The unit will develop a better understanding of what research in IT is and how it differs from other projects in IT. This unit of study is required for students in IT who are enrolled in a research project as part of their Honours or MIT/MITM degree. It is also recommended for students enrolled or planning to do a research degree in IT and Engineering.

For a standard enrolment plan for Bachelor of Computer Science and Technology visit CUSP

Bachelor of Computer Science and Technology Advanced

Course Overview

The Bachelor of Computer Science and Technology (Advanced) is a more challenging variant of the Bachelor of Computer Science and Technology, and will appeal to you if you have substantial programming experience, aptitude and/or a high ATAR.

The course has the same flexible structure as the Bachelor of Computer Science and Technology, except that students complete a significant amount of their study in advanced units, where more sophisticated and challenging topics and approaches are covered. You will choose units of study from a wide range of areas including networking, human-computer interaction, graphics, object-oriented design, internet software platforms, artificial intelligence, and e-business analysis and design.

As in the Bachelor of Computer Science and Technology, all students will enrol in one of two streams: information systems or computer science.

An additional honours year is available to eligible students.

Course Requirements

To qualify for the award of the Bachelor of Computer Science and Technology (Advanced), a candidate must successfully complete 144 credit points specified in the Bachelor of Computer Science and Technology above, except:

1. a minimum of 12 credit points of 2000-level core and recommended elective units are at the Advanced level; and
2. a minimum of 12 credit points of 3000-level core and recommended elective units are at the Advanced level.

For a standard enrolment plan for Bachelor of Computer Science and Technology (Advanced) visit CUSP.

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Bachelor of Computer Science and Technology (Advanced)			
Candidates for the degree of Bachelor of Computer Science and Technology (Advanced) (BCST(Adv)) are required to gain 144 credit points from the units of study set out below. The selection of units must satisfy the degree rules in the Resolutions of the Faculty. In particular, all core units must be completed, along with appropriate amount of elective units of study as recommended by the Faculty. Candidates for the BSCT(Adv) degree must complete a stream in either Computer Science or Information Systems, or both, as described in the Tables below. Candidates in the BCST(Adv) degree must maintain a credit average in each year of enrolment. If this level of result is not achieved candidates will be transferred to the BCST degree program. Candidates in the BCST(Adv) degree must complete at least 12 credit points of 2000-level core and recommended units, and at least 12 credit points of 3000-level core and recommended units at advanced level. Enrolment is subject to the following constraint: 1. At most 72 credit points accumulated from first year units (including core and recommended electives) can be counted for degree completion. Candidates may substitute an appropriate unit from an Advanced Engineering program of the Faculty of Engineering and IT, or the Talented Student Program of the Faculty of Science, if they are eligible to enrol in such units.			
(i) Stream in Computer Science			
First year core units of study for CS stream			
ELEC1601 **Foundations of Computer Systems**	6	**A** HSC Mathematics extension 1 or 2	Semester 2
ENGG1805 **Professional Engineering and IT**	6		Semester 1
INFO1103 **Introduction to Programming**	6		Semester 1 Semester 2
INFO1105 **Data Structures**	6	**P** INFO1003 or INFO1103 or INFO1903 or INFS1000	Semester 2
Note: INFO1905 (advanced version) can be taken as an alternative core unit to INFO1105.			
First year recommended elective units of study for CS stream.			
At least 12 crpts must be completed from 1000-level Mathematics and/or Statistics.			
BUSS1001 **Understanding Business**	6	**N** ECOF1003 *This unit of study is a compulsory part of the Bachelor of Commerce, combined Bachelor of Commerce degrees and the Bachelor of Commerce (Liberal Studies).*	Semester 1 Semester 2
BUSS1002 **The Business Environment**	6	**P** ECOF1003 or BUSS1001 **N** ECOF1004, CISS2001 *This unit of study is a compulsory part of the Bachelor of Commerce, combined Bachelor of Commerce degrees and the Bachelor of Commerce (Liberal Studies).*	Semester 1 Semester 2
ELEC1103 **Fundamentals of Elec and Electronic Eng**	6	**A** Basic knowledge of differentiation & integration, and HSC Physics	Semester 1
INFO1003 **Foundations of Information Technology**	6	**N** INFO1000, ISYS1003, INFO1903, INFS1000	Semester 1 Semester 2
INFO1903 **Informatics (Advanced)**	6	**P** ATAR sufficient to enter BCST(Adv), BIT or BSc(Adv), or portfolio of work suitable for entry *Note: Department permission required for enrolment*	Semester 1
PHIL1012 **Introductory Logic**	6		Semester 2
All 1000-level MATH units of study are recommended electives. A full list of available MATH/STAT units can be obtained from the School of Mathematics and Statistics, who can also advise on the appropriate level of unit for the students preparation. We strongly suggest including some statistics unit among the choices.			
Second year core units of study for CS stream			
COMP2129 **Operating Systems and Machine Principles**	6	**A** INFO1105 OR INFO1905. **P** INFO1103.	Semester 1
COMP2907 **Algorithms and Complexity (Advanced)**	6	**A** MATH1004 **P** Distinction level result in INFO1105 or INFO1905	Semester 2
INFO2110 **Systems Analysis and Modelling**	6	**A** Experience with a data model as in INFO1003 or INFO1103 or INFS1000	Semester 2
INFO2820 **Database Systems 1 (Advanced)**	6	**P** Distinction-level result in INFO1003 or INFO1103 or INFO1903 or INFO1105 or INFO1905 or DECO1012. **N** COMP5138, INFO2120, INFO2905	Semester 1
Second year recommended elective units of study for CS stream			
Students must complete at least 12 crpts.			

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
At least 6 crpts must be completed from 2000-level Mathematics and/or Statistics (we suggest choosing from MATH2069, MATH2063, STAT2012 and/or STAT2912)			
At least 6 crpts must be completed from (COMP2022, COMP2121)			
INFS2020 **Business Process Modelling & Improvement**	6	**A** INFS1000 or equivalent **N** INFS2005	Semester 2
All 2000-level COMP, INFO, ISYS units of study are recommended electives.			
All 2000-level ELEC units of study are recommended electives.			
All 2000-level MATH or STAT units of study are recommended electives.			
Third year core units of study for CS stream			
INFO3220 **Object Oriented Design**	6	**P** INFO2110 and COMP2129	Semester 1
INFO3402 **Management of IT Projects and Systems**	6	**A** INFO2110 or INFO2810 or INFO2900	Semester 1
INFO3600 **Major Development Project (Advanced)**	12	**P** INFO3402 **N** ISYS3400, COMP3615 *Only available to students in BIT, BCST(Adv) or BSc(Adv).*	Semester 2
CS & IS double stream: Students enrolled in the double stream must also complete ISYS3401 Analytical Methods and Information Systems as a core unit of study			
Third year recommended elective units of study for CS stream			
Student must complete at least 18 crpts.			
At least 12 crpts must be completed from (COMP3109, COMP3308, COMP3419, COMP3520, COMP3530, COMP3608) if single stream.			
At least 12 crpts must be completed from 3000-level COMP, INFO, ISYS units if double streams.			
INFS3040 **Enterprise Systems & Integrated Business**	6	**A** INFS1000 or equivalent **N** INFS3005	Semester 1
All 3000-level COMP, INFO, ISYS units of study are recommended electives.			
All 3000-level ELEC units of study are recommended elective units.			
Also, appropriate fourth year units of study from BIT table can be taken as recommended electives with permission of the Head of School.			
(ii) Stream in Information Systems			
First year core units of study for IS stream			
ENGG1805 **Professional Engineering and IT**	6		Semester 1
INFO1103 **Introduction to Programming**	6		Semester 1 Semester 2
ELEC1601 **Foundations of Computer Systems**	6	**A** HSC Mathematics extension 1 or 2	Semester 2
INFO1105 **Data Structures**	6	**P** INFO1003 or INFO1103 or INFO1903 or INFS1000	Semester 2
Note: INFO1905 (advanced version) can be taken as an alternative core unit to INFO1905.			
First year recommended elective units of study for IS stream			
At least 12 crpts must be completed from 1000-level Mathematics and/or Statistics.			
BUSS1001 **Understanding Business**	6	**N** ECOF1003 *This unit of study is a compulsory part of the Bachelor of Commerce, combined Bachelor of Commerce degrees and the Bachelor of Commerce (Liberal Studies).*	Semester 1 Semester 2
BUSS1002 **The Business Environment**	6	**P** ECOF1003 or BUSS1001 **N** ECOF1004, CISS2001 *This unit of study is a compulsory part of the Bachelor of Commerce, combined Bachelor of Commerce degrees and the Bachelor of Commerce (Liberal Studies).*	Semester 1 Semester 2
ELEC1103 **Fundamentals of Elec and Electronic Eng**	6	**A** Basic knowledge of differentiation & integration, and HSC Physics	Semester 1
INFO1003 **Foundations of Information Technology**	6	**N** INFO1000, ISYS1003, INFO1903, INFS1000	Semester 1 Semester 2
INFO1903 **Informatics (Advanced)**	6	**P** ATAR sufficient to enter BCST(Adv), BIT or BSc(Adv), or portfolio of work suitable for entry *Note: Department permission required for enrolment*	Semester 1
PHIL1012 **Introductory Logic**	6		Semester 2
All 1000-level MATH units of study are recommended electives.			
A full list of available MATH/STAT units can be obtained from the School of Mathematics and Statistics, who can also advise on the appropriate level of unit for the students preparation. We strongly suggest including some statistics unit among the choices.			
Second year core units of study for IS stream			
COMP2129 **Operating Systems and Machine Principles**	6	**A** INFO1105 OR INFO1905. **P** INFO1103.	Semester 1
COMP2907 **Algorithms and Complexity (Advanced)**	6	**A** MATH1004 **P** Distinction level result in INFO1105 or INFO1905	Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
INFO2110 **Systems Analysis and Modelling**	6	**A** Experience with a data model as in INFO1003 or INFO1103 or INFS1000	Semester 2
INFO2820 **Database Systems 1 (Advanced)**	6	**P** Distinction-level result in INFO1003 or INFO1103 or INFO1903 or INFO1105 or INFO1905 or DECO1012. **N** COMP5138, INFO2120, INFO2905	Semester 1
ISYS2140 **Information Systems**	6	**P** INFO1103 OR INFO1903 OR INFS1000 OR INFO1003	Semester 1
Second year recommended elective units of study for IS stream			
Students must complete at least 6 crpts.			
At least 6 crpts must be completed from 2000-level Mathematics and/or Statistics. We strongly suggest STAT2012 or STAT2912.			
INFS2020 **Business Process Modelling & Improvement**	6	**A** INFS1000 or equivalent **N** INFS2005	Semester 2
All 2000-level COMP, INFO, ISYS units of study are recommended electives.			
All 2000-level ELEC units of study are recommended electives.			
All 2000-level MATH or STAT units of study are recommended electives.			
Third year core units of study for IS stream			
INFO3402 **Management of IT Projects and Systems**	6	**A** INFO2110 or INFO2810 or INFO2900	Semester 1
INFO3600 **Major Development Project (Advanced)**	12	**P** INFO3402 **N** ISYS3400, COMP3615 *Only available to students in BIT, BCST(Adv) or BSc(Adv).*	Semester 2
ISYS3401 **Analytical Methods & Information Systems**	6	**A** INFO2110, ISYS2140	Semester 1
CS & IS double stream: Students enrolled in the double stream must also complete INFO3220 Object Oriented Design as a core unit of study.			
Third year recommended elective units of study for IS stream			
Student must complete at least 18 crpts.			
At least 12 crpts must be completed from (INFO3220, INFO3315, INFO3404, INFO3406, INFO3504)			
INFS3040 **Enterprise Systems & Integrated Business**	6	**A** INFS1000 or equivalent **N** INFS3005	Semester 1
All 3000-level COMP, INFO, ISYS units of study are recommended electives.			
All 3000-level ELEC units of study are recommended electives.			
Also, appropriate fourth year units of study from BIT table can be taken as recommended electives with permission of the Head of School.			
Honours			
Students who have qualified for the BCST(Adv) degree may apply to enter the BCST(Adv)(Honours) year. Note that unlike BIT(Honours) or BE(Honours), the Honours in BCST(Adv) requires an additional 48 credit points of study.			
All BCST(Adv)(Honours) students must complete the following 24 credit points of core units of study. These units are only available to students enrolled in Honours degrees, those in Research Higher degrees, or those in the Research track in postgraduate coursework degrees. In addition to the core units students must also complete 24 credit points of elective units of study list in the table below .			
Fourth year Honours core units of study			
INFO4991 **IT Research Thesis A**	6	**C** INFO5993 *Note: Department permission required for enrolment* *INFO4991 and INFO4992 together form the Honours Research thesis. It is allowed to enrol in one of these units in one semester, and the other the following semester; the same mark and grade is given for both once they have both been completed.*	Semester 1 Semester 2
INFO4992 **IT Research Thesis B**	12	**C** INFO4991 and INFO5993 *Note: Department permission required for enrolment* *INFO4991 and INFO4992 together form the Honours Research thesis. It is allowed to enrol in one of these units in one semester, and the other the following semester; the same mark and grade is given for both once they have both been completed.*	Semester 1 Semester 2
INFO4999 **Computer Science Honours Result**		*Note: Department permission required for enrolment*	Semester 1 Semester 2
INFO5993 **IT Research Methods**	6		Semester 1 Semester 2

For a standard enrolment plan for Bachelor of Computer Science and Technology (Advanced) visit CUSP.

Unit of Study Descriptions

Bachelor of Computer Science and Technology (Advanced)

Candidates for the degree of Bachelor of Computer Science and Technology (Advanced) (BCST(Adv)) are required to gain 144 credit points from the units of study set out below. The selection of units must satisfy the degree rules in the Resolutions of the Faculty. In particular, all core units must be completed, along with appropriate amount of elective units of study as recommended by the Faculty. Candidates for the BSCT(Adv) degree must complete a stream in either Computer Science or Information Systems, or both, as described in the Tables below. Candidates in the BCST(Adv) degree must maintain a credit average in each year of enrolment. If this level of result is not achieved candidates will be transferred to the BCST degree program.Candidates in the BCST(Adv) degree must complete at least 12 credit points of 2000-level core and recommended units, and at least 12 credit points of 3000-level core and recommended units at advanced level.Enrolment is subject to the following constraint:1. At most 72 credit points accumulated from first year units (including core and recommended electives) can be counted for degree completion.Candidates may substitute an appropriate unit from an Advanced Engineering program of the Faculty of Engineering and IT, or the Talented Student Program of the Faculty of Science, if they are eligible to enrol in such units.

(i) Stream in Computer Science

First year core units of study for CS stream

ELEC1601
Foundations of Computer Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** HSC Mathematics extension 1 or 2 **Assessment:** Through semester assessment (61%) Final Exam (39%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study introduces the fundamental digital concepts upon which the design and operation of modern digital computers are based. A prime aim of the unit is to develop a professional view of, and a capacity for inquiry into, the field of computing.

Topics covered include: data representation, basic computer organisation, the CPU, elementary gates and logic, peripheral devices, software organisation, machine language, assembly language, operating systems, data communications and computer networks.

ENGG1805
Professional Engineering and IT

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week; Project Work - own time 2 hrs. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

ENGG1805 aims to introduce students to the fundamental principles that underlie the study of engineering and information technologies. It lays the foundation for later studies, and presents to the students challenges common to a multidisciplinary engineering environment. The subject also provides students with the opportunity to develop an understanding of engineering ethics and of working as a part of a team.

Professional Engineering and IT (6CP) is composed from the following five parts: (a) Introduction to engineering: the engineer as problem solver, critical analysis of greatest engineering achievements and failure. (b) Introduction to common engineering software tools: word processors, project management tools (c) Ethics and workplace health and safety. (d) Testing - concepts of destructive and not destructive tests will be given on samples. (e) "Meet the professionals" - A selection of guest speakers will address students on the most important aspects of the engineering profession. (f) Design Process - The process of design synthesis as an important part of engineering: students will be required to complete an engineering design (from conception, to implementation and testing) maintaining proper lab notes.

INFO1103
Introduction to Programming

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Laboratory 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Programming in a legible, maintainable, reusable way is essential to solve complex problems in the pervasive computing environments. This unit will equip students with foundation of programming concepts that are common to widely used programming languages. The "fundamentals-first & objects-later" strategy is used to progressively guide this introductory unit from necessary and important building blocks of programming to the object-oriented approach. Java, one of the most popular programming languages, is used in this unit. It provides interdisciplinary approaches, applications and examples to support students from broad backgrounds such as science, engineering, and mathematics.

INFO1105
Data Structures

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1003 or INFO1103 or INFO1903 or INFS1000 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will teach some powerful ideas that are central to quality software: data abstraction and recursion. It will also show how one can analyse the scalability of algorithms using mathematical tools of asymptotic notation. Contents include: both external "interface" view, and internal "implementation" details, for commonly used data structures, including lists, stacks, queues, priority queues, search trees, hash tables, and graphs; asymptotic analysis of algorithm scalability, including use of recurrence relations to analyse recursive code. This unit covers the way information is represented in each structure, algorithms for manipulating the structure, and analysis of asymptotic complexity of the operations. Outcomes include: ability to write code that recursively performs an operation on a data structure; experience designing an algorithmic solution to a problem using appropriate data structures, coding the solution, and analysing its complexity.

Note: INFO1905 (advanced version) can be taken as an alternative core unit to INFO1105.

First year recommended elective units of study for CS stream.

At least 12 crpts must be completed from 1000-level Mathematics and/or Statistics.

BUSS1001
Understanding Business

Credit points: 6 **Teacher/Coordinator:** Professor Marcus O'Connor **Session:** Semester 1, Semester 2 **Classes:** 1x 1.5 hr lecture and 1x 1.5 hr tutorial per week **Prohibitions:** ECOF1003 **Assessment:** participation (15%), essay (20%), case study (20%), and final exam (45%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This unit of study is a compulsory part of the Bachelor of Commerce, combined Bachelor of Commerce degrees and the Bachelor of Commerce (Liberal Studies).

This unit of study is the first of two junior core units aimed at introducing students to the internal and external contexts in which business operates in the twenty-first century. It also aims to lay the foundations for effective communication (written and oral), critical analysis, problem solving, and team work skills, which are essential to achieving program learning goals. In this unit, students will build an understanding of the dynamics of business through the lens of the company and its stakeholders. Business ethics is also introduced as key learning goal.

BUSS1002
The Business Environment

Credit points: 6 **Teacher/Coordinator:** Omer Konakci **Session:** Semester 1, Semester 2 **Classes:** 1x 1.5hr lecture and 1x 1.5hr tutorial per week **Prerequisites:** ECOF1003 or BUSS1001 **Prohibitions:** ECOF1004, CISS2001 **Assessment:** media summary and analyses (55%), tutorial participation (10%), and final exam (35%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This unit of study is a compulsory part of the Bachelor of Commerce, combined Bachelor of Commerce degrees and the Bachelor of Commerce (Liberal Studies).

This unit of study is the second of two junior core units aimed at introducing students to the external and internal contexts in which business operates in the twenty-first century while developing effective problem solving, critical analysis and communication skills. In this unit, students will build an understanding of the economic, political and regulatory, socio-cultural, and technological factors that impact on the external context of the commercial landscape while developing an awareness of potential of risk and change. An awareness of corporate social responsibility and sustainability is also introduced as a key learning goal.

ELEC1103
Fundamentals of Elec and Electronic Eng

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Basic knowledge of differentiation & integration, and HSC Physics **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to develop knowledge of the fundamental concepts and building blocks of electrical and electronics circuits. This is a foundation unit in circuit theory. Circuit theory is the electrical engineer's fundamental tool.

The concepts learnt in this unit will be made use of heavily in many units of study (in later years) in the areas of electronics, instrumentation, electrical machines, power systems, communication systems, and signal processing.

Topics: a) Basic electrical and electronic circuit concepts: Circuits, circuit elements, circuit laws, node and mesh analysis, circuit theorems, energy storage, capacitors and inductors, circuits with switches, transient response, sine waves and complex analysis, phasors, impedance, ac power.; b) Project management, teamwork, ethics; c) Safety issues

INFO1003
Foundations of Information Technology

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 3 hrs/week; Laboratory 2 hrs/week. **Prohibitions:** INFO1000, ISYS1003, INFO1903, INFS1000 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Information technologies (IT) and systems have emerged as the primary platform to support communication, collaboration, research, decision making, and problem solving in contemporary organisations. The essential necessity for all university students to acquire the fundamental knowledge and skills for applying IT effectively for a wide range of tasks is widely recognised. It is an introductory unit of study which prepares students from any academic discipline to develop the necessary knowledge, skills and abilities to be competent in the use of information technology for solving a variety of problems. The main focus of this unit is on modelling and problem solving through the effective use of using IT. Students will learn how to navigate independently to solve their problems on their own, and to be capable of fully applying the power of IT tools in the service of their goals in their own domains while not losing sight of the fundamental concepts of computing.

Students are taught core skills related to general purpose computing involving a range of software tools such as spreadsheets, database management systems, internet search engine, HTML, and JavaScript. Students will undertake practical tasks including authoring an interactive website using HTML, JavaScript and AJAX and building a small scale application for managing information. In addition, the course will address the many social, ethical, and intellectual property issues arising from the wide-spread use of information technology in our society.

INFO1903
Informatics (Advanced)

Credit points: 6 **Session:** Semester 1 **Classes:** Tutorial 3 hrs/week; Lecture 3 hrs/week. **Prerequisites:** ATAR sufficient to enter BCST(Adv), BIT or BSc(Adv), or portfolio of work suitable for entry **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit covers advanced data processing and management, integrating the use of existing productivity software, e.g. spreadsheets and databases, with the development of custom software using the powerful general-purpose Python scripting language. It will focus on skills directly applicable to research in any quantitative domain. The unit will also cover presentation of data through written publications and dynamically generated web pages, visual representations and oral presentation skills. The assessment, a semester long project, involves the demonstration of these skills and techniques for processing and presenting data in a choice of domains.

PHIL1012
Introductory Logic

Credit points: 6 **Session:** Semester 2 **Classes:** 1x2hr lecture/week, 1x1hr tutorial/week **Assessment:** Tutorial participation (10%), 2x assignments (40%) and 1x2hr exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

An introduction to modern logic: the investigation of the laws of truth. One essential aspect of good reasoning or argumentation is that it is valid: it cannot lead from true premises to a false conclusion. In this unit we learn how to identify and construct valid arguments, using techniques such as truth tables, models and truth trees. Apart from being a great aid to clear thinking about any subject, knowledge of logic is essential for understanding many areas not only of contemporary philosophy, but also linguistics, mathematics and computing.

All 1000-level MATH units of study are recommended electives. A full list of available MATH/STAT units can be obtained from the School of Mathematics and Statistics, who can also advise on the appropriate level of unit for the students preparation. We strongly suggest including some statistics unit among the choices.

Second year core units of study for CS stream

COMP2129
Operating Systems and Machine Principles

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1103. **Assumed knowledge:** INFO1105 OR INFO1905. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

In this unit of study elementary methods for developing robust, efficient, and re-usable software will be covered. The unit is taught in C, in a Unix environment. Specific coding topics include memory management, the pragmatic aspects of implementing data structures such as lists and hash tables and managing concurrent threads. Debugging tools and techniques are discussed and common programming errors are considered along with defensive programming techniques to avoid such errors. Emphasis is placed on using common Unix tools to manage aspects of the software construction process, such as version control and regression testing. The subject is taught from a practical viewpoint and it includes a considerable amount of programming practice.

COMP2907
Algorithms and Complexity (Advanced)

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** Distinction level result in INFO1105 or INFO1905 **Assumed knowledge:** MATH1004 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

An advanced alternative to COMP2007; covers material at an advanced and challenging level.

This unit provides an introduction to the design and analysis of algorithms. The main aims are (i) to learn how to develop algorithmic solutions to computational problem and (ii) to develop understanding of algorithm efficiency and the notion of computational hardness.

INFO2110
Systems Analysis and Modelling

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Experience with a data model as in INFO1003 or INFO1103 or INFS1000 **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides a comprehensive introduction to the analysis of complex systems. Key topics are the determination and expression of system requirements (both functional and on-functional), and the representation of structural and behavioural models of the system in UML notations. Students will be expected to evaluate requirements documents and models as well as producing them. This unit covers essential topics from the ACM/IEEE SE2004 curriculum, especially from MAA Software Modelling and Analysis.

INFO2820
Database Systems 1 (Advanced)

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Laboratory 2 hrs/week; Project Work - own time 3 hrs. **Prerequisites:** Distinction-level result in INFO1003 or INFO1103 or INFO1903 or INFO1105 or INFO1905 or DECO1012. **Prohibitions:** COMP5138, INFO2120, INFO2905 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The ubiquitous use of information technology leaves us facing a tsunami of data produced by users, IT systems and mobile devices. The proper management of data is essential for all applications, especially new ones that want to make intelligent use of the data, and for effective decision making within organisations.

This unit of study is an advanced alternative to INFO2120 that will introduce the basic concepts of database designs at the conceptual, logical and physical levels. Particular emphasis will be placed on introducing integrity constraints and the concept of data normalization which prevents data from being corrupted or duplicated in different parts of the database. This in turn helps in the data remaining consistent during its lifetime. Once a database design is in place, the emphasis shifts towards querying the data in order to extract useful information. The unit will introduce different query languages with a particular emphasis on SQL and, in INFO2820, deductive databases and DATALOG, which are all industry standard. Other topics covered will include recursive SQL, graphs in databases, NoSQL databases, transaction management, application development with a backend database, an overview of data warehousing and OLAP, and the use of XML as a data integration language.

Second year recommended elective units of study for CS stream

Students must complete at least 12 crpts.At least 6 crpts must be completed from 2000-level Mathematics and/or Statistics (we suggest choosing from MATH2069, MATH2063, STAT2012 and/or STAT2912)At least 6 crpts must be completed from (COMP2022, COMP2121)

INFS2020
Business Process Modelling & Improvement

Credit points: 6 **Teacher/Coordinator:** TBA **Session:** Semester 2 **Classes:** 1 x 3 hr seminar per week **Prohibitions:** INFS2005 **Assumed knowledge:** INFS1000 or equivalent **Assessment:** individual assignment (30%), group project (30%), and final examination (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides you with an in depth understanding of the role of business process management (BPM) and process architectures in a business environment. You will gain essential skills of the entire BPM lifecycle, from process identification to process monitoring, including process modelling, analysis, redesign and automation required to achieve high performing business processes in a service oriented business environment. In this unit, you will attain considerable hands-on skills with BPM tools, by documenting, analysing, and simulating current and improved processes.

All 2000-level COMP, INFO, ISYS units of study are recommended electives.All 2000-level ELEC units of study are recommended electives.All 2000-level MATH or STAT units of study are recommended electives.

Third year core units of study for CS stream

INFO3220
Object Oriented Design

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Project Work - own time 2 hrs. **Prerequisites:** INFO2110 and COMP2129 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit covers essential design methods and language mechanisms for successful object-oriented design and programming. C++ is used as the implementation language and a special emphasis is placed on those features of C++ that are important for solving real-world problems. Advanced software engineering features, including exceptions and name spaces are thoroughly covered.

INFO3402
Management of IT Projects and Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Project Work - own time 2 hrs. **Assumed knowledge:** INFO2110 or INFO2810 or INFO2900 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course introduces the basic processes and techniques for managing IT projects, systems and services, throughout the IT lifecycle. It addresses both the technical and behavioural aspects of IT management at the enterprise level. Major topics include: IT planning, project planning and scheduling, project tracking, resource estimation, team management, software testing, change and problem management, and quality assurance.

INFO3600
Major Development Project (Advanced)

Credit points: 12 **Session:** Semester 2 **Classes:** Project Work - in class 2 hrs/week; Site Visit 1 hr/week; Project Work - own time 16 hrs/week; Meeting 1 hr/week. **Prerequisites:** INFO3402 **Prohibitions:** ISYS3400, COMP3615 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Only available to students in BIT, BCST(Adv) or BSc(Adv).

This unit will provide students an opportunity to carry out substantial aspects of a significant software development project. The project will be directed towards assisting a client group (from industry or with strong industry links). The student's contribution could cover one or more aspects such as requirements capture, system design, implementation, change management, upgrades, operation, and/or tuning. Assessment will be based on the quality of the delivered outputs, the effectiveness of the process followed, and the understanding of the way the work fits into the client's goals, as shown in a written report.

CS & IS double stream: Students enrolled in the double stream must also complete ISYS3401 Analytical Methods and Information Systems as a core unit of study

Third year recommended elective units of study for CS stream

Student must complete at least 18 crpts.At least 12 crpts must be completed from (COMP3109, COMP3308, COMP3419, COMP3520, COMP3530, COMP3608) if single stream.At least 12 crpts must be completed from 3000-level COMP, INFO, ISYS units if double streams.

INFS3040
Enterprise Systems & Integrated Business

Credit points: 6 **Teacher/Coordinator:** TBA **Session:** Semester 1 **Classes:** 1x 3hr seminar per week **Prohibitions:** INFS3005 **Assumed knowledge:** INFS1000 or equivalent **Assessment:** mid-semester test (35%); individual enterprise system portfolio (35%), and group project (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides you with an in depth understanding of the way in which implementation and use of large scale integrated Enterprise Systems change the nature of organisational capabilities, processes, and roles.You will understand the strategic role of Enterprise Systems in providing a platform for improved business operations and designing information infrastructures. You will gain considerable hands on experience with an enterprise wide system, such as SAP, concentrating on the way in which such systems support integrated business processes.Through a combination of discussion and practical work, you will gain strong knowledge in both the organisational and technical aspects of Enterprise Systems You will also explore the emergence and implications of cloud-based Enterprise Systems and the implementation process.

All 3000-level COMP, INFO, ISYS units of study are recommended electives.All 3000-level ELEC units of study are recommended elective units.Also, appropriate fourth year units of study from BIT table can be taken as recommended electives with permission of the Head of School.

(ii) Stream in Information Systems

First year core units of study for IS stream

ENGG1805
Professional Engineering and IT

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week; Project Work - own time 2 hrs. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

ENGG1805 aims to introduce students to the fundamental principles that underlie the study of engineering and information technologies. It lays the foundation for later studies, and presents to the students challenges common to a multidisciplinary engineering environment. The subject also provides students with the opportunity to develop an understanding of engineering ethics and of working as a part of a team.

Professional Engineering and IT (6CP) is composed from the following five parts: (a) Introduction to engineering: the engineer as problem solver, critical analysis of greatest engineering achievements and failure. (b) Introduction to common engineering software tools: word processors, project management tools (c) Ethics and workplace health and safety. (d) Testing - concepts of destructive and not destructive tests will be given on samples. (e) "Meet the professionals" - A selection of guest speakers will address students on the most important aspects of the engineering profession. (f) Design Process - The process of design synthesis as an important part of engineering: students will be required to complete an engineering design (from conception, to implementation and testing) maintaining proper lab notes.

INFO1103
Introduction to Programming

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Laboratory 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Programming in a legible, maintainable, reusable way is essential to solve complex problems in the pervasive computing environments. This unit will equip students with foundation of programming concepts that are common to widely used programming languages. The "fundamentals-first & objects-later" strategy is used to progressively guide this introductory unit from necessary and important building blocks of programming to the object-oriented approach. Java, one of the most popular programming languages, is used in this unit. It provides interdisciplinary approaches, applications and examples to support students from broad backgrounds such as science, engineering, and mathematics.

ELEC1601
Foundations of Computer Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** HSC Mathematics extension 1 or 2 **Assessment:** Through semester assessment (61%) Final Exam (39%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study introduces the fundamental digital concepts upon which the design and operation of modern digital computers are based. A prime aim of the unit is to develop a professional view of, and a capacity for inquiry into, the field of computing.

Topics covered include: data representation, basic computer organisation, the CPU, elementary gates and logic, peripheral devices, software organisation, machine language, assembly language, operating systems, data communications and computer networks.

INFO1105
Data Structures

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1003 or INFO1103 or INFO1903 or INFS1000 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will teach some powerful ideas that are central to quality software: data abstraction and recursion. It will also show how one can analyse the scalability of algorithms using mathematical tools of asymptotic notation. Contents include: both external "interface" view, and internal "implementation" details, for commonly used data structures, including lists, stacks, queues, priority queues, search trees, hash tables, and graphs; asymptotic analysis of algorithm scalability, including use of recurrence relations to analyse recursive code. This unit covers the way information is represented in each structure, algorithms for manipulating the structure, and analysis of asymptotic complexity of the operations. Outcomes include: ability to write code that recursively performs an operation on a data structure; experience designing an algorithmic solution to a problem using appropriate data structures, coding the solution, and analysing its complexity.

Note: INFO1905 (advanced version) can be taken as an alternative core unit to INFO1905.

First year recommended elective units of study for IS stream

At least 12 crpts must be completed from 1000-level Mathematics and/or Statistics.

BUSS1001
Understanding Business

Credit points: 6 **Teacher/Coordinator:** Professor Marcus O'Connor **Session:** Semester 1, Semester 2 **Classes:** 1x 1.5 hr lecture and 1x 1.5 hr tutorial per week **Prohibitions:** ECOF1003 **Assessment:** participation (15%), essay (20%), case study (20%), and final exam (45%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This unit of study is a compulsory part of the Bachelor of Commerce, combined Bachelor of Commerce degrees and the Bachelor of Commerce (Liberal Studies).

This unit of study is the first of two junior core units aimed at introducing students to the internal and external contexts in which business operates in the twenty-first century. It also aims to lay the foundations for effective communication (written and oral), critical analysis, problem solving, and team work skills, which are essential to achieving program learning goals. In this unit, students will build an understanding of the dynamics of business through the lens of the company and its stakeholders. Business ethics is also introduced as key learning goal.

BUSS1002
The Business Environment

Credit points: 6 **Teacher/Coordinator:** Omer Konakci **Session:** Semester 1, Semester 2 **Classes:** 1x 1.5hr lecture and 1x 1.5hr tutorial per week **Prerequisites:** ECOF1003 or BUSS1001 **Prohibitions:** ECOF1004, CISS2001 **Assessment:** media summary and analyses (55%), tutorial participation (10%), and final exam (35%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This unit of study is a compulsory part of the Bachelor of Commerce, combined Bachelor of Commerce degrees and the Bachelor of Commerce (Liberal Studies).

This unit of study is the second of two junior core units aimed at introducing students to the external and internal contexts in which business operates in the twenty-first century while developing effective problem solving, critical analysis and communication skills. In this unit, students will build an understanding of the economic, political and regulatory, socio-cultural, and technological factors that impact on the external context of the commercial landscape while developing an awareness of potential of risk and change. An awareness of corporate social responsibility and sustainability is also introduced as a key learning goal.

ELEC1103
Fundamentals of Elec and Electronic Eng

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Basic knowledge of differentiation & integration, and HSC Physics **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to develop knowledge of the fundamental concepts and building blocks of electrical and electronics circuits. This is a foundation unit in circuit theory. Circuit theory is the electrical engineer's fundamental tool.

The concepts learnt in this unit will be made use of heavily in many units of study (in later years) in the areas of electronics, instrumentation, electrical machines, power systems, communication systems, and signal processing.

Topics: a) Basic electrical and electronic circuit concepts: Circuits, circuit elements, circuit laws, node and mesh analysis, circuit theorems, energy storage, capacitors and inductors, circuits with switches, transient response, sine waves and complex analysis, phasors, impedance, ac power.; b) Project management, teamwork, ethics; c) Safety issues

INFO1003
Foundations of Information Technology

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 3 hrs/week; Laboratory 2 hrs/week. **Prohibitions:** INFO1000, ISYS1003, INFO1903, INFS1000 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Information technologies (IT) and systems have emerged as the primary platform to support communication, collaboration, research, decision making, and problem solving in contemporary organisations. The essential necessity for all university students to acquire the fundamental knowledge and skills for applying IT effectively for a wide range of tasks is widely recognised. It is an introductory unit of study which prepares students from any academic discipline to develop the necessary knowledge, skills and abilities to be competent in the use of information technology for solving a variety of problems. The main focus of this unit is on modelling and problem solving through the effective use of using IT. Students will learn how to navigate independently to solve their problems on their own, and to be capable of fully applying the power of IT tools in the service of their goals in their own domains while not losing sight of the fundamental concepts of computing.

Students are taught core skills related to general purpose computing involving a range of software tools such as spreadsheets, database management systems, internet search engine, HTML, and JavaScript. Students will undertake practical tasks including authoring an interactive website using HTML, JavaScript and AJAX and building a small scale application for managing information. In addition, the course will address the many social, ethical, and intellectual property issues arising from the wide-spread use of information technology in our society.

INFO1903
Informatics (Advanced)

Credit points: 6 **Session:** Semester 1 **Classes:** Tutorial 3 hrs/week; Lecture 3 hrs/week. **Prerequisites:** ATAR sufficient to enter BCST(Adv), BIT or BSc(Adv), or portfolio of work suitable for entry **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit covers advanced data processing and management, integrating the use of existing productivity software, e.g. spreadsheets and databases, with the development of custom software using the powerful general-purpose Python scripting language. It will focus on skills directly applicable to research in any quantitative domain. The unit will also cover presentation of data through written publications and dynamically generated web pages, visual representations and oral presentation skills. The assessment, a semester long project, involves the demonstration of these skills and techniques for processing and presenting data in a choice of domains.

PHIL1012
Introductory Logic

Credit points: 6 **Session:** Semester 2 **Classes:** 1x2hr lecture/week, 1x1hr tutorial/week **Assessment:** Tutorial participation (10%), 2x assignments (40%) and 1x2hr exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

An introduction to modern logic: the investigation of the laws of truth. One essential aspect of good reasoning or argumentation is that it is valid: it cannot lead from true premises to a false conclusion. In this unit we learn how to identify and construct valid arguments, using techniques such as truth tables, models and truth trees. Apart from being a great aid to clear thinking about any subject, knowledge of logic is essential for understanding many areas not only of contemporary philosophy, but also linguistics, mathematics and computing.

All 1000-level MATH units of study are recommended electives.A full list of available MATH/STAT units can be obtained from the School of Mathematics and Statistics, who can also advise on the appropriate level of unit for the students preparation. We strongly suggest including some statistics unit among the choices.

Second year core units of study for IS stream

COMP2129
Operating Systems and Machine Principles

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1103. **Assumed knowledge:** INFO1105 OR INFO1905. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

In this unit of study elementary methods for developing robust, efficient, and re-usable software will be covered. The unit is taught in C, in a Unix environment. Specific coding topics include memory management, the pragmatic aspects of implementing data structures such as lists and hash tables and managing concurrent threads. Debugging tools and techniques are discussed and common programming errors are considered along with defensive programming techniques to avoid such errors. Emphasis is placed on using common Unix tools to manage aspects of the software construction process, such as version control and regression testing. The subject is taught from a practical viewpoint and it includes a considerable amount of programming practice.

COMP2907
Algorithms and Complexity (Advanced)

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** Distinction level result in INFO1105 or INFO1905 **Assumed knowledge:** MATH1004 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

An advanced alternative to COMP2007; covers material at an advanced and challenging level.

This unit provides an introduction to the design and analysis of algorithms. The main aims are (i) to learn how to develop algorithmic solutions to computational problem and (ii) to develop understanding of algorithm efficiency and the notion of computational hardness.

INFO2110
Systems Analysis and Modelling

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Experience with a data model as in INFO1003 or INFO1103 or INFS1000 **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides a comprehensive introduction to the analysis of complex systems. Key topics are the determination and expression of system requirements (both functional and on-functional), and the representation of structural and behavioural models of the system in UML notations. Students will be expected to evaluate requirements documents and models as well as producing them. This unit covers essential topics from the ACM/IEEE SE2004 curriculum, especially from MAA Software Modelling and Analysis.

INFO2820
Database Systems 1 (Advanced)

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Laboratory 2 hrs/week; Project Work - own time 3 hrs. **Prerequisites:** Distinction-level result in INFO1003 or INFO1103 or INFO1903 or INFO1105 or INFO1905 or DECO1012. **Prohibitions:** COMP5138, INFO2120, INFO2905 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The ubiquitous use of information technology leaves us facing a tsunami of data produced by users, IT systems and mobile devices. The proper management of data is essential for all applications, especially new ones that want to make intelligent use of the data, and for effective decision making within organisations.

This unit of study is an advanced alternative to INFO2120 that will introduce the basic concepts of database designs at the conceptual, logical and physical levels. Particular emphasis will be placed on introducing integrity constraints and the concept of data normalization which prevents data from being corrupted or duplicated in different parts of the database. This in turn helps in the data remaining consistent during its lifetime. Once a database design is in place, the emphasis shifts towards querying the data in order to extract useful information. The unit will introduce different query languages with a particular emphasis on SQL and, in INFO2820, deductive databases and DATALOG, which are all industry standard. Other topics covered will include recursive SQL, graphs in databases, NoSQL databases, transaction management, application development with a backend database, an overview of data warehousing and OLAP, and the use of XML as a data integration language.

ISYS2140
Information Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Prerequisites:** INFO1103 OR INFO1903 OR INFS1000 OR INFO1003 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will provide a comprehensive conceptual and practical introduction to information systems (IS) in contemporary organisations. Key topics covered include:

* Basic concepts of information systems
* Network fundamentals and applications
* E-business and e-commerce
* Information systems for competitive advantage
* Functional and enterprise systems
* Business intelligence
* Information systems acquisition
* Information security, ethics, and privacy

Second year recommended elective units of study for IS stream

Students must complete at least 6 crpts.At least 6 crpts must be completed from 2000-level Mathematics and/or Statistics. We strongly suggest STAT2012 or STAT2912.

INFS2020
Business Process Modelling & Improvement

Credit points: 6 **Teacher/Coordinator:** TBA **Session:** Semester 2 **Classes:** 1 x 3 hr seminar per week **Prohibitions:** INFS2005 **Assumed knowledge:** INFS1000 or equivalent **Assessment:** individual assignment (30%), group project (30%), and final examination (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides you with an in depth understanding of the role of business process management (BPM) and process architectures in a business environment. You will gain essential skills of the entire BPM lifecycle, from process identification to process monitoring, including process modelling, analysis, redesign and automation required to achieve high performing business processes in a service oriented business environment. In this unit, you will attain considerable hands-on skills with BPM tools, by documenting, analysing, and simulating current and improved processes.

All 2000-level COMP, INFO, ISYS units of study are recommended electives.All 2000-level ELEC units of study are recommended electives.All 2000-level MATH or STAT units of study are recommended electives.

Third year core units of study for IS stream

INFO3402
Management of IT Projects and Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Project Work - own time 2 hrs. **Assumed knowledge:** INFO2110 or INFO2810 or INFO2900 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course introduces the basic processes and techniques for managing IT projects, systems and services, throughout the IT lifecycle. It addresses both the technical and behavioural aspects of IT management at the enterprise level. Major topics include: IT planning, project planning and scheduling, project tracking, resource estimation, team management, software testing, change and problem management, and quality assurance.

INFO3600
Major Development Project (Advanced)

Credit points: 12 **Session:** Semester 2 **Classes:** Project Work - in class 2 hrs/week; Site Visit 1 hr/week; Project Work - own time 16 hrs/week; Meeting 1 hr/week. **Prerequisites:** INFO3402 **Prohibitions:** ISYS3400, COMP3615 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Only available to students in BIT, BCST(Adv) or BSc(Adv).

This unit will provide students an opportunity to carry out substantial aspects of a significant software development project. The project will be directed towards assisting a client group (from industry or with strong industry links). The student's contribution could cover one or more aspects such as requirements capture, system design, implementation, change management, upgrades, operation, and/or tuning. Assessment will be based on the quality of the delivered outputs, the effectiveness of the process followed, and the understanding of the way the work fits into the client's goals, as shown in a written report.

ISYS3401
Analytical Methods & Information Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assumed knowledge:** INFO2110, ISYS2140 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Information Systems (IS) professionals in today's organisations are required to play leadership roles in change and development. Your success in this field will be aided by your being able to carry out research-based investigations using suitable methods and mastery over data collection and analysis to assist in managing projects and in decision making. Practical research skills are some of the most important assets you will need in your career.

This unit of study will cover important concepts and skills in practical research for solving and managing important problems. This will also provide you with the skills to undertake the capstone project in the IS project unit of study offered in Semester 2 or other projects. It will also provide hand-on experience of using Microsoft Excel and other tools to perform some of the quantitative analysis.

CS & IS double stream: Students enrolled in the double stream must also complete INFO3220 Object Oriented Design as a core unit of study.

Third year recommended elective units of study for IS stream

Student must complete at least 18 crpts.At least 12 crpts must be completed from (INFO3220, INFO3315, INFO3404, INFO3406, INFO3504)

INFS3040
Enterprise Systems & Integrated Business

Credit points: 6 **Teacher/Coordinator:** TBA **Session:** Semester 1 **Classes:** 1x 3hr seminar per week **Prohibitions:** INFS3005 **Assumed knowledge:** INFS1000 or equivalent **Assessment:** mid-semester test (35%); individual enterprise system portfolio (35%), and group project (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides you with an in depth understanding of the way in which implementation and use of large scale integrated Enterprise Systems change the nature of organisational capabilities, processes, and roles. You will understand the strategic role of Enterprise Systems in providing a platform for improved business operations and designing information infrastructures. You will gain considerable hands on experience with an enterprise wide system, such as SAP, concentrating on the way in which such systems support integrated business processes. Through a combination of discussion and practical work, you will gain strong knowledge in both the organisational and technical aspects of Enterprise Systems You will also explore the emergence and implications of cloud-based Enterprise Systems and the implementation process.

All 3000-level COMP, INFO, ISYS units of study are recommended electives.All 3000-level ELEC units of study are recommended electives.Also, appropriate fourth year units of study from BIT table can be taken as recommended electives with permission of the Head of School.

Honours

Students who have qualified for the BCST(Adv) degree may apply to enter the BCST(Adv)(Honours) year. Note that unlike BIT(Honours) or BE(Honours), the Honours in BCST(Adv) requires an additional 48 credit points of study.All BCST(Adv)(Honours) students must complete the following 24 credit points of core units of study. These units are only available to students enrolled in Honours degrees, those in Research Higher degrees, or those in the Research track in postgraduate coursework degrees. In addition to the core units students must also complete 24 credit points of elective units of study list in the table below .

Fourth year Honours core units of study

INFO4991
IT Research Thesis A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research 12 hrs/week. **Corequisites:** INFO5993 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: INFO4991 and INFO4992 together form the Honours Research thesis. It is allowed to enrol in one of these units in one semester, and the other the following semester; the same mark and grade is given for both once they have both been completed.

Students enrolled in the Honours programs study various advanced aspects of Information Technology. The program may include lectures, tutorials, seminars and practicals. They will undertake a research project. Assessment will include the project and may include examinations and classwork.

INFO4992
IT Research Thesis B

Credit points: 12 **Session:** Semester 1, Semester 2 **Classes:** Research 24 hrs/week. **Corequisites:** INFO4991 and INFO5993 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: INFO4991 and INFO4992 together form the Honours Research thesis. It is allowed to enrol in one of these units in one semester, and the other the following semester; the same mark and grade is given for both once they have both been completed.

Students enrolled in the Honours programs study various advanced aspects of Information Technology. The program may include lectures, tutorials, seminars and practicals. They will undertake a research project. Assessment will include the project and may include examinations and classwork.

INFO4999
Computer Science Honours Result

Session: Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

All SIT Honours students must enrol in this non assessable unit of study in their final semester.

INFO5993
IT Research Methods

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Seminar 2 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will provide an overview of the different research methods that are used in IT. Students will learn to find and evaluate research on their topic and to present their own research plan or results for evaluation by others. The unit will develop a better understanding of what research in IT is and how it differs from other projects in IT. This unit of study is required for students in IT who are enrolled in a research project as part of their Honours or MIT/MITM degree. It is also recommended for students enrolled or planning to do a research degree in IT and Engineering.

For a standard enrolment plan for Bachelor of Computer Science and Technology (Advanced) visit CUSP.

Bachelor of Information Technology

Course Overview

If you aim to pursue a career as a multi-skilled leader in IT, our Bachelor of Information Technology has been developed in extensive consultation with the industry. You will enjoy considerable flexibility within your course of study and emerge equipped to tackle the challenges of this demanding and dynamic field.

We offer a choice of two streams: information systems or computer science.

The computer science stream involves the study of computers and computer programs. You will excel in this stream if you're more technically-minded and want to contribute to the future development and support of computer technology.

The information systems stream comprises the study of the direct application of software design and development to the business domain. You will gain an understanding of the principles and techniques involved in the analysis, design, implementation and maintenance of computer systems within a business environment.

Course Requirements

To meet the requirements of the Bachelor of Information Technology, a candidate must successfully complete 192 credit points, comprising:

1. a minimum of 144 credit points of core and selected core units of study in the chosen stream; and
2. 18 credit points of selected Mathematics and Statistics units, with at least six credit points at 2000-level or above; and
3. 30 credit points of elective units of study;

and ensuring:

1. no more than 72 credit points in junior (1000-level) units of study, and
2. at least 84 credit points in 3000-level or above units of study.

For a standard enrolment plan for Bachelor of Information Technology visit CUSP.

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Bachelor of Information Technology			
Candidates for the degree of Bachelor of Information Technology (BIT) are required to gain credit for 192 credit points from the units of study set out below. The selection of units must satisfy the degree rules in the Resolutions of the Faculty. In particular, all core units must be completed, along with an appropriate amount from the elective units of study as recommended by the Faculty. Candidates for the BIT degree must complete a stream in either Computer Science or Information Systems, or both, as described in the Tables below. Enrolment is subject to the following constraints: 1. At most 72 credit points accumulated from first year units (core and recommended electives) can be counted for degree completion. 2. Candidates in the BIT degree must maintain a credit average in each year of enrolment. If this level of result is not achieved candidates will be transferred to the BCST degree program. Through this table, candidates may substitute an advanced equivalent for a non- advanced unit mentioned. They may also substitute an appropriate unit from the Advanced Engineering program of the Faculty of Engineering, or the Talented Student Program of the Faculty of Science, if they are eligible to enrol in such units.			
(i) Stream in Computer Science			
First year core units of study for CS stream			
ENGG1805 **Professional Engineering and IT**	6		Semester 1
ELEC1601 **Foundations of Computer Systems**	6	**A** HSC Mathematics extension 1 or 2	Semester 2
INFO1103 **Introduction to Programming**	6		Semester 1 Semester 2
INFO1105 **Data Structures**	6	**P** INFO1003 or INFO1103 or INFO1903 or INFS1000	Semester 2
Note: INFO1905 (advanced version) can be taken as an alternative to INFO1105.			
First year recommended elective units of study for CS stream			
At least 12 crpts must be completed from 1000-level Mathematics and/or Statistics.			
ELEC1103 **Fundamentals of Elec and Electronic Eng**	6	**A** Basic knowledge of differentiation & integration, and HSC Physics	Semester 1
INFO1003 **Foundations of Information Technology**	6	**N** INFO1000, ISYS1003, INFO1903, INFS1000	Semester 1 Semester 2
INFO1903 **Informatics (Advanced)**	6	**P** ATAR sufficient to enter BCST(Adv), BIT or BSc(Adv), or portfolio of work suitable for entry *Note: Department permission required for enrolment*	Semester 1
BUSS1001 **Understanding Business**	6	**N** ECOF1003 *This unit of study is a compulsory part of the Bachelor of Commerce, combined Bachelor of Commerce degrees and the Bachelor of Commerce (Liberal Studies).*	Semester 1 Semester 2
BUSS1002 **The Business Environment**	6	**P** ECOF1003 or BUSS1001 **N** ECOF1004, CISS2001 *This unit of study is a compulsory part of the Bachelor of Commerce, combined Bachelor of Commerce degrees and the Bachelor of Commerce (Liberal Studies).*	Semester 1 Semester 2
All 1000-level MATH units of study are recommended electives. A full list of available MATH/STAT units can be obtained from the School of Mathematics and Statistics, who can also advise on the appropriate level of unit for the students preparation. We strongly suggest including some statistics unit among the choices.			
Second Year core units of study for CS stream			
COMP2007 **Algorithms and Complexity**	6	**A** MATH1004 **P** INFO1105 OR INFO1905.	Semester 2
Note: COMP2907 (advanced version) can be taken as an alternative to COMP2007.			
COMP2129 **Operating Systems and Machine Principles**	6	**A** INFO1105 OR INFO1905. **P** INFO1103.	Semester 1
INFO2110 **Systems Analysis and Modelling**	6	**A** Experience with a data model as in INFO1003 or INFO1103 or INFS1000	Semester 2
INFO2120 **Database Systems 1**	6	**P** INFO1003 OR INFO1103 OR INFO1903 OR INFS1000 OR DECO1012. **N** INFO2820, INFO2905, COMP5138	Semester 1
Note: INFO2820 (advanced version) can be taken as an alternative core unit to INFO2120.			
Second year recommended elective units of study for CS stream			
BIT single degree students must complete at least 12 crpts. For BIT single degree students, at least 6 crpts must be completed from 2000-level Mathematics and/or Statistics (we suggest choosing from MATH2069, MATH2063, STAT2012 and/or STAT2912).			

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
For BIT single and combined degree students, at least 6 credit points must be completed from COMP2022 or COMP2121.			
INFS2020 **Business Process Modelling & Improvement**	6	**A** INFS1000 or equivalent **N** INFS2005	Semester 2
All 2000-level COMP, INFO, ISYS units of study are recommended electives.			
All 2000-level ELEC units of study are recommended.			
All 2000-level MATH or STAT units of study are recommended electives.			
Third year core units of study for CS stream			
INFO3220 **Object Oriented Design**	6	**P** INFO2110 and COMP2129	Semester 1
INFO3402 **Management of IT Projects and Systems**	6	**A** INFO2110 or INFO2810 or INFO2900	Semester 1
INFO3600 **Major Development Project (Advanced)**	12	**P** INFO3402 **N** ISYS3400, COMP3615 *Only available to students in BIT, BCST(Adv) or BSc(Adv).*	Semester 2
CS & IS double stream: BIT single degree students enrolled in the double stream must also complete ISYS3401 Analytical Methods and Information Systems as a core unit of study. BIT combined degree students do not have double stream.			
Third year recommended elective units of study for CS stream			
BIT single degree students must complete at least 18 crpts			
BIT combined degree students must complete at least 6 crpts			
For single degree students, at least 12 crpts must be completed from (COMP3109, COMP3308, COMP3419, COMP3520, COMP3530, COMP3608)			
For combined degree students, at least 6 crpts must be completed from (COMP3109, COMP3308, COMP3419, COMP3520, COMP3530, COMP3608)			
INFS3040 **Enterprise Systems & Integrated Business**	6	**A** INFS1000 or equivalent **N** INFS3005	Semester 1
All 3000-level COMP, INFO, ISYS units of study are recommended electives.			
All 3000-level and above ELEC units of study are recommended electives			
Fourth year recommended elective units of study for CS stream			
Students in the BIT Pass degree must complete at least 48 credit points from this list. At least 36 crpts must be completed from 5000-level or above COMP, INFO, ISYS units of study.			
COMP5045 **Computational Geometry**	6	**A** Students are assumed to have a basic knowledge of the design and analysis of algorithms and data structures: you should be familiar with big-O notations and simple algorithmic techniques like sorting, binary search, and balanced search trees.	Semester 1
COMP5046 **Statistical Natural Language Processing**	6	**A** Knowledge of an OO programming language *Practical work will use the Natural Language Toolkit*	Semester 1
COMP5047 **Pervasive Computing**	6	**A** Background in programming and operating systems that is sufficient for the student to independently learn new programming tools from standard online technical materials. Ability to conduct a literature search. Ability to write reports of work done. *Note: Department permission required for enrolment*	Semester 2
COMP5048 **Visual Analytics**	6	**A** It is assumed that students will have basic knowledge of data structures, algorithms and programming skills.	Semester 2
COMP5216 **Mobile Computing**	6	**A** COMP5214 Software Development in JAVA, or similar introductory software development units.	Semester 2
COMP5313 **Large Scale Networks**	6	**A** Algorithmic skills (as expected from any IT graduate). Basic probability knowledge. *Note: Department permission required for enrolment*	Semester 1
COMP5318 **Knowledge Discovery and Data Mining**	6	**A** INFO9120 OR COMP5138	Semester 1
COMP5338 **Advanced Data Models**	6	**A** This unit of study assumes foundational knowledge of relational database systems as taught in COMP5138/ INFO9120 (Database Management Systems) or INFO2120/2820 (Database Systems 1).	Semester 2
COMP5347 **Web Application Development**	6	**A** INFO9220 or COMP5028. The course assumes basic knowledge on OO design and UML diagrams.	Semester 1
COMP5348 **Enterprise Scale Software Architecture**	6	**A** Programming competence in Java or similar OO language. Capacity to master novel technologies (especially to program against novel APIs) using manuals, tutorial examples, etc.	Semester 1
COMP5349 **Cloud Computing**	6	**A** Good programming skills, especially in Java for the practical assignment, as well as proficiency in databases and SQL. The unit is expected to be taken after introductory courses in related units such as COMP5214 OR INFO9103 Software Development in JAVA	Semester 1
COMP5416 **Advanced Network Technologies**	6	**A** COMP5116 OR ELEC3506	Semester 2
COMP5424 **Information Technology in Biomedicine**	6		Semester 1
COMP5425 **Multimedia Retrieval**	6	**A** COMP9007 or COMP5211. Basic Programming skills and data structure knowledge.	Semester 1
COMP5426 **Parallel and Distributed Computing**	6	**A** COMP5116	Semester 1
COMP5427 **Usability Engineering**	6		Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
COMP5456 **Introduction to Bioinformatics** *This unit of study is not available in 2015*	6	**A** Some experience with basic programming (coding) in Java, C, C++ or Perl; Some proven ability in mathematical or information sciences (as evinced in the prerequisites); Some knowledge of molecular biology either through first year BIOL papers or MBLG1001. **N** COMP3456	Summer Main
INFO5010 **IT Advanced Topic A**	6	*Note: Department permission required for enrolment*	Semester 1 Semester 2 Summer Late
INFO5011 **IT Advanced Topic B** *This unit of study is not available in 2015*	6	**N** INFO4011	Semester 1 Semester 2 Winter Main
INFO5060 **Data Analytics and Business Intelligence**	6	**A** The unit is expected to be taken after introductory courses or related units such as COMP5206 Information Technologies and Systems	Summer Early
INFO5301 **Information Security Management**	6	**A** This unit of study assumes foundational knowledge of Information systems management. Two year IT industry exposure and a breadth of IT experience will be preferable.	Semester 1
INFO5991 **Services Science Management and Eng**	6	**A** INFO5990. Students are expected to have a degree in computer science, engineering, information technology, information systems or business. *Note: Department permission required for enrolment*	Semester 1 Semester 2
INFO5992 **Understanding IT Innovations**	6	**A** INFO5990. Students are expected to be fluent in English and capable of participating in group discussions, and capable of producing an individually written paper of 5-9 pages (double spaced) of high quality and clarity. Although some work experience is ideal in adding value to the case discussions, allowing students to pull from their personal experiences, those students with no work experience will be expected to do appropriate research on the discussion topics in order to contribute. **N** PMGT5875 *A variety of learning situations will be employed during the unit of study, including lectures, recommended reading, a few short exercises during class, and discussions of cases. To benefit fully from this unit it is necessary to participate fully in all aspects of the unit of study.*	Semester 1 Semester 2
INFO6010 **Advanced Topics in IT Project Management**	6	**A** Students are assumed to understand the role of IT projects. **P** INFO6007, OR 3-5 years working experience in IT Project Management	Semester 2
INFO6012 **Information Technology Strategy & Value**	6	**A** COMP5206. Introduction to Information Systems	Semester 2
ISYS5070 **Change Management in IT**	6	**A** The unit is expected to be taken after the following related units INFO6007 Project Managemnet in IT and COMP5206 Introduction to Information Systems.	Winter Main
ELEC5508 **Wireless Engineering**	6	**A** Basic knowledge in probability and statistics, analog and digital communications, error probability calculation in communications channels, and telecommunications network.	Semester 2
ELEC5509 **Mobile Networks**	6	**A** Basically, students need to know the concepts of data communications and mobile communications, which could be gained in one the following units of study: ELEC3505 Communications, ELEC3506 Data Communications and the Internet, or similar units. If you are not sure, please contact the instructor.	Semester 1
ELEC5514 **Networked Embedded Systems**	6	**A** ELEC3305, ELEC3506, ELEC3607 and ELEC5508	Semester 2
ELEC5614 **Real Time Computing**	6	**A** SOFT2130 Software Construction (or SOFT2004 Software Development Methods 1) and ELEC3607 Embedded Computing (or ELEC2601 Microprocessor Systems) **N** MECH5701	Semester 1
ELEC5616 **Computer and Network Security**	6	**A** A programming language, basic maths.	Semester 1
ELEC5618 **Software Quality Engineering**	6	**A** You are capable of writing programs with multiple functions or methods in multiple files. You are capable of design complex data structures and combine them in non trivial algorithms. You know how to use an integrated development environment. You are familiar and have worked previously with software version control systems. You know how to distribute the workload derived from the unit of study effectively throughoug the week and make sure that time is truly productive.	Semester 1
ELEC5619 **Object Oriented Application Frameworks**	6	**A** Java programming, and some web development experience are essential. Databases strongly recommended	Semester 2
ELEC5620 **Model Based Software Engineering**	6	**A** A programming language, basic maths. *Note: Department permission required for enrolment*	Semester 2
(ii) Stream in Information Systems			
First year core units of study for IS stream			
ENGG1805 **Professional Engineering and IT**	6		Semester 1
ELEC1601 **Foundations of Computer Systems**	6	**A** HSC Mathematics extension 1 or 2	Semester 2
INFO1103 **Introduction to Programming**	6		Semester 1 Semester 2
INFO1105 **Data Structures**	6	**P** INFO1003 or INFO1103 or INFO1903 or INFS1000	Semester 2
Note: INFO1905 (advanced version) can be taken as an alternative core unit to INFO1105.			
First year recommended elective units of study for IS stream			
At least 12 crpts must be completed from 1000-level Mathematics and/or Statistics.			
ELEC1103 **Fundamentals of Elec and Electronic Eng**	6	**A** Basic knowledge of differentiation & integration, and HSC Physics	Semester 1

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
INFO1003 Foundations of Information Technology	6	**N** INFO1000, ISYS1003, INFO1903, INFS1000	Semester 1 Semester 2
INFO1903 Informatics (Advanced)	6	**P** ATAR sufficient to enter BCST(Adv), BIT or BSc(Adv), or portfolio of work suitable for entry *Note: Department permission required for enrolment*	Semester 1
BUSS1001 Understanding Business	6	**N** ECOF1003 *This unit of study is a compulsory part of the Bachelor of Commerce, combined Bachelor of Commerce degrees and the Bachelor of Commerce (Liberal Studies).*	Semester 1 Semester 2
BUSS1002 The Business Environment	6	**P** ECOF1003 or BUSS1001 **N** ECOF1004, CISS2001 *This unit of study is a compulsory part of the Bachelor of Commerce, combined Bachelor of Commerce degrees and the Bachelor of Commerce (Liberal Studies).*	Semester 1 Semester 2
All 1000-level MATH units of study are recommended electives.			
A full list of available MATH/STAT units can be obtained from the School of Mathematics and Statistics, who can also advise on the appropriate level of unit for the students preparation. We strongly suggest including some statistics unit among the choices.			
Second year core units of study for IS stream			
COMP2007 Algorithms and Complexity	6	**A** MATH1004 **P** INFO1105 OR INFO1905.	Semester 2
Note: COMP2907 (advanced version) can be taken as an alternative core unit to COMP2007.			
COMP2129 Operating Systems and Machine Principles	6	**A** INFO1105 OR INFO1905. **P** INFO1103.	Semester 1
INFO2110 Systems Analysis and Modelling	6	**A** Experience with a data model as in INFO1003 or INFO1103 or INFS1000	Semester 2
ISYS2140 Information Systems	6	**P** INFO1103 OR INFO1903 OR INFS1000 OR INFO1003	Semester 1
INFO2120 Database Systems 1	6	**P** INFO1003 OR INFO1103 OR INFO1903 OR INFS1000 OR DECO1012. **N** INFO2820, INFO2905, COMP5138	Semester 1
Note: INFO2820 (advanced version) can be taken as an alternative core unit to INFO2120.			
Second year recommended elective units of study for IS stream			
BIT single degree students must complete at least 6 crpts			
For BIT single degree students, at least 6 crpts must be completed from 2000-level Mathematics and/or Statistics (we strongly suggest STAT2012 or STAT2912)			
INFS2020 Business Process Modelling & Improvement	6	**A** INFS1000 or equivalent **N** INFS2005	Semester 2
All 2000-level COMP, INFO, ISYS units of study are recommended electives.			
All 2000-level ELEC units of study are recommended electives.			
All 2000-level MATH or STAT units of study are recommended electives.			
Third year core units of study for IS stream			
INFO3402 Management of IT Projects and Systems	6	**A** INFO2110 or INFO2810 or INFO2900	Semester 1
INFO3600 Major Development Project (Advanced)	12	**P** INFO3402 **N** ISYS3400, COMP3615 *Only available to students in BIT, BCST(Adv) or BSc(Adv).*	Semester 2
ISYS3401 Analytical Methods & Information Systems	6	**A** INFO2110, ISYS2140	Semester 1
CS & IS double stream: BIT single degree students enrolled in the double stream must also complete INFO3220 Object Oriented Design as a core unit of study. BIT combined degree students do not have double stream.			
Third year recommended elective units of study for IS stream			
BIT single degree students must complete at least 18 credit points			
BIT combined degree students must complete at least 6 credit points			
For single degree students, at least 12 credit pointsmust be completed from (INFO3220, INFO3315, INFO3404, INFO3406, INFO3504)			
For combined degree students, at least 6 credit points must be completed from (INFO3220, INFO3315, INFO3404, INFO3406, INFO3504)			
INFS3040 Enterprise Systems & Integrated Business	6	**A** INFS1000 or equivalent **N** INFS3005	Semester 1
All 3000-level COMP, INFO, ISYS units of study are recommended electives.			
All 3000-level and above ELEC units of study are recommended electives.			
Fourth year recommended elective units of study for IS stream			
Students in the BIT Pass degree must complete at least 48 credit points from this list. At least 36 crpts must be completed from 5000-level or above COMP, INFO, ISYS units of study.			
COMP5045 Computational Geometry	6	**A** Students are assumed to have a basic knowledge of the design and analysis of algorithms and data structures: you should be familiar with big-O notations and simple algorithmic techniques like sorting, binary search, and balanced search trees.	Semester 1
COMP5046 Statistical Natural Language Processing	6	**A** Knowledge of an OO programming language *Practical work will use the Natural Language Toolkit*	Semester 1

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
COMP5047 **Pervasive Computing**	6	**A** Background in programming and operating systems that is sufficient for the student to independently learn new programming tools from standard online technical materials. Ability to conduct a literature search. Ability to write reports of work done. *Note: Department permission required for enrolment*	Semester 2
COMP5048 **Visual Analytics**	6	**A** It is assumed that students will have basic knowledge of data structures, algorithms and programming skills.	Semester 2
COMP5216 **Mobile Computing**	6	**A** COMP5214 Software Development in JAVA, or similar introductory software development units.	Semester 2
COMP5313 **Large Scale Networks**	6	**A** Algorithmic skills (as expected from any IT graduate). Basic probability knowledge. *Note: Department permission required for enrolment*	Semester 1
COMP5318 **Knowledge Discovery and Data Mining**	6	**A** INFO9120 OR COMP5138	Semester 1
COMP5338 **Advanced Data Models**	6	**A** This unit of study assumes foundational knowledge of relational database systems as taught in COMP5138/ INFO9120 (Database Management Systems) or INFO2120/2820 (Database Systems 1).	Semester 2
COMP5347 **Web Application Development**	6	**A** INFO9220 or COMP5028. The course assumes basic knowledge on OO design and UML diagrams.	Semester 1
COMP5348 **Enterprise Scale Software Architecture**	6	**A** Programming competence in Java or similar OO language. Capacity to master novel technologies (especially to program against novel APIs) using manuals, tutorial examples, etc.	Semester 1
COMP5349 **Cloud Computing**	6	**A** Good programming skills, especially in Java for the practical assignment, as well as proficiency in databases and SQL. The unit is expected to be taken after introductory courses in related units such as COMP5214 OR INFO9103 Software Development in JAVA	Semester 1
COMP5416 **Advanced Network Technologies**	6	**A** COMP5116 OR ELEC3506	Semester 2
COMP5424 **Information Technology in Biomedicine**	6		Semester 1
COMP5425 **Multimedia Retrieval**	6	**A** COMP9007 or COMP5211. Basic Programming skills and data structure knowledge.	Semester 1
COMP5426 **Parallel and Distributed Computing**	6	**A** COMP5116	Semester 1
COMP5427 **Usability Engineering**	6		Semester 2
COMP5456 **Introduction to Bioinformatics** *This unit of study is not available in 2015*	6	**A** Some experience with basic programming (coding) in Java, C, C++ or Perl; Some proven ability in mathematical or information sciences (as evinced in the prerequisites); Some knowledge of molecular biology either through first year BIOL papers or MBLG1001. **N** COMP3456	Summer Main
INFO5010 **IT Advanced Topic A**	6	*Note: Department permission required for enrolment*	Semester 1 Semester 2 Summer Late
INFO5011 **IT Advanced Topic B** *This unit of study is not available in 2015*	6	**N** INFO4011	Semester 1 Semester 2 Winter Main
INFO5060 **Data Analytics and Business Intelligence**	6	**A** The unit is expected to be taken after introductory courses or related units such as COMP5206 Information Technologies and Systems	Summer Early
INFO5301 **Information Security Management**	6	**A** This unit of study assumes foundational knowledge of Information systems management. Two year IT industry exposure and a breadth of IT experience will be preferable.	Semester 1
INFO5991 **Services Science Management and Eng**	6	**A** INFO5990. Students are expected to have a degree in computer science, engineering, information technology, information systems or business. *Note: Department permission required for enrolment*	Semester 1 Semester 2
INFO5992 **Understanding IT Innovations**	6	**A** INFO5990. Students are expected to be fluent in English and capable of participating in group discussions, and capable of producing an individually written paper of 5-9 pages (double spaced) of high quality and clarity. Although some work experience is ideal in adding value to the case discussions, allowing students to pull from their personal experiences, those students with no work experience will be expected to do appropriate research on the discussion topics in order to contribute. **N** PMGT5875 *A variety of learning situations will be employed during the unit of study, including lectures, recommended reading, a few short exercises during class, and discussions of cases. To benefit fully from this unit it is necessary to participate fully in all aspects of the unit of study.*	Semester 1 Semester 2
INFO6010 **Advanced Topics in IT Project Management**	6	**A** Students are assumed to understand the role of IT projects. **P** INFO6007, OR 3-5 years working experience in IT Project Management	Semester 2
INFO6012 **Information Technology Strategy & Value**	6	**A** COMP5206. Introduction to Information Systems	Semester 2
ISYS5070 **Change Management in IT**	6	**A** The unit is expected to be taken after the following related units INFO6007 Project Managemnet in IT and COMP5206 Introduction to Information Systems.	Winter Main
ELEC5508 **Wireless Engineering**	6	**A** Basic knowledge in probability and statistics, analog and digital communications, error probability calculation in communications channels, and telecommunications network.	Semester 2
ELEC5509 **Mobile Networks**	6	**A** Basically, students need to know the concepts of data communications and mobile communications, which could be gained in one the following units of study: ELEC3505 Communications, ELEC3506 Data Communications and the Internet, or similar units. If you are not sure, please contact the instructor.	Semester 1
ELEC5514 **Networked Embedded Systems**	6	**A** ELEC3305, ELEC3506, ELEC3607 and ELEC5508	Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
ELEC5614 **Real Time Computing**	6	**A** SOFT2130 Software Construction (or SOFT2004 Software Development Methods 1) and ELEC3607 Embedded Computing (or ELEC2601 Microprocessor Systems) **N** MECH5701	Semester 1
ELEC5616 **Computer and Network Security**	6	**A** A programming language, basic maths.	Semester 1
ELEC5618 **Software Quality Engineering**	6	**A** You are capable of writing programs with multiple functions or methods in multiple files. You are capable of design complex data structures and combine them in non trivial algorithms. You know how to use an integrated development environment. You are familiar and have worked previously with software version control systems. You know how to distribute the workload derived from the unit of study effectively throughoug the week and make sure that time is truly productive.	Semester 1
ELEC5619 **Object Oriented Application Frameworks**	6	**A** Java programming, and some web development experience are essential. Databases strongly recommended	Semester 2
ELEC5620 **Model Based Software Engineering**	6	**A** A programming language, basic maths. *Note: Department permission required for enrolment*	Semester 2

Honours (CS and IS streams)

The BIT may be awarded as an Honours degree. Students may enrol in the Honours course after completion of 144 credit points, if they meet the specified entry conditions.

All students in BIT(Honours) must complete the following 24 credit points oAll students in BIT(Honours) must complete the following 24 credit points of corerequirements plus 24 credit points from the fourth year recommended elective list of their respective stream. These core units are only available to students enrolled in Honours degrees, those in Research Higher degrees, or those in the Research track in postgraduate coursework degreesf core requirements plus 24 credit points from the fourth year selected core list of their respective stream. These units are only available to students enrolled in Honours degrees, those in Research Higher degrees, or those in the Research track in postgraduate coursework degrees. In addition to the core units students must also complete 24 credit points of elective units of study, please refer to the Fourth year selected core units listed in this table.

Honours core units of study

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
INFO4991 **IT Research Thesis A**	6	**C** INFO5993 *Note: Department permission required for enrolment* *INFO4991 and INFO4992 together form the Honours Research thesis. It is allowed to enrol in one of these units in one semester, and the other the following semester; the same mark and grade is given for both once they have both been completed.*	Semester 1 Semester 2
INFO4992 **IT Research Thesis B**	12	**C** INFO4991 and INFO5993 *Note: Department permission required for enrolment* *INFO4991 and INFO4992 together form the Honours Research thesis. It is allowed to enrol in one of these units in one semester, and the other the following semester; the same mark and grade is given for both once they have both been completed.*	Semester 1 Semester 2
INFO4999 **Computer Science Honours Result**		*Note: Department permission required for enrolment*	Semester 1 Semester 2
INFO5993 **IT Research Methods**	6		Semester 1 Semester 2

For a standard enrolment plan for Bachelor of Information Technology visit CUSP.

Unit of Study Descriptions

Bachelor of Information Technology

Candidates for the degree of Bachelor of Information Technology (BIT) are required to gain credit for 192 credit points from the units of study set out below. The selection of units must satisfy the degree rules in the Resolutions of the Faculty. In particular, all core units must be completed, along with an appropriate amount from the elective units of study as recommended by the Faculty. Candidates for the BIT degree must complete a stream in either Computer Science or Information Systems, or both, as described in the Tables below.Enrolment is subject to the following constraints:1. At most 72 credit points accumulated from first year units (core and recommended electives) can be counted for degree completion.2. Candidates in the BIT degree must maintain a credit average in each year of enrolment. If this level of result is not achieved candidates will be transferred to the BCST degree program.Through this table, candidates may substitute an advanced equivalent for a non- advanced unit mentioned. They may also substitute an appropriate unit from the Advanced Engineering program of the Faculty of Engineering, or the Talented Student Program of the Faculty of Science, if they are eligible to enrol in such units.

(i) Stream in Computer Science

First year core units of study for CS stream

ENGG1805
Professional Engineering and IT

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week; Project Work - own time 2 hrs. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

ENGG1805 aims to introduce students to the fundamental principles that underlie the study of engineering and information technologies. It lays the foundation for later studies, and presents to the students challenges common to a multidisciplinary engineering environment. The subject also provides students with the opportunity to develop an understanding of engineering ethics and of working as a part of a team.

Professional Engineering and IT (6CP) is composed from the following five parts: (a) Introduction to engineering: the engineer as problem solver, critical analysis of greatest engineering achievements and failure. (b) Introduction to common engineering software tools: word processors, project management tools (c) Ethics and workplace health and safety. (d) Testing - concepts of destructive and not destructive tests will be given on samples. (e) "Meet the professionals" - A selection of guest speakers will address students on the most important aspects of the engineering profession. (f) Design Process - The process of design synthesis as an important part of engineering: students will be required to complete an engineering design (from conception, to implementation and testing) maintaining proper lab notes.

ELEC1601
Foundations of Computer Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** HSC Mathematics extension 1 or 2 **Assessment:** Through semester assessment (61%) Final Exam (39%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study introduces the fundamental digital concepts upon which the design and operation of modern digital computers are based. A prime aim of the unit is to develop a professional view of, and a capacity for inquiry into, the field of computing.

Topics covered include: data representation, basic computer organisation, the CPU, elementary gates and logic, peripheral devices, software organisation, machine language, assembly language, operating systems, data communications and computer networks.

INFO1103
Introduction to Programming

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Laboratory 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Programming in a legible, maintainable, reusable way is essential to solve complex problems in the pervasive computing environments. This unit will equip students with foundation of programming concepts that are common to widely used programming languages. The "fundamentals-first & objects-later" strategy is used to progressively guide this introductory unit from necessary and important building blocks of programming to the object-oriented approach. Java, one of the most popular programming languages, is used in this unit. It provides interdisciplinary approaches, applications and examples to support students from broad backgrounds such as science, engineering, and mathematics.

INFO1105
Data Structures

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1003 or INFO1103 or INFO1903 or INFS1000 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will teach some powerful ideas that are central to quality software: data abstraction and recursion. It will also show how one can analyse the scalability of algorithms using mathematical tools of asymptotic notation. Contents include: both external "interface" view, and internal "implementation" details, for commonly used data structures, including lists, stacks, queues, priority queues, search trees, hash tables, and graphs; asymptotic analysis of algorithm scalability, including use of recurrence relations to analyse recursive code. This unit covers the way information is represented in each structure, algorithms for manipulating the structure, and analysis of asymptotic complexity of the operations. Outcomes include: ability to write code that recursively performs an operation on a data structure; experience designing an algorithmic solution to a problem using appropriate data structures, coding the solution, and analysing its complexity.

Note: INFO1905 (advanced version) can be taken as an alternative to INFO1105.

First year recommended elective units of study for CS stream

At least 12 crpts must be completed from 1000-level Mathematics and/or Statistics.

ELEC1103
Fundamentals of Elec and Electronic Eng

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Basic knowledge of differentiation & integration, and HSC Physics **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to develop knowledge of the fundamental concepts and building blocks of electrical and electronics circuits. This is a foundation unit in circuit theory. Circuit theory is the electrical engineer's fundamental tool.

The concepts learnt in this unit will be made use of heavily in many units of study (in later years) in the areas of electronics, instrumentation, electrical machines, power systems, communication systems, and signal processing.

Topics: a) Basic electrical and electronic circuit concepts: Circuits, circuit elements, circuit laws, node and mesh analysis, circuit theorems, energy storage, capacitors and inductors, circuits with switches, transient response, sine waves and complex analysis, phasors, impedance, ac power.; b) Project management, teamwork, ethics; c) Safety issues

INFO1003
Foundations of Information Technology

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 3 hrs/week; Laboratory 2 hrs/week. **Prohibitions:** INFO1000, ISYS1003, INFO1903, INFS1000 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Information technologies (IT) and systems have emerged as the primary platform to support communication, collaboration, research, decision making, and problem solving in contemporary organisations. The essential necessity for all university students to acquire the fundamental knowledge and skills for applying IT effectively for a wide range of tasks is widely recognised. It is an introductory unit of study which prepares students from any academic discipline to develop the necessary knowledge, skills and abilities to be competent in the use of information technology for solving a variety of problems. The main focus of this unit is on modelling and problem solving through the effective use of using IT. Students will learn how to navigate independently to solve their problems on their own, and to be capable of fully applying the power of IT tools in the service of their goals in their own domains while not losing sight of the fundamental concepts of computing.

Students are taught core skills related to general purpose computing involving a range of software tools such as spreadsheets, database management systems, internet search engine, HTML, and JavaScript. Students will undertake practical tasks including authoring an interactive website using HTML, JavaScript and AJAX and building a small scale application for managing information. In addition, the course will address the many social, ethical, and intellectual property issues arising from the wide-spread use of information technology in our society.

INFO1903
Informatics (Advanced)

Credit points: 6 **Session:** Semester 1 **Classes:** Tutorial 3 hrs/week; Lecture 3 hrs/week. **Prerequisites:** ATAR sufficient to enter BCST(Adv), BIT or BSc(Adv), or portfolio of work suitable for entry **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit covers advanced data processing and management, integrating the use of existing productivity software, e.g. spreadsheets and databases, with the development of custom software using the powerful general-purpose Python scripting language. It will focus on skills directly applicable to research in any quantitative domain. The unit will also cover presentation of data through written publications and dynamically generated web pages, visual representations and oral presentation skills. The assessment, a semester long project, involves the demonstration of these skills and techniques for processing and presenting data in a choice of domains.

BUSS1001
Understanding Business

Credit points: 6 **Teacher/Coordinator:** Professor Marcus O'Connor **Session:** Semester 1, Semester 2 **Classes:** 1x 1.5 hr lecture and 1x 1.5 hr tutorial per week **Prohibitions:** ECOF1003 **Assessment:** participation (15%), essay (20%), case study (20%), and final exam (45%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This unit of study is a compulsory part of the Bachelor of Commerce, combined Bachelor of Commerce degrees and the Bachelor of Commerce (Liberal Studies).

This unit of study is the first of two junior core units aimed at introducing students to the internal and external contexts in which business operates in the twenty-first century. It also aims to lay the foundations for effective communication (written and oral), critical analysis, problem solving, and team work skills, which are essential to achieving program learning goals. In this unit, students will build an understanding of the dynamics of business through the lens of the company and its stakeholders. Business ethics is also introduced as key learning goal.

BUSS1002
The Business Environment

Credit points: 6 **Teacher/Coordinator:** Omer Konakci **Session:** Semester 1, Semester 2 **Classes:** 1x 1.5hr lecture and 1x 1.5hr tutorial per week **Prerequisites:** ECOF1003 or BUSS1001 **Prohibitions:** ECOF1004, CISS2001 **Assessment:** media summary and analyses (55%), tutorial participation (10%), and final exam (35%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This unit of study is a compulsory part of the Bachelor of Commerce, combined Bachelor of Commerce degrees and the Bachelor of Commerce (Liberal Studies).

This unit of study is the second of two junior core units aimed at introducing students to the external and internal contexts in which business operates in the twenty-first century while developing effective problem solving, critical analysis and communication skills. In this unit, students will build an understanding of the economic, political and regulatory, socio-cultural, and technological factors that impact on the external context of the commercial landscape while developing an awareness of potential of risk and change. An awareness of corporate social responsibility and sustainability is also introduced as a key learning goal.

All 1000-level MATH units of study are recommended electives.A full list of available MATH/STAT units can be obtained from the School of Mathematics and Statistics, who can also advise on the appropriate level of unit for the students preparation. We strongly suggest including some statistics unit among the choices.

Second Year core units of study for CS stream

COMP2007
Algorithms and Complexity

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** INFO1105 OR INFO1905. **Assumed knowledge:** MATH1004 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides an introduction to the design and analysis of algorithms. The main aims are (i) to learn how to develop algorithmic solutions to computational problem and (ii) to develop understanding of algorithm efficiency and the notion of computational hardness.

Note: COMP2907 (advanced version) can be taken as an alternative to COMP2007.

COMP2129
Operating Systems and Machine Principles

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1103. **Assumed knowledge:** INFO1105 OR INFO1905. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

In this unit of study elementary methods for developing robust, efficient, and re-usable software will be covered. The unit is taught in C, in a Unix environment. Specific coding topics include memory management, the pragmatic aspects of implementing data structures such as lists and hash tables and managing concurrent threads. Debugging tools and techniques are discussed and common programming errors are considered along with defensive programming techniques to avoid such errors. Emphasis is placed on using common Unix tools to manage aspects of the software construction process, such as version control and regression testing. The subject is taught from a practical viewpoint and it includes a considerable amount of programming practice.

INFO2110
Systems Analysis and Modelling

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Experience with a data model as in INFO1003 or INFO1103 or INFS1000 **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides a comprehensive introduction to the analysis of complex systems. Key topics are the determination and expression of system requirements (both functional and on-functional), and the representation of structural and behavioural models of the system in UML notations. Students will be expected to evaluate requirements documents and models as well as producing them. This unit covers essential topics from the ACM/IEEE SE2004 curriculum, especially from MAA Software Modelling and Analysis.

INFO2120
Database Systems 1

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week; Project Work - own time 3 hrs/week. **Prerequisites:** INFO1003 OR INFO1103 OR INFO1903 OR INFS1000 OR DECO1012. **Prohibitions:** INFO2820, INFO2905, COMP5138 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The ubiquitous use of information technology leaves us facing a tsunami of data produced by users, IT systems and mobile devices. The proper management of data is hence essential for all applications and for effective decision making within organizations.

This unit of study will introduce the basic concepts of database designs at the conceptual, logical and physical levels. We will place particular emphasis on introducing integrity constraints and the concept of data normalization which prevents data from being corrupted or duplicated in different parts of the database. This in turn helps in the data remaining consistent during its lifetime. Once a database design is in place, the emphasis shifts towards querying the data in order to extract useful information. The unit will introduce different query languages with a particular emphasis on SQL, which is industry standard. Other topics covered will include the important concept of transaction management, application development with a backend database, an overview of data warehousing and OLAP, and the use of XML as a data integration language.

Note: INFO2820 (advanced version) can be taken as an alternative core unit to INFO2120.

Second year recommended elective units of study for CS stream

BIT single degree students must complete at least 12 crpts. For BIT single degree students, at least 6 crpts must be completed from 2000-level Mathematics and/or Statistics (we suggest choosing from MATH2069, MATH2063, STAT2012 and/or STAT2912). For BIT single and combined degree students, at least 6 credit points must be completed from COMP2022 or COMP2121.

INFS2020
Business Process Modelling & Improvement

Credit points: 6 **Teacher/Coordinator:** TBA **Session:** Semester 2 **Classes:** 1 x 3 hr seminar per week **Prohibitions:** INFS2005 **Assumed knowledge:** INFS1000 or equivalent **Assessment:** individual assignment (30%), group project (30%), and final examination (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides you with an in depth understanding of the role of business process management (BPM) and process architectures in a business environment. You will gain essential skills of the entire BPM lifecycle, from process identification to process monitoring, including process modelling, analysis, redesign and automation required to achieve high performing business processes in a service oriented business environment. In this unit, you will attain considerable hands-on skills with BPM tools, by documenting, analysing, and simulating current and improved processes.

All 2000-level COMP, INFO, ISYS units of study are recommended electives.All 2000-level ELEC units of study are recommended.All 2000-level MATH or STAT units of study are recommended electives.

Third year core units of study for CS stream

INFO3220
Object Oriented Design

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Project Work - own time 2 hrs. **Prerequisites:** INFO2110 and COMP2129 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit covers essential design methods and language mechanisms for successful object-oriented design and programming. C++ is used as the implementation language and a special emphasis is placed on those features of C++ that are important for solving real-world problems. Advanced software engineering features, including exceptions and name spaces are thoroughly covered.

INFO3402
Management of IT Projects and Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Project Work - own time 2 hrs. **Assumed knowledge:** INFO2110 or INFO2810 or INFO2900 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course introduces the basic processes and techniques for managing IT projects, systems and services, throughout the IT lifecycle. It addresses both the technical and behavioural aspects of IT management at the enterprise level. Major topics include: IT planning, project planning and scheduling, project tracking, resource estimation, team management, software testing, change and problem management, and quality assurance.

INFO3600
Major Development Project (Advanced)

Credit points: 12 **Session:** Semester 2 **Classes:** Project Work - in class 2 hrs/week; Site Visit 1 hr/week; Project Work - own time 16 hrs/week; Meeting 1 hr/week. **Prerequisites:** INFO3402 **Prohibitions:** ISYS3400, COMP3615 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Only available to students in BIT, BCST(Adv) or BSc(Adv).

This unit will provide students an opportunity to carry out substantial aspects of a significant software development project. The project will be directed towards assisting a client group (from industry or with strong industry links). The student's contribution could cover one or more aspects such as requirements capture, system design, implementation, change management, upgrades, operation, and/or tuning. Assessment will be based on the quality of the delivered outputs, the effectiveness of the process followed, and the understanding of the way the work fits into the client's goals, as shown in a written report.

CS & IS double stream: BIT single degree students enrolled in the double stream must also complete ISYS3401 Analytical Methods and Information Systems as a core unit of study. BIT combined degree students do not have double stream.

Third year recommended elective units of study for CS stream

BIT single degree students must complete at least 18 crptsBIT combined degree students must complete at least 6 crpts For single degree students, at least 12 crpts must be completed from (COMP3109, COMP3308, COMP3419, COMP3520, COMP3530, COMP3608) For combined degree students, at least 6 crpts must be completed from (COMP3109, COMP3308, COMP3419, COMP3520, COMP3530, COMP3608)

INFS3040
Enterprise Systems & Integrated Business

Credit points: 6 **Teacher/Coordinator:** TBA **Session:** Semester 1 **Classes:** 1x 3hr seminar per week **Prohibitions:** INFS3005 **Assumed knowledge:** INFS1000 or equivalent **Assessment:** mid-semester test (35%); individual enterprise system portfolio (35%), and group project (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides you with an in depth understanding of the way in which implementation and use of large scale integrated Enterprise Systems change the nature of organisational capabilities, processes, and roles. You will understand the strategic role of Enterprise Systems in providing a platform for improved business operations and designing information infrastructures. You will gain considerable hands on experience with an enterprise wide system, such as SAP, concentrating on the way in which such systems support integrated business processes. Through a combination of discussion and practical work, you will gain strong knowledge in both the organisational and technical aspects of Enterprise Systems You will also explore the emergence and implications of cloud-based Enterprise Systems and the implementation process.

All 3000-level COMP, INFO, ISYS units of study are recommended electives.All 3000-level and above ELEC units of study are recommended electives

Fourth year recommended elective units of study for CS stream

Students in the BIT Pass degree must complete at least 48 credit points from this list. At least 36 crpts must be completed from 5000-level or above COMP, INFO, ISYS units of study.

COMP5045
Computational Geometry

Credit points: 6 **Session:** Semester 1 **Classes:** Project Work - in class 12 hrs/week. **Assumed knowledge:** Students are assumed to have a basic knowledge of the design and analysis of algorithms and data structures: you should be familiar with big-O notations and simple algorithmic techniques like sorting, binary search, and balanced search trees. **Assessment:** Through semester assessment (80%) Final Exam (20%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

In many areas of computer science - robotics, computer graphics, virtual reality, and geographic information systems are some examples - it is necessary to store, analyse, and create or manipulate spatial data. This course deals with the algorithmic aspects of these tasks: we study techniques and concepts needed for the design and analysis of geometric algorithms and data structures. Each technique and concept will be illustrated on the basis of a problem arising in one of the application areas mentioned above.

COMP5046
Statistical Natural Language Processing

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 1 hr/week. **Assumed knowledge:** Knowledge of an OO programming language **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Practical work will use the Natural Language Toolkit

This unit introduces computational linguistics and the statistical techniques and algorithms used to automatically process natural languages (such as English or Chinese). It will review the core statistics and information theory, and the basic linguistics, required to understand statistical natural language processing (NLP).

Statistical NLP is used in a wide range of applications, including information retrieval and extraction; question answer; machine translation; and classifying and clustering of documents. This unit will explore state of the art approaches to the key NLP sub-tasks, including tokenisation, morphological analysis, word sense disambiguation, part-of-speech tagging, named entity recognition, text categorisation, phrase structure and Combinatory Categorial Grammar parsing.

Students will implement many of these sub-tasks in labs and assignments. The unit will also investigate the annotation process that is central to creating training data for statistical NLP systems. Students will annotate data as part of completing a real-world NLP task.

COMP5047
Pervasive Computing

Credit points: 6 **Session:** Semester 2 **Classes:** Studio class 3 hrs/week. **Assumed knowledge:** Background in programming and operating systems that is sufficient for the student to independently learn new programming tools from standard online technical materials. Ability to conduct a literature search. Ability to write reports of work done. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This is an advanced course in HCI, Human Computer Interaction, with a focus on Pervasive Computing. It introduces the key aspects of HCI and explores these in terms of the new research towards creating user interfaces that disappear into the environment and are available pervasively, for example in homes, workplaces, cars and carried or work.

COMP5048
Visual Analytics

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assumed knowledge:** It is assumed that students will have basic knowledge of data structures, algorithms and programming skills. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Visual Analytics aims to facilitate the data analytics process through Information Visualisation. Information Visualisation aims to make good pictures of abstract information, such as stock prices, family trees, and software design diagrams. Well designed pictures can convey this information rapidly and effectively.

The challenge for Visual Analytics is to design and implement "effective Visualisation methods that produce pictorial representation of complex data so that data analysts from various fields (bioinformatics, social network, software visualisation and network) can visually inspect complex data and carry out critical decision making.

This unit will provide basic HCI concepts, Visualisaiton techniques and fundamental algorithms to achieve good visualisation of abstract information. Further, it will also provide opportunities for academic research and developing new methods for Visual Analytic methods.

COMP5216
Mobile Computing

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assumed knowledge:** COMP5214 Software Development in JAVA, or similar introductory software development units. **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Mobile computing is becoming a main stream for many IT applications, due to the availability of more and more powerful and affordable mobile devices with rich sensors such as cameras and GPS, which have already significantly changed many aspects in business, education, social network, health care, and entertainment in our daily life. Therefore it has been critical for students to be equipped with sufficient knowledge of such new computing platform and necessary skills. The unit aims to provide an in-depth overview of existing and emerging mobile computing techniques and applications, the eco-system of the mobile computing platforms, and its key building components. The unit will also train students with hand-on experiences in developing mobile applications in a broad range of areas.

COMP5313
Large Scale Networks

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assumed knowledge:** Algorithmic skills (as expected from any IT graduate). Basic probability knowledge. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

The growing connectedness of modern society translates into simplifying global communication and accelerating spread of news, information and epidemics. The focus of this unit is on the key concepts to address the challenges induced by the recent scale shift of complex networks. In particular, the course will present how scalable solutions exploiting graph theory, sociology, game theory and probability tackle the problems of communicating (routing, diffusing, aggregating) in dynamic and social networks.

COMP5318
Knowledge Discovery and Data Mining

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assumed knowledge:** INFO9120 OR COMP5138 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Knowledge discovery is the process of extracting useful knowledge from data. Data mining is a discipline within knowledge discovery that seeks to facilitate the exploration and analysis of large quantities for data, by automatic and semiautomatic means. This subject provides a practical and technical introduction to knowledge discovery and data mining.

Objectives: Topics to be covered include problems of data analysis in databases, discovering patterns in the data, and knowledge interpretation, extraction and visualisation. Also covered are analysis, comparison and usage of various types of machine learning techniques and statistical techniques: clustering, classification, prediction, estimation, affinity grouping, description and scientific visualisation

COMP5338
Advanced Data Models

Credit points: 6 **Session:** Semester 2 **Classes:** Tutorial 1 hr/week. **Assumed knowledge:** This unit of study assumes foundational knowledge of relational database systems as taught in COMP5138/ INFO9120 (Database Management Systems) or INFO2120/2820 (Database Systems 1). **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study gives a comprehensive overview of post-relational data models and of latest developments in data storage technology.

Particular emphasis is put on spatial, temporal, and NoSQL data storage. This unit extensively covers the advanced features of SQL:2003, as well as a few dominant NoSQL storage technologies. Besides in lectures, the advanced topics will be also studied with prescribed readings of database research publications.

COMP5347
Web Application Development

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 1 hr/week; Project Work - own time 3 hrs/week; Independent Study, **Assumed knowledge:** INFO9220 or COMP5028. The course assumes basic knowledge on OO design and UML diagrams. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will focus on technological advances supporting the development of e-commerce applications and systems. This includes client and server side development of e-commerce applications. AJAX is the core client side technology covered in this course. Both server scripting and server page technology are covered as key server side technology. It will also examine the emerging trend of web services and its role in E-commerce systems. This unit aims at providing both conceptual understanding and hand-on experiences for the technologies covered.

COMP5348
Enterprise Scale Software Architecture

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 1 hr/week. **Assumed knowledge:** Programming competence in Java or similar OO language. Capacity to master novel technologies (especially to program against novel APIs) using manuals, tutorial examples, etc. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit covers topics on software architecture for large-scale enterprises. Computer systems for large-scale enterprises handle critical business processes, interact with computer systems of other organisations, and have to be highly reliable, available and scalable. This class of systems are built up from several application components, incorporating existing "legacy" code and data stores as well as linking these through middleware technologies, such as distributed transaction processing, remote objects, message-queuing, publish-subscribe, and clustering. The choice of middleware can decide whether the system achieves essential non- functional requirements such as performance and availability. The objective of this unit of study is to educate students for their later professional career and it covers Software Architecture topics of the ACM/IEEE Software Engineering curriculum. Objective: The objective of this unit of study is to educate students for their later professional career and it covers topics of the ACM/IEEE Software Engineering curriculum.

COMP5349
Cloud Computing

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Practical Labs 2 hrs/week; Project Work 3 hrs/week. **Assumed knowledge:** Good programming skills, especially in Java for the practical assignment, as well as proficiency in databases and SQL. The unit is expected to be taken after introductory courses in related units such as COMP5214 OR INFO9103 Software Development in JAVA **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit covers topics of active and cutting-edge research within IT in the area of 'Cloud Computing'.

Cloud Computing is an emerging paradigm of utilising large-scale computing services over the Internet that will affect individual and organization's computing needs from small to large. Over the last decade, many cloud computing platforms have been set up by companies like Google, Yahoo!, Amazon, Microsoft, Salesforce, Ebay and Facebook. Some of the platforms are open to public via various pricing models. They operate at different levels and enable business to harness different computing power from the cloud.

In this course, we will describe the important enabling technologies of cloud computing, explore the state-of-the art platforms and the existing services, and examine the challenges and opportunities of adopting cloud computing. The course will be organized as a series of presentations and discussions of seminal and timely research papers and articles. Students are expected to read all papers, to lead discussions on some of the papers and to complete a hands-on cloud-programming project.

COMP5416
Advanced Network Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 1 hr/week. **Assumed knowledge:** COMP5116 OR ELEC3506 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit introduces networking concepts beyond the best effort service of the core TCP/IP protocol suite. Understanding of the fundamental issues in building an integrated multi-service network for global Internet services, taking into account service objectives, application characteristics and needs and network mechanisms will be discussed. Enables students to understand the core issues and be aware of proposed solutions so they can actively follow and participate in the development of the Internet beyond the basic bit transport service.

COMP5424
Information Technology in Biomedicine

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Information technology (IT) has significantly contributed to the research and practice of medicine, biology and health care. The IT field is growing enormously in scope with biomedicine taking a lead role in utilizing the evolving applications to its best advantage. The goal of this unit of study is to provide students with the necessary knowledge to understand the information technology in biomedicine. The major emphasis will be on the principles associated with biomedical digital imaging systems and related biomedicine data processing, analysis, visualization, registration, modelling, compression, management, communication and security. Specialist areas such as Picture Archiving and Communication Systems (PACS), computer-aided diagnosis (CAD), content-based medical image retrieval (CBMIR), and ubiquitous m-Health, etc. will be addressed. A broad range of practical integrated clinical applications will be also elaborated.

COMP5425
Multimedia Retrieval

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assumed knowledge:** COMP9007 or COMP5211. Basic Programming skills and data structure knowledge. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The explosive growth of multimedia data, including text, audio, images and video, has generated an extremely challenging job in effective and efficient retrieval techniques demanded by users to meet their information needs. This unit provides students with the most updated knowledge in order to address this issue in the context of big data, from the basics of textual information retrieval, to many advanced techniques in the field, such as large scale retrieval and social media.

COMP5426
Parallel and Distributed Computing

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assumed knowledge:** COMP5116 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit is intended to introduce and motivate the study of high performance computer systems. The student will be presented with the foundational concepts pertaining to the different types and classes of high performance computers. The student will be exposed to the description of the technological context of current high performance computer systems. Students will gain skills in evaluating, experimenting with, and optimizing the performance of high performance computers. The unit also provides students with the ability to undertake more advanced topics and courses on high performance computing.

COMP5427
Usability Engineering

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Usability engineering is the systematic process of designing and evaluating user interfaces so that they are usable. This means that people can readily learn to use them efficiently, can later remember how to use them and find it pleasant to use them. The wide use of computers in many aspects of people's lives means that usability engineering is of the utmost importance.

There is a substantial body of knowledge about how to elicit usability requirements, identify the tasks that a system needs to support, design interfaces and then evaluate them. This makes for systematic ways to go about the creation and evaluation of interfaces to be usable for the target users, where this may include people with special needs. The field is extremely dynamic with the fast emergence of new ways to interact, ranging from conventional WIMP interfaces, to touch and gesture interaction, and involving mobile, portable, embedded and desktop computers.

This unit will enable students to learn the fundamental concepts, methods and techniques of usability engineering. Students will practice these in small classroom activities. They will then draw them together to complete a major usability evaluation assignment in which they will design the usability testing process, recruit participants, conduct the evaluation study, analyse these and report the results.

COMP5456
Introduction to Bioinformatics

Credit points: 6 **Session:** Summer Main **Classes:** Laboratory 2 hrs/week; Lecture 2 hrs/week. **Prohibitions:** COMP3456 **Assumed knowledge:** Some experience with basic programming (coding) in Java, C, C++ or Perl; Some proven ability in mathematical or information sciences (as evinced in the prerequisites); Some knowledge of molecular biology either through first year BIOL papers or MBLG1001. **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit brings together a wide range of skills that are routinely practised in bioinformatics, from the 'hard' subjects of mathematics, statistics and computer science, to the 'soft' subjects in the biological / health sciences and pharmacology. The unit covers the essentials of bioinformatics data gathering, manipulation, mining and storage that underpin bioinformatics research. It further provides additional practice in the graduate attributes of Research and Inquiry, Information Literacy and Communication through analysis of scientific research, use of large bioinformatics data sets, and writing of reports.

INFO5010
IT Advanced Topic A

Credit points: 6 **Session:** Semester 1, Semester 2, Summer Late **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit will cover some topic of active and cutting-edge research within IT; the content of this unit may be varied depending on special opportunities such as a distinguished researcher visiting the University.

INFO5011
IT Advanced Topic B

Credit points: 6 **Session:** Semester 1, Semester 2, Winter Main **Classes:** One 2 hour scheduled small-group class per week. **Prohibitions:** INFO4011 **Assessment:** Through session assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will cover some topic of active and cutting-edge research within IT; the content of this unit may be varied depending on special opportunities such as a distinguished researcher visiting the University.

INFO5060
Data Analytics and Business Intelligence

Credit points: 6 **Session:** Summer Early **Classes:** Lecture 4 hrs; Tutorial 2 hrs; Laboratory 6 hrs; Presentation 3 hrs; Project Work - own time 6 hrs. **Assumed knowledge:** The unit is expected to be taken after introductory courses or related units such as COMP5206 Information Technologies and Systems **Assessment:** Through semester assessment (65%) Final Exam (35%) **Mode of delivery:** Block mode

The frontier for using data to make decisions has shifted dramatically. High performing enterprises are now building their competitive strategies around data-driven insights that in turn generate impressive business results. This course provides an overview of Business Intelligence (BI) concepts, technologies and practices, and then focuses on the application of BI through a team based project simulation that will allow students to have practical experience in building a BI solution based on a real world case study.

INFO5301
Information Security Management

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assumed knowledge:** This unit of study assumes foundational knowledge of Information systems management. Two year IT industry exposure and a breadth of IT experience will be preferable. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study gives a broad view of the management aspects of information security. We emphasise corporate governance for information security, organisational structures within which information security is managed, risk assessment, and control structures. Planning for security, and regulatory issues, are also addressed.

INFO5991
Services Science Management and Eng

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Seminar 2 hrs/week. **Assumed knowledge:** INFO5990. Students are expected to have a degree in computer science, engineering, information technology, information systems or business. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

The service economy plays a dominant and growing role in growth and employment in most parts of the world. Increasingly, the improved productivity and competitive performance of firms and nations in the services arena relies on innovative and effective design, engineering and management of IT-centric services. In response to industry needs, this unit offers IT professionals a social, economic and technical perspective of service-oriented IT.

INFO5992
Understanding IT Innovations

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Prohibitions:** PMGT5875 **Assumed knowledge:** INFO5990. Students are expected to be fluent in English and capable of participating in group discussions, and capable of producing an individually written paper of 5-9 pages (double spaced) of high quality and clarity. Although some work experience is ideal in adding value to the case discussions, allowing students to pull from their personal experiences, those students with no work experience will be expected to do appropriate research on the discussion topics in order to contribute. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: A variety of learning situations will be employed during the unit of study, including lectures, recommended reading, a few short exercises during class, and discussions of cases. To benefit fully from this unit it is necessary to participate fully in all aspects of the unit of study.

An essential skill for an IT manager is the ability to keep up-to-date with emerging technologies, and be able to evaluate the significance of these technologies to their organisation's business activities. This unit of study is based around a study of current technologies and the influence of these technologies on business strategies.

Important trends in innovation in IT are identified and their implications for innovation management explored. Major topics include: drivers of innovation; the trend to open information ("open source") rather than protected intellectual property; and distribution of innovation over many independent but collaborating actors.

On completion of this unit, students will be able to identify and analyse an emerging technology and write a detailed evaluation of the impact of this technology on existing business practices.

INFO6010
Advanced Topics in IT Project Management

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial (applied workshop) 1 hr/week; E-Learning 1 hr/week. **Prerequisites:** INFO6007, OR 3-5 years working experience in IT Project Management **Assumed knowledge:** Students are assumed to understand the role of IT projects. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will explore the limitations of IT project management and the most promising techniques to overcome project failure. It will start by reviewing case study research showing we have reached the limits of traditional IT project management practice. The theoretical base will be completed by exploring the finding that senior management have more impact on success than traditional approaches.

Participants will be introduced to and learn to apply the most promising tools and techniques needed to govern IT projects. The topics reviewed will include:

1)strategy,

2)organisational change,

3)project sponsorship,

4)programme management,

5)performance measurement,

6)culture

7)portfolio management.

8)Relevant Australian and International Standards on IT/Project Governance and new industry methodologies around portfolio, programme and change management will be reviewed.

INFO6012
Information Technology Strategy & Value

Credit points: 6 **Session:** Semester 2 **Classes:** Flexible Session 3 hrs/week. **Assumed knowledge:** COMP5206. Introduction to Information Systems **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The increasingly strategic role of IT in organisations is widely recognised. This unit of study is designed to provide a comprehensive introduction to strategic aspects of IT as they impact on business value. Such a perspective is critical for IT professionals in both IT producer and user organisations from the level of Chief Information Officer to managers as well as technical specialists. Deep understanding of IT strategy formulation and implementation and ensuring its alignment with the organisation's strategic directions is important for successfully managing the major changes that the IT function has undergone in recent years.

Topics covered will include technology forecasting and assessment of IT impacts, achieving sustainable competitive through IT, relationship between IT strategy and value, IT strategy formulation and implementation, evaluation of strategic investments in IT, IT portfolio management, IT souring and open innovation, and dynamics of IT strategy and game theory. It will explore IT-related strategic decision making at the different organisational levels and the concept of strategic congruence. This unit will provide students with models, tools, and techniques to evaluate an organisation's IT strategic position, and hence to help make appropriate strategic choices.

ISYS5070
Change Management in IT

Credit points: 6 **Session:** Winter Main **Classes:** Lecture 6 hrs/week; Tutorial 6 hrs/week; Presentation 3 hrs/week; Project Work - own time 6 hrs. **Assumed knowledge:** The unit is expected to be taken after the following related units INFO6007 Project Managemnet in IT and COMP5206 Introduction to Information Systems. **Assessment:** Through semester assessment (70%) Final Exam (30%) **Mode of delivery:** Block mode

This unit of study presents the leading edge of research and practice in change management and focuses on theories, frameworks and perspectives that can guide your work as a change agent in the IT industries. The unit will cover a range of approaches, methods, interventions and tools that can be used to successfully manage change projects that relate to the implementation of new technologies.

The globalisation of markets and industries, accelerating technological innovations and the need of companies to remain at the forefront of technological developments in an increasingly competitive, globalised industry have resulted in a significant increase in the speed, magnitude, and unpredictability of technological and organisational change over the last decades. Companies who have the competencies required to navigate change and overcome the inevitable obstacles to success gain a much-needed competitive edge in the marketplace. Increased globalization, economic rationalism, environmental dynamics and technological changes mean that companies, more than ever before, need to be highly flexible and adaptable to survive and thrive. Yet, a large percentage of IT projects fail to achieve the intended objectives, go over time or over budget. The capability to successfully manage organisational and technological change has become a core competency for IT professionals, business leaders and project managers.

This unit has been specifically developed for IT professionals, project managers, and senior managers to equip them with the knowledge and tools needed to ensure that IT projects remain on track to achieving the intended objectives on time and on budget. The course presents the key theories, concepts and findings in the context of academic research and change management practice. The objective is to allow participants to critically assess academic theories and methodological practice and devise interventions and actions that allow the successful management of IT initiatives.

ELEC5508
Wireless Engineering

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assumed knowledge:** Basic knowledge in probability and statistics, analog and digital communications, error probability calculation in communications channels, and telecommunications network. **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will introduce the key ideas in modern wireless telecommunications networks. It will address both physical layer issues such as propagation and modulation, plus network layer issues such as capacity, radio resource management and mobility management issues.

The following topics are covered. Mobile radio channel: Multipath fading, diversity, log-normal fading, mean propagation loss, propagation models. Cellular technologies: Cell types, coverage, frequency reuse, spectral efficiency, link budget, power budget, traffic capacity. Omnidirectional and sectorised antennas. Handover, interaction with the fixed network. Microcells and macrocells, Medium access control: Near-far effect and the hidden terminal problem. Multiple access schemes: FDMA, TDMA, CDMA. Aloha and s-Aloha, carrier sense multiple access, reservation-based MAC schemes, polling, spread-aloha multiple access. GSM: System architecture, radio resource management, mobility management, connection management.

Third generation systems: WCDMA and cdma2000. Wireless LANs: IEEE802.11, Hiperlan, Bluetooth. Convergence: GSM evolution to data services via GPRS and EDGE. Issues with TCP over wireless. Mobility management in MobileIP.

ELEC5509
Mobile Networks

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Basically, students need to know the concepts of data communications and mobile communications, which could be gained in one the following units of study: ELEC3505 Communications, ELEC3506 Data Communications and the Internet, or similar units. If you are not sure, please contact the instructor. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study serves as an introduction to communications network research. The unit relies on a solid understanding of data communications and mobile networks. It introduces some of the currently most debated research topics in mobile networking and presents an overview of different technical solutions. Students are expected to critically evaluate these solutions in their context and produce an objective analysis of the advantages/disadvantages of the different research proposals. The general areas covered are wireless Internet, mobility management, quality of service in mobile and IP networks, ad hoc networks, and cellular network architectures.

The following topics are covered. Introduction to wireless and mobile Internet. Wireless cellular data networks. Cellular mobile networks. Mobile networks of the future. Quality of service in a mobile environment. Traffic modelling for wireless Internet. Traffic management for wireless Internet. Mobility management in mobile networks. Transport protocols for mobile networks. Internet protocols for mobile networks.

ELEC5514
Networked Embedded Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Assumed knowledge:** ELEC3305, ELEC3506, ELEC3607 and ELEC5508 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aim to teach the fundamentals concepts associated with:

oNetworked Embedded Systems, wireless sensor networks

oWireless channel propagation and radio power consumption

oWireless networks, ZigBee, Bluetooth, etc.

oSensor principle, data fusion, source detection and identification

oMultiple source detection, multiple access communications.

oNetwork topology, routing, network information theory

oDistributed source channel coding for sensor networks

oPower-aware and energy-aware communication protocols.

oDistributed embedded systems problems such as time synchronization and node localization,

Exposure to several recently developed solutions to address problems in wireless sensor networks and ubiquitous computing giving them a well-rounded view of the state-of the-art in the networked embedded systems field.

Student involvement with projects will expose them to the usage of simulators and/or programming some types of networked embedded systems platforms.

oAbility to identify the main issues and trade-offs in networked embedded systems.

oUnderstanding of the state-of-the-art solutions in the area

oBased on the above understanding, ability to analyze requirements and devise first-order solutions for particular networked embedded systems problems.

oFamiliarization with a simulator platform and real hardware platforms for network embedded systems through the students involvement in project

ELEC5614
Real Time Computing

Credit points: 6 **Session:** Semester 1 **Classes:** Project Work - own time 2 hrs; Lecture 2 hrs/week; Laboratory 2 hrs/week; Tutorial 1 hr/week; E-Learning 1 hr. **Prohibitions:** MECH5701 **Assumed knowledge:** SOFT2130 Software Construction (or SOFT2004 Software Development Methods 1) and ELEC3607 Embedded Computing (or ELEC2601 Microprocessor Systems) **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit is concerned with the theory and practice of real time computer systems as applied to the design of embedded systems and computer control systems in engineering, manufacturing and automation.

Some background in programming, object oriented design and system architecture is assumed. A prime aim of this unit of study is to develop a capacity for research and inquiry in the field of real-time and embedded systems. Completion of this unit will facilitate progression to advanced study or to work in embedded systems and industrial real-time computer systems.

The following topics are covered. Hard real time and embedded systems, as applied to engineering, manufacturing and automation. Timing and scheduling: periodic vs aperiodic processes, deadlines, rate monotonic, deadline monotonic and earliest deadline scheduling. Management of shared resources. Real-time languages and their features. Real time operating systems. Real time software design. Embedded Systems: overview, signal flow, interfacing. Reliability and fault tolerance in hardware and software. SCADA and DCCS. Some case studies.

ELEC5616
Computer and Network Security

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Laboratory 2 hrs/week; Project Work - own time 2 hrs. **Assumed knowledge:** A programming language, basic maths. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit examines the basic cryptographic building blocks of security, working through to their applications in authentication, key exchange, secret and public key encryption, digital signatures, protocols and systems. It then considers these applications in the real world, including models for integrity, authentication, electronic cash, viruses, firewalls, electronic voting, risk assessment, secure web browsers and electronic warfare. Practical cryptosystems are analysed with regard to the assumptions with which they were designed, their limitations, failure modes and ultimately why most end up broken.

ELEC5618
Software Quality Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** You are capable of writing programs with multiple functions or methods in multiple files. You are capable of design complex data structures and combine them in non trivial algorithms. You know how to use an integrated development environment. You are familiar and have worked previously with software version control systems. You know how to distribute the workload derived from the unit of study effectively throughoug the week and make sure that time is truly productive. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will cover software quality planning, validation and verification methods and techniques, risk analysis, software review techniques, software standards and software process improvement and software reliability.

Students who successfully complete this unit will understand the fundamental concepts of software quality engineering and be able to define software quality requirements, assess the quality of a software design, explain specific methods of building software quality, understand software reliability models and metrics, develop a software quality plan, understand quality assurance and control activities and techniques, understand various testing techniques including being able to verify and test a unit of code and comprehend ISO standards, SPICE, CMM and CMMI.

ELEC5619
Object Oriented Application Frameworks

Credit points: 6 **Session:** Semester 2 **Classes:** Project Work - in class 3 hrs; Project Work - own time 6 hrs; Presentation 2 hrs; Tutorial 3 hrs. **Assumed knowledge:** Java programming, and some web development experience are essential. Databases strongly recommended **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to introduce students to the main issues involved in producing large Internet systems by using and building application frameworks. Frameworks allow great reuse so developers do not have to design and implement applications from scratch, as students have done in ELEC3610 The unit lays down the basic concepts and hands on experience on the design and development of enterprise systems, emphasizing the development of systems using design patterns and application frameworks.

A project-based approach will introduce the problems often found when building such systems, and will require students to take control of their learning. A project-based approach will introduce the problems often found when building such systems, and will require students to take control of their learning. Several development Java frameworks will be used, including Spring, Hibernate, and others. Principles of design patterns will also be studied.

ELEC5620
Model Based Software Engineering

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Laboratory - Project Work - in class 2 hrs/week; Project Work - own time 2 hrs. **Assumed knowledge:** A programming language, basic maths. **Assessment:** Through semester assessment (80%) Final Exam (20%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

Model-Based Software Engineering focuses on modern software engineering methods, technologies, and processes used in professional development projects. It covers both the pragmatic engineering elements and the underlying theory of the model-based approach to the analysis, design, implementation, and maintenance of complex software-intensive systems.

Students will participate in a group project, which will entail developing and/or evolving a software system, following a full development cycle from requirements specification through to implementation and testing using up-to-date industrial development tools and processes. At the end of the course they will provide a presentation and demonstration of their project work to the class. There is no formal teaching of a programming language in this unit, although students will be expected to demonstrate through their project work their general software engineering and architectural skills as well as their mastery of model-based methods and technologies.

Students successfully completing this unit will have a strong practical and theoretical understanding of the modern software development cycle as applied in industrial settings. In particular, they will be familiar with the latest model-based software engineering approaches necessary for successfully dealing with today's highly complex and challenging software systems.

The pedagogic grounds for this course and its focus on model-based approaches are to arm new software engineers with skills and perspectives that extend beyond the level of basic programming. Such skills are essential to success in software development nowadays, and are in great demand but very low supply. The dearth of such expertise is one of the key reasons behind the alarmingly high failure rate of industrial software projects (currently estimated at being greater than 40%). Therefore, this unit complements SQE and strengthens a key area in the program.

(ii) Stream in Information Systems

First year core units of study for IS stream

ENGG1805
Professional Engineering and IT

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week; Project Work - own time 2 hrs. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

ENGG1805 aims to introduce students to the fundamental principles that underlie the study of engineering and information technologies. It lays the foundation for later studies, and presents to the students challenges common to a multidisciplinary engineering environment. The subject also provides students with the opportunity to develop an understanding of engineering ethics and of working as a part of a team.

Professional Engineering and IT (6CP) is composed from the following five parts: (a) Introduction to engineering: the engineer as problem solver, critical analysis of greatest engineering achievements and failure. (b) Introduction to common engineering software tools: word processors, project management tools (c) Ethics and workplace health and safety. (d) Testing - concepts of destructive and not destructive tests will be given on samples. (e) "Meet the professionals" - A selection of guest speakers will address students on the most important aspects of the engineering profession. (f) Design Process - The process of design synthesis as an important part of engineering: students will be required to complete an engineering design (from conception, to implementation and testing) maintaining proper lab notes.

ELEC1601
Foundations of Computer Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** HSC Mathematics extension 1 or 2 **Assessment:** Through semester assessment (61%) Final Exam (39%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study introduces the fundamental digital concepts upon which the design and operation of modern digital computers are based. A prime aim of the unit is to develop a professional view of, and a capacity for inquiry into, the field of computing.

Topics covered include: data representation, basic computer organisation, the CPU, elementary gates and logic, peripheral devices, software organisation, machine language, assembly language, operating systems, data communications and computer networks.

INFO1103
Introduction to Programming

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Laboratory 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Programming in a legible, maintainable, reusable way is essential to solve complex problems in the pervasive computing environments. This unit will equip students with foundation of programming concepts that are common to widely used programming languages. The "fundamentals-first & objects-later" strategy is used to progressively guide this introductory unit from necessary and important building blocks of programming to the object-oriented approach. Java, one of the most popular programming languages, is used in this unit. It provides interdisciplinary approaches, applications and examples to support students from broad backgrounds such as science, engineering, and mathematics.

INFO1105
Data Structures

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1003 or INFO1103 or INFO1903 or INFS1000 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will teach some powerful ideas that are central to quality software: data abstraction and recursion. It will also show how one can analyse the scalability of algorithms using mathematical tools of asymptotic notation. Contents include: both external "interface" view, and internal "implementation" details, for commonly used data structures, including lists, stacks, queues, priority queues, search trees, hash tables, and graphs; asymptotic analysis of algorithm scalability, including use of recurrence relations to analyse recursive code. This unit covers the way information is represented in each structure, algorithms for manipulating the structure, and analysis of asymptotic complexity of the operations. Outcomes include: ability to write code that recursively performs an operation on a data structure; experience designing an algorithmic solution to a problem using appropriate data structures, coding the solution, and analysing its complexity.

Note: INFO1905 (advanced version) can be taken as an alternative core unit to INFO1105.

First year recommended elective units of study for IS stream

At least 12 crpts must be completed from 1000-level Mathematics and/or Statistics.

ELEC1103
Fundamentals of Elec and Electronic Eng

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 3 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Basic knowledge of differentiation & integration, and HSC Physics **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to develop knowledge of the fundamental concepts and building blocks of electrical and electronics circuits. This is a foundation unit in circuit theory. Circuit theory is the electrical engineer's fundamental tool.

The concepts learnt in this unit will be made use of heavily in many units of study (in later years) in the areas of electronics, instrumentation, electrical machines, power systems, communication systems, and signal processing.

Topics: a) Basic electrical and electronic circuit concepts: Circuits, circuit elements, circuit laws, node and mesh analysis, circuit theorems, energy storage, capacitors and inductors, circuits with switches, transient response, sine waves and complex analysis, phasors, impedance, ac power.; b) Project management, teamwork, ethics; c) Safety issues

INFO1003
Foundations of Information Technology

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 3 hrs/week; Laboratory 2 hrs/week. **Prohibitions:** INFO1000, ISYS1003, INFO1903, INFS1000 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Information technologies (IT) and systems have emerged as the primary platform to support communication, collaboration, research, decision making, and problem solving in contemporary organisations. The essential necessity for all university students to acquire the fundamental knowledge and skills for applying IT effectively for a wide range of tasks is widely recognised. It is an introductory unit of study which prepares students from any academic discipline to develop the necessary knowledge, skills and abilities to be competent in the use of information technology for solving a variety of problems. The main focus of this unit is on modelling and problem solving through the effective use of using IT. Students will learn how to navigate independently to solve their problems on their own, and to be capable of fully applying the power of IT tools in the service of their goals in their own domains while not losing sight of the fundamental concepts of computing.

Students are taught core skills related to general purpose computing involving a range of software tools such as spreadsheets, database management systems, internet search engine, HTML, and JavaScript. Students will undertake practical tasks including authoring an interactive website using HTML, JavaScript and AJAX and building a small scale application for managing information. In addition, the course will address the many social, ethical, and intellectual property issues arising from the wide-spread use of information technology in our society.

INFO1903
Informatics (Advanced)

Credit points: 6 **Session:** Semester 1 **Classes:** Tutorial 3 hrs/week; Lecture 3 hrs/week. **Prerequisites:** ATAR sufficient to enter BCST(Adv), BIT or BSc(Adv), or portfolio of work suitable for entry **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit covers advanced data processing and management, integrating the use of existing productivity software, e.g. spreadsheets and databases, with the development of custom software using the powerful general-purpose Python scripting language. It will focus on skills directly applicable to research in any quantitative domain. The unit will also cover presentation of data through written publications and dynamically generated web pages, visual representations and oral presentation skills. The assessment, a semester long project, involves the demonstration of these skills and techniques for processing and presenting data in a choice of domains.

BUSS1001
Understanding Business

Credit points: 6 **Teacher/Coordinator:** Professor Marcus O'Connor **Session:** Semester 1, Semester 2 **Classes:** 1x 1.5 hr lecture and 1x 1.5 hr tutorial per week **Prohibitions:** ECOF1003 **Assessment:** participation (15%), essay (20%), case study (20%), and final exam (45%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This unit of study is a compulsory part of the Bachelor of Commerce, combined Bachelor of Commerce degrees and the Bachelor of Commerce (Liberal Studies).

This unit of study is the first of two junior core units aimed at introducing students to the internal and external contexts in which business operates in the twenty-first century. It also aims to lay the foundations for effective communication (written and oral), critical analysis, problem solving, and team work skills, which are essential to achieving program learning goals. In this unit, students will build an understanding of the dynamics of business through the lens of the company and its stakeholders. Business ethics is also introduced as key learning goal.

BUSS1002
The Business Environment

Credit points: 6 **Teacher/Coordinator:** Omer Konakci **Session:** Semester 1, Semester 2 **Classes:** 1x 1.5hr lecture and 1x 1.5hr tutorial per week **Prerequisites:** ECOF1003 or BUSS1001 **Prohibitions:** ECOF1004, CISS2001 **Assessment:** media summary and analyses (55%), tutorial participation (10%), and final exam (35%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This unit of study is a compulsory part of the Bachelor of Commerce, combined Bachelor of Commerce degrees and the Bachelor of Commerce (Liberal Studies).

This unit of study is the second of two junior core units aimed at introducing students to the external and internal contexts in which business operates in the twenty-first century while developing effective problem solving, critical analysis and communication skills. In this unit, students will build an understanding of the economic, political and regulatory, socio-cultural, and technological factors that impact on the external context of the commercial landscape while developing an awareness of potential of risk and change. An awareness of corporate social responsibility and sustainability is also introduced as a key learning goal.

All 1000-level MATH units of study are recommended electives.A full list of available MATH/STAT units can be obtained from the School of Mathematics and Statistics, who can also advise on the appropriate level of unit for the students preparation. We strongly suggest including some statistics unit among the choices.

Second year core units of study for IS stream

COMP2007
Algorithms and Complexity

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** INFO1105 OR INFO1905. **Assumed knowledge:** MATH1004 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides an introduction to the design and analysis of algorithms. The main aims are (i) to learn how to develop algorithmic solutions to computational problem and (ii) to develop understanding of algorithm efficiency and the notion of computational hardness.

Note: COMP2907 (advanced version) can be taken as an alternative core unit to COMP2007.

COMP2129
Operating Systems and Machine Principles

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1103. **Assumed knowledge:** INFO1105 OR INFO1905. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

In this unit of study elementary methods for developing robust, efficient, and re-usable software will be covered. The unit is taught in C, in a Unix environment. Specific coding topics include memory management, the pragmatic aspects of implementing data structures such as lists and hash tables and managing concurrent threads. Debugging tools and techniques are discussed and common programming errors are considered along with defensive programming techniques to avoid such errors. Emphasis is placed on using common Unix tools to manage aspects of the software construction process, such as version control and regression testing. The subject is taught from a practical viewpoint and it includes a considerable amount of programming practice.

INFO2110
Systems Analysis and Modelling

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Experience with a data model as in INFO1003 or INFO1103 or INFS1000 **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides a comprehensive introduction to the analysis of complex systems. Key topics are the determination and expression of system requirements (both functional and on-functional), and the representation of structural and behavioural models of the system in UML notations. Students will be expected to evaluate requirements documents and models as well as producing them. This unit covers essential topics from the ACM/IEEE SE2004 curriculum, especially from MAA Software Modelling and Analysis.

ISYS2140
Information Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Prerequisites:** INFO1103 OR INFO1903 OR INFS1000 OR INFO1003 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will provide a comprehensive conceptual and practical introduction to information systems (IS) in contemporary organisations. Key topics covered include:

* Basic concepts of information systems

* Network fundamentals and applications

* E-business and e-commerce

* Information systems for competitive advantage

* Functional and enterprise systems

* Business intelligence

* Information systems acquisition

* Information security, ethics, and privacy

INFO2120
Database Systems 1

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week; Project Work - own time 3 hrs/week. **Prerequisites:** INFO1003 OR INFO1103 OR INFO1903 OR INFS1000 OR DECO1012. **Prohibitions:** INFO2820, INFO2905, COMP5138 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The ubiquitous use of information technology leaves us facing a tsunami of data produced by users, IT systems and mobile devices. The proper management of data is hence essential for all applications and for effective decision making within organizations.

This unit of study will introduce the basic concepts of database designs at the conceptual, logical and physical levels. We will place particular emphasis on introducing integrity constraints and the concept of data normalization which prevents data from being corrupted or duplicated in different parts of the database. This in turn helps in the data remaining consistent during its lifetime. Once a database design is in place, the emphasis shifts towards querying the data in order to extract useful information. The unit will introduce different query languages with a particular emphasis on SQL, which is industry standard. Other topics covered will include the important concept of transaction management, application development with a backend database, an overview of data warehousing and OLAP, and the use of XML as a data integration language.

Note: INFO2820 (advanced version) can be taken as an alternative core unit to INFO2120.

Second year recommended elective units of study for IS stream

BIT single degree students must complete at least 6 crptsFor BIT single degree students, at least 6 crpts must be completed from 2000-level Mathematics and/or Statistics (we strongly suggest STAT2012 or STAT2912)

INFS2020
Business Process Modelling & Improvement

Credit points: 6 **Teacher/Coordinator:** TBA **Session:** Semester 2 **Classes:** 1 x 3 hr seminar per week **Prohibitions:** INFS2005 **Assumed knowledge:** INFS1000 or equivalent **Assessment:** individual assignment (30%), group project (30%), and final examination (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides you with an in depth understanding of the role of business process management (BPM) and process architectures in a business environment. You will gain essential skills of the entire BPM lifecycle, from process identification to process monitoring, including process modelling, analysis, redesign and automation required to achieve high performing business processes in a service oriented business environment. In this unit, you will attain considerable hands-on skills with BPM tools, by documenting, analysing, and simulating current and improved processes.

All 2000-level COMP, INFO, ISYS units of study are recommended electives.All 2000-level ELEC units of study are recommended electives.All 2000-level MATH or STAT units of study are recommended electives.

Third year core units of study for IS stream

INFO3402
Management of IT Projects and Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Project Work - own time 2 hrs. **Assumed knowledge:** INFO2110 or INFO2810 or INFO2900 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course introduces the basic processes and techniques for managing IT projects, systems and services, throughout the IT lifecycle. It addresses both the technical and behavioural aspects of IT management at the enterprise level. Major topics include: IT planning, project planning and scheduling, project tracking, resource estimation, team management, software testing, change and problem management, and quality assurance.

INFO3600
Major Development Project (Advanced)

Credit points: 12 **Session:** Semester 2 **Classes:** Project Work - in class 2 hrs/week; Site Visit 1 hr/week; Project Work - own time 16 hrs/week; Meeting 1 hr/week. **Prerequisites:** INFO3402 **Prohibitions:** ISYS3400, COMP3615 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Only available to students in BIT, BCST(Adv) or BSc(Adv).

This unit will provide students an opportunity to carry out substantial aspects of a significant software development project. The project will be directed towards assisting a client group (from industry or with strong industry links). The student's contribution could cover one or more aspects such as requirements capture, system design, implementation, change management, upgrades, operation, and/or tuning. Assessment will be based on the quality of the delivered outputs, the effectiveness of the process followed, and the understanding of the way the work fits into the client's goals, as shown in a written report.

ISYS3401
Analytical Methods & Information Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assumed knowledge:** INFO2110, ISYS2140 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Information Systems (IS) professionals in today's organisations are required to play leadership roles in change and development. Your success in this field will be aided by your being able to carry out research-based investigations using suitable methods and mastery over data collection and analysis to assist in managing projects and in decision making. Practical research skills are some of the most important assets you will need in your career.

This unit of study will cover important concepts and skills in practical research for solving and managing important problems. This will also provide you with the skills to undertake the capstone project in the IS project unit of study offered in Semester 2 or other projects. It will also provide hand-on experience of using Microsoft Excel and other tools to perform some of the quantitative analysis.

CS & IS double stream: BIT single degree students enrolled in the double stream must also complete INFO3220 Object Oriented Design as a core unit of study. BIT combined degree students do not have double stream.

Third year recommended elective units of study for IS stream

BIT single degree students must complete at least 18 credit pointsBIT combined degree students must complete at least 6 credit pointsFor single degree students, at least 12 credit pointsmust be completed from (INFO3220, INFO3315, INFO3404, INFO3406, INFO3504)For combined degree students, at least 6 credit points must be completed from (INFO3220, INFO3315, INFO3404, INFO3406, INFO3504)

INFS3040
Enterprise Systems & Integrated Business

Credit points: 6 **Teacher/Coordinator:** TBA **Session:** Semester 1 **Classes:** 1x 3hr seminar per week **Prohibitions:** INFS3005 **Assumed knowledge:** INFS1000 or equivalent **Assessment:** mid-semester test (35%); individual enterprise system portfolio (35%), and group project (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides you with an in depth understanding of the way in which implementation and use of large scale integrated Enterprise Systems change the nature of organisational capabilities, processes, and roles. You will understand the strategic role of Enterprise Systems in providing a platform for improved business operations and designing information infrastructures. You will gain considerable hands on experience with an enterprise wide system, such as SAP, concentrating on the way in which such systems support integrated business processes. Through a combination of discussion and practical work, you will gain strong knowledge in both the organisational and technical aspects of Enterprise Systems You will also explore the emergence and implications of cloud-based Enterprise Systems and the implementation process.

All 3000-level COMP, INFO, ISYS units of study are recommended electives.All 3000-level and above ELEC units of study are recommended electives.

Fourth year recommended elective units of study for IS stream

Students in the BIT Pass degree must complete at least 48 credit points from this list. At least 36 crpts must be completed from 5000-level or above COMP, INFO, ISYS units of study.

COMP5045
Computational Geometry

Credit points: 6 **Session:** Semester 1 **Classes:** Project Work - in class 12 hrs/week. **Assumed knowledge:** Students are assumed to have a basic knowledge of the design and analysis of algorithms and data structures: you should be familiar with big-O notations and simple algorithmic techniques like sorting, binary search, and balanced search trees. **Assessment:** Through semester assessment (80%) Final Exam (20%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

In many areas of computer science - robotics, computer graphics, virtual reality, and geographic information systems are some examples - it is necessary to store, analyse, and create or manipulate spatial data. This course deals with the algorithmic aspects of these tasks: we study techniques and concepts needed for the design and analysis of geometric algorithms and data structures. Each technique and concept will be illustrated on the basis of a problem arising in one of the application areas mentioned above.

COMP5046
Statistical Natural Language Processing

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 1 hr/week. **Assumed knowledge:** Knowledge of an OO programming language **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Practical work will use the Natural Language Toolkit

This unit introduces computational linguistics and the statistical techniques and algorithms used to automatically process natural languages (such as English or Chinese). It will review the core statistics and information theory, and the basic linguistics, required to understand statistical natural language processing (NLP).

Statistical NLP is used in a wide range of applications, including information retrieval and extraction; question answer; machine translation; and classifying and clustering of documents. This unit will explore state of the art approaches to the key NLP sub-tasks, including tokenisation, morphological analysis, word sense disambiguation, part-of-speech tagging, named entity recognition, text categorisation, phrase structure and Combinatory Categorial Grammar parsing.

Students will implement many of these sub-tasks in labs and assignments. The unit will also investigate the annotation process that is central to creating training data for statistical NLP systems. Students will annotate data as part of completing a real-world NLP task.

COMP5047
Pervasive Computing

Credit points: 6 **Session:** Semester 2 **Classes:** Studio class 3 hrs/week. **Assumed knowledge:** Background in programming and operating systems that is sufficient for the student to independently learn new programming tools from standard online technical materials. Ability to conduct a literature search. Ability to write reports of work done. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This is an advanced course in HCI, Human Computer Interaction, with a focus on Pervasive Computing. It introduces the key aspects of HCI and explores these in terms of the new research towards creating user interfaces that disappear into the environment and are available pervasively, for example in homes, workplaces, cars and carried or work.

COMP5048
Visual Analytics

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assumed knowledge:** It is assumed that students will have basic knowledge of data structures, algorithms and programming skills. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Visual Analytics aims to facilitate the data analytics process through Information Visualisation. Information Visualisation aims to make good pictures of abstract information, such as stock prices, family trees, and software design diagrams. Well designed pictures can convey this information rapidly and effectively.

The challenge for Visual Analytics is to design and implement "effective Visualisation methods that produce pictorial representation of complex data so that data analysts from various fields (bioinformatics, social network, software visualisation and network) can visually inspect complex data and carry out critical decision making.

This unit will provide basic HCI concepts, Visualisaiton techniques and fundamental algorithms to achieve good visualisation of abstract information. Further, it will also provide opportunities for academic research and developing new methods for Visual Analytic methods.

COMP5216
Mobile Computing

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assumed knowledge:** COMP5214 Software Development in JAVA, or similar introductory software development units. **Assessment:** Through semester assessment (45%) Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Mobile computing is becoming a main stream for many IT applications, due to the availability of more and more powerful and affordable mobile devices with rich sensors such as cameras and GPS, which have already significantly changed many aspects in business, education, social network, health care, and entertainment in our daily life. Therefore it has been critical for students to be equipped with sufficient knowledge of such new computing platform and necessary skills. The unit aims to provide an in-depth overview of existing and emerging mobile computing techniques and applications, the eco-system of the mobile computing platforms, and its key building components. The unit will also train students with hand-on experiences in developing mobile applications in a broad range of areas.

COMP5313
Large Scale Networks

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assumed knowledge:** Algorithmic skills (as expected from any IT graduate). Basic probability knowledge. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

The growing connectedness of modern society translates into simplifying global communication and accelerating spread of news, information and epidemics. The focus of this unit is on the key concepts to address the challenges induced by the recent scale shift of complex networks. In particular, the course will present how scalable solutions exploiting graph theory, sociology, game theory and probability tackle the problems of communicating (routing, diffusing, aggregating) in dynamic and social networks.

COMP5318
Knowledge Discovery and Data Mining

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assumed knowledge:** INFO9120 OR COMP5138 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Knowledge discovery is the process of extracting useful knowledge from data. Data mining is a discipline within knowledge discovery that seeks to facilitate the exploration and analysis of large quantities for data, by automatic and semiautomatic means. This subject provides a practical and technical introduction to knowledge discovery and data mining.

Objectives: Topics to be covered include problems of data analysis in databases, discovering patterns in the data, and knowledge interpretation, extraction and visualisation. Also covered are analysis, comparison and usage of various types of machine learning techniques and statistical techniques: clustering, classification, prediction, estimation, affinity grouping, description and scientific visualisation

COMP5338
Advanced Data Models

Credit points: 6 **Session:** Semester 2 **Classes:** Tutorial 1 hr/week. **Assumed knowledge:** This unit of study assumes foundational knowledge of relational database systems as taught in COMP5138/ INFO9120 (Database Management Systems) or INFO2120/2820 (Database Systems 1). **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study gives a comprehensive overview of post-relational data models and of latest developments in data storage technology.

Particular emphasis is put on spatial, temporal, and NoSQL data storage. This unit extensively covers the advanced features of SQL:2003, as well as a few dominant NoSQL storage technologies. Besides in lectures, the advanced topics will be also studied with prescribed readings of database research publications.

COMP5347
Web Application Development

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 1 hr/week; Project Work - own time 3 hrs/week; Independent Study, **Assumed knowledge:** INFO9220 or COMP5028. The course assumes basic knowledge on OO design and UML diagrams. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will focus on technological advances supporting the development of e-commerce applications and systems. This includes client and server side development of e-commerce applications. AJAX is the core client side technology covered in this course. Both server scripting and server page technology are covered as key server side technology. It will also examine the emerging trend of web services and its role in E-commerce systems. This unit aims at providing both conceptual understanding and hand-on experiences for the technologies covered.

COMP5348
Enterprise Scale Software Architecture

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 1 hr/week. **Assumed knowledge:** Programming competence in Java or similar OO language. Capacity to master novel technologies (especially to program against novel APIs) using manuals, tutorial examples, etc. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit covers topics on software architecture for large-scale enterprises. Computer systems for large-scale enterprises handle critical business processes, interact with computer systems of other organisations, and have to be highly reliable, available and scalable. This class of systems are built up from several application components, incorporating existing "legacy" code and data stores as well as linking these through middleware technologies, such as distributed transaction processing, remote objects, message-queuing, publish-subscribe, and clustering. The choice of middleware can decide whether the system achieves essential non- functional requirements such as performance and availability. The objective of this unit of study is to educate students for their later professional career and it covers Software Architecture topics of the ACM/IEEE Software Engineering curriculum. Objective: The objective of this unit of study is to educate students for their later professional career and it covers topics of the ACM/IEEE Software Engineering curriculum.

COMP5349
Cloud Computing

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Practical Labs 2 hrs/week; Project Work 3 hrs/week. **Assumed knowledge:** Good programming skills, especially in Java for the practical assignment, as well as proficiency in databases and SQL. The unit is expected to be taken after introductory courses in related units such as COMP5214 OR INFO9103 Software Development in JAVA **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit covers topics of active and cutting-edge research within IT in the area of 'Cloud Computing'.

Cloud Computing is an emerging paradigm of utilising large-scale computing services over the Internet that will affect individual and organization's computing needs from small to large. Over the last decade, many cloud computing platforms have been set up by companies like Google, Yahoo!, Amazon, Microsoft, Salesforce, Ebay and Facebook. Some of the platforms are open to public via various pricing models. They operate at different levels and enable business to harness different computing power from the cloud.

In this course, we will describe the important enabling technologies of cloud computing, explore the state-of-the art platforms and the existing services, and examine the challenges and opportunities of adopting cloud computing. The course will be organized as a series of presentations and discussions of seminal and timely research papers and articles. Students are expected to read all papers, to lead discussions on some of the papers and to complete a hands-on cloud-programming project.

COMP5416
Advanced Network Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 1 hr/week. **Assumed knowledge:** COMP5116 OR ELEC3506 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit introduces networking concepts beyond the best effort service of the core TCP/IP protocol suite. Understanding of the fundamental issues in building an integrated multi-service network for global Internet services, taking into account service objectives, application characteristics and needs and network mechanisms will be discussed. Enables students to understand the core issues and be aware of proposed solutions so they can actively follow and participate in the development of the Internet beyond the basic bit transport service.

COMP5424
Information Technology in Biomedicine

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Information technology (IT) has significantly contributed to the research and practice of medicine, biology and health care. The IT field is growing enormously in scope with biomedicine taking a lead role in utilizing the evolving applications to its best advantage. The goal of this unit of study is to provide students with the necessary knowledge to understand the information technology in biomedicine. The major emphasis will be on the principles associated with biomedical digital imaging systems and related biomedicine data processing, analysis, visualization, registration, modelling, compression, management, communication and security. Specialist areas such as Picture Archiving and Communication Systems (PACS), computer-aided diagnosis (CAD), content-based medical image retrieval (CBMIR), and ubiquitous m-Health, etc. will be addressed. A broad range of practical integrated clinical applications will be also elaborated.

COMP5425
Multimedia Retrieval

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assumed knowledge:** COMP9007 or COMP5211. Basic Programming skills and data structure knowledge. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The explosive growth of multimedia data, including text, audio, images and video, has generated an extremely challenging job in effective and efficient retrieval techniques demanded by users to meet their information needs. This unit provides students with the most updated knowledge in order to address this issue in the context of big data, from the basics of textual information retrieval, to many advanced techniques in the field, such as large scale retrieval and social media.

COMP5426
Parallel and Distributed Computing

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assumed knowledge:** COMP5116 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit is intended to introduce and motivate the study of high performance computer systems. The student will be presented with the foundational concepts pertaining to the different types and classes of high performance computers. The student will be exposed to the description of the technological context of current high performance computer systems. Students will gain skills in evaluating, experimenting with, and optimizing the performance of high performance computers. The unit also provides students with the ability to undertake more advanced topics and courses on high performance computing.

COMP5427
Usability Engineering

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Usability engineering is the systematic process of designing and evaluating user interfaces so that they are usable. This means that people can readily learn to use them efficiently, can later remember how to use them and find it pleasant to use them. The wide use of computers in many aspects of people's lives means that usability engineering is of the utmost importance.

There is a substantial body of knowledge about how to elicit usability requirements, identify the tasks that a system needs to support, design interfaces and then evaluate them. This makes for systematic ways to go about the creation and evaluation of interfaces to be usable for the target users, where this may include people with special needs. The field is extremely dynamic with the fast emergence of new ways to interact, ranging from conventional WIMP interfaces, to touch and gesture interaction, and involving mobile, portable, embedded and desktop computers.

This unit will enable students to learn the fundamental concepts, methods and techniques of usability engineering. Students will practice these in small classroom activities. They will then draw them together to complete a major usability evaluation assignment in which they will design the usability testing process, recruit participants, conduct the evaluation study, analyse these and report the results.

COMP5456
Introduction to Bioinformatics

Credit points: 6 **Session:** Summer Main **Classes:** Laboratory 2 hrs/week; Lecture 2 hrs/week. **Prohibitions:** COMP3456 **Assumed knowledge:** Some experience with basic programming (coding) in Java, C, C++ or Perl; Some proven ability in mathematical or information sciences (as evinced in the prerequisites); Some knowledge of molecular biology either through first year BIOL papers or MBLG1001. **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit brings together a wide range of skills that are routinely practised in bioinformatics, from the 'hard' subjects of mathematics, statistics and computer science, to the 'soft' subjects in the biological / health sciences and pharmacology. The unit covers the essentials of bioinformatics data gathering, manipulation, mining and storage that underpin bioinformatics research. It further provides additional practice in the graduate attributes of Research and Inquiry, Information Literacy and Communication through analysis of scientific research, use of large bioinformatics data sets, and writing of reports.

INFO5010
IT Advanced Topic A

Credit points: 6 **Session:** Semester 1, Semester 2, Summer Late **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit will cover some topic of active and cutting-edge research within IT; the content of this unit may be varied depending on special opportunities such as a distinguished researcher visiting the University.

INFO5011
IT Advanced Topic B

Credit points: 6 **Session:** Semester 1, Semester 2, Winter Main **Classes:** One 2 hour scheduled small-group class per week. **Prohibitions:** INFO4011 **Assessment:** Through session assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will cover some topic of active and cutting-edge research within IT; the content of this unit may be varied depending on special opportunities such as a distinguished researcher visiting the University.

INFO5060
Data Analytics and Business Intelligence

Credit points: 6 **Session:** Summer Early **Classes:** Lecture 4 hrs; Tutorial 2 hrs; Laboratory 6 hrs; Presentation 3 hrs; Project Work - own time 6 hrs. **Assumed knowledge:** The unit is expected to be taken after introductory courses or related units such as COMP5206 Information Technologies and Systems **Assessment:** Through semester assessment (65%) Final Exam (35%) **Mode of delivery:** Block mode

The frontier for using data to make decisions has shifted dramatically. High performing enterprises are now building their competitive strategies around data-driven insights that in turn generate impressive business results. This course provides an overview of Business Intelligence (BI) concepts, technologies and practices, and then focuses on the application of BI through a team based project simulation that will allow students to have practical experience in building a BI solution based on a real world case study.

INFO5301
Information Security Management

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assumed knowledge:** This unit of study assumes foundational knowledge of Information systems management. Two year IT industry exposure and a breadth of IT experience will be preferable. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study gives a broad view of the management aspects of information security. We emphasise corporate governance for information security, organisational structures within which information security is managed, risk assessment, and control structures. Planning for security, and regulatory issues, are also addressed.

INFO5991
Services Science Management and Eng

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Seminar 2 hrs/week. **Assumed knowledge:** INFO5990. Students are expected to have a degree in computer science, engineering, information technology, information systems or business. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

The service economy plays a dominant and growing role in growth and employment in most parts of the world. Increasingly, the improved productivity and competitive performance of firms and nations in the services arena relies on innovative and effective design, engineering and management of IT-centric services. In response to industry needs, this unit offers IT professionals a social, economic and technical perspective of service-oriented IT.

INFO5992
Understanding IT Innovations

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Prohibitions:** PMGT5875 **Assumed knowledge:** INFO5990. Students are expected to be fluent in English and capable of participating in group discussions, and capable of producing an individually written paper of 5-9 pages (double spaced) of high quality and clarity. Although some work experience is ideal in adding value to the case discussions, allowing students to pull from their personal experiences, those students with no work experience will be expected to do appropriate research on the discussion topics in order to contribute. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: A variety of learning situations will be employed during the unit of study, including lectures, recommended reading, a few short exercises during class, and discussions of cases. To benefit fully from this unit it is necessary to participate fully in all aspects of the unit of study.

An essential skill for an IT manager is the ability to keep up-to-date with emerging technologies, and be able to evaluate the significance of these technologies to their organisation's business activities. This unit of study is based around a study of current technologies and the influence of these technologies on business strategies.

Important trends in innovation in IT are identified and their implications for innovation management explored. Major topics include: drivers of innovation; the trend to open information ("open source") rather than protected intellectual property; and distribution of innovation over many independent but collaborating actors.

On completion of this unit, students will be able to identify and analyse an emerging technology and write a detailed evaluation of the impact of this technology on existing business practices.

INFO6010
Advanced Topics in IT Project Management

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial (applied workshop) 1 hr/week; E-Learning 1 hr/week. **Prerequisites:** INFO6007, OR 3-5 years working experience in IT Project Management **Assumed knowledge:** Students are assumed to understand the role of IT projects. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will explore the limitations of IT project management and the most promising techniques to overcome project failure. It will start by reviewing case study research showing we have reached the limits of traditional IT project management practice. The theoretical base will be completed by exploring the finding that senior management have more impact on success than traditional approaches.

Participants will be introduced to and learn to apply the most promising tools and techniques needed to govern IT projects. The topics reviewed will include:

1)strategy,

2)organisational change,

3)project sponsorship,

4)programme management,

5)performance measurement,

6)culture

7)portfolio management.

8)Relevant Australian and International Standards on IT/Project Governance and new industry methodologies around portfolio, programme and change management will be reviewed.

INFO6012
Information Technology Strategy & Value

Credit points: 6 **Session:** Semester 2 **Classes:** Flexible Session 3 hrs/week. **Assumed knowledge:** COMP5206. Introduction to Information Systems **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The increasingly strategic role of IT in organisations is widely recognised. This unit of study is designed to provide a comprehensive introduction to strategic aspects of IT as they impact on business value. Such a perspective is critical for IT professionals in both IT producer and user organisations from the level of Chief Information Officer to managers as well as technical specialists. Deep understanding of IT strategy formulation and implementation and ensuring its alignment with the organisation's strategic directions is important for successfully managing the major changes that the IT function has undergone in recent years.

Topics covered will include technology forecasting and assessment of IT impacts, achieving sustainable competitive through IT, relationship between IT strategy and value, IT strategy formulation and implementation, evaluation of strategic investments in IT, IT portfolio management, IT souring and open innovation, and dynamics of IT strategy and game theory. It will explore IT-related strategic decision making at the different organisational levels and the concept of strategic congruence. This unit will provide students with models, tools, and techniques to evaluate an organisation's IT strategic position, and hence to help make appropriate strategic choices.

ISYS5070
Change Management in IT

Credit points: 6 **Session:** Winter Main **Classes:** Lecture 6 hrs/week; Tutorial 6 hrs/week; Presentation 3 hrs/week; Project Work - own time 6 hrs. **Assumed knowledge:** The unit is expected to be taken after the following related units INFO6007 Project Managemnet in IT and COMP5206 Introduction to Information Systems. **Assessment:** Through semester assessment (70%) Final Exam (30%) **Mode of delivery:** Block mode

This unit of study presents the leading edge of research and practice in change management and focuses on theories, frameworks and perspectives that can guide your work as a change agent in the IT industries. The unit will cover a range of approaches, methods, interventions and tools that can be used to successfully manage change projects that relate to the implementation of new technologies.

The globalisation of markets and industries, accelerating technological innovations and the need of companies to remain at the forefront of technological developments in an increasingly competitive, globalised industry have resulted in a significant increase in the speed, magnitude, and unpredictability of technological and organisational change over the last decades. Companies who have the competencies required to navigate change and overcome the inevitable obstacles to success gain a much-needed competitive edge in the marketplace. Increased globalization, economic rationalism, environmental dynamics and technological changes mean that companies, more than ever before, need to be highly flexible and adaptable to survive and thrive. Yet, a large percentage of IT projects fail to achieve the intended objectives, go over time or over budget. The capability to successfully manage organisational and technological change has become a core competency for IT professionals, business leaders and project managers.

This unit has been specifically developed for IT professionals, project managers, and senior managers to equip them with the knowledge and tools needed to ensure that IT projects remain on track to achieving the intended objectives on time and on budget. The course presents the key theories, concepts and findings in the context of academic research and change management practice. The objective is to allow participants to critically assess academic theories and methodological practice and devise interventions and actions that allow the successful management of IT initiatives.

ELEC5508
Wireless Engineering

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assumed knowledge:** Basic knowledge in probability and statistics, analog and digital communications, error probability calculation in communications channels, and telecommunications network. **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will introduce the key ideas in modern wireless telecommunications networks. It will address both physical layer issues such as propagation and modulation, plus network layer issues such as capacity, radio resource management and mobility management issues.

The following topics are covered. Mobile radio channel: Multipath fading, diversity, log-normal fading, mean propagation loss, propagation models. Cellular technologies: Cell types, coverage, frequency reuse, spectral efficiency, link budget, power budget, traffic capacity. Omnidirectional and sectorised antennas. Handover, interaction with the fixed network. Microcells and macrocells, Medium access control: Near-far effect and the hidden terminal problem. Multiple access schemes: FDMA, TDMA, CDMA. Aloha and s-Aloha, carrier sense multiple access, reservation-based MAC schemes, polling, spread-aloha multiple access. GSM: System architecture, radio resource management, mobility management, connection management.

Third generation systems: WCDMA and cdma2000. Wireless LANs: IEEE802.11, Hiperlan, Bluetooth. Convergence: GSM evolution to data services via GPRS and EDGE. Issues with TCP over wireless. Mobility management in MobileIP.

ELEC5509
Mobile Networks

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Basically, students need to know the concepts of data communications and mobile communications, which could be gained in one the following units of study: ELEC3505 Communications, ELEC3506 Data Communications and the Internet, or similar units. If you are not sure, please contact the instructor. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study serves as an introduction to communications network research. The unit relies on a solid understanding of data communications and mobile networks. It introduces some of the currently most debated research topics in mobile networking and presents an overview of different technical solutions. Students are expected to critically evaluate these solutions in their context and produce an objective analysis of the advantages/disadvantages of the different research proposals. The general areas covered are wireless Internet, mobility management, quality of service in mobile and IP networks, ad hoc networks, and cellular network architectures.

The following topics are covered. Introduction to wireless and mobile Internet. Wireless cellular data networks. Cellular mobile networks. Mobile networks of the future. Quality of service in a mobile environment. Traffic modelling for wireless Internet. Traffic management for wireless Internet. Mobility management in mobile networks. Transport protocols for mobile networks. Internet protocols for mobile networks.

ELEC5514
Networked Embedded Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Assumed knowledge:** ELEC3305, ELEC3506, ELEC3607 and ELEC5508 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aim to teach the fundamentals concepts associated with:

oNetworked Embedded Systems, wireless sensor networks

oWireless channel propagation and radio power consumption

oWireless networks, ZigBee, Bluetooth, etc.

oSensor principle, data fusion, source detection and identification

oMultiple source detection, multiple access communications.

oNetwork topology, routing, network information theory

oDistributed source channel coding for sensor networks

oPower-aware and energy-aware communication protocols.

oDistributed embedded systems problems such as time synchronization and node localization,

Exposure to several recently developed solutions to address problems in wireless sensor networks and ubiquitous computing giving them a well-rounded view of the state-of the-art in the networked embedded systems field.

Student involvement with projects will expose them to the usage of simulators and/or programming some types of networked embedded systems platforms.

oAbility to identify the main issues and trade-offs in networked embedded systems.

oUnderstanding of the state-of-the-art solutions in the area

oBased on the above understanding, ability to analyze requirements and devise first-order solutions for particular networked embedded systems problems.

oFamiliarization with a simulator platform and real hardware platforms for network embedded systems through the students involvement in project

ELEC5614
Real Time Computing

Credit points: 6 **Session:** Semester 1 **Classes:** Project Work - own time 2 hrs; Lecture 2 hrs/week; Laboratory 2 hrs/week; Tutorial 1 hr/week; E-Learning 1 hr. **Prohibitions:** MECH5701 **Assumed knowledge:** SOFT2130 Software Construction (or SOFT2004 Software Development Methods 1) and ELEC3607 Embedded Computing (or ELEC2601 Microprocessor Systems) **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit is concerned with the theory and practice of real time computer systems as applied to the design of embedded systems and computer control systems in engineering, manufacturing and automation.

Some background in programming, object oriented design and system architecture is assumed. A prime aim of this unit of study is to develop a capacity for research and inquiry in the field of real-time and embedded systems. Completion of this unit will facilitate progression to advanced study or to work in embedded systems and industrial real-time computer systems.

The following topics are covered. Hard real time and embedded systems, as applied to engineering, manufacturing and automation. Timing and scheduling: periodic vs aperiodic processes, deadlines, rate monotonic, deadline monotonic and earliest deadline scheduling. Management of shared resources. Real-time languages and their features. Real time operating systems. Real time software design. Embedded Systems: overview, signal flow, interfacing. Reliability and fault tolerance in hardware and software. SCADA and DCCS. Some case studies.

ELEC5616
Computer and Network Security

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Laboratory 2 hrs/week; Project Work - own time 2 hrs. **Assumed knowledge:** A programming language, basic maths. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit examines the basic cryptographic building blocks of security, working through to their applications in authentication, key exchange, secret and public key encryption, digital signatures, protocols and systems. It then considers these applications in the real world, including models for integrity, authentication, electronic cash, viruses, firewalls, electronic voting, risk assessment, secure web browsers and electronic warfare. Practical cryptosystems are analysed with regard to the assumptions with which they were designed, their limitations, failure modes and ultimately why most end up broken.

ELEC5618
Software Quality Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** You are capable of writing programs with multiple functions or methods in multiple files.You are capable of design complex data structures and combine them in non trivial algorithms. You know how to use an integrated development environment. You are familiar and have worked previously with software version control systems. You know how to distribute the workload derived from the unit of study effectively throughoug the week and make sure that time is truly productive. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will cover software quality planning, validation and verification methods and techniques, risk analysis, software review techniques, software standards and software process improvement and software reliability.

Students who successfully complete this unit will understand the fundamental concepts of software quality engineering and be able to define software quality requirements, assess the quality of a software design, explain specific methods of building software quality, understand software reliability models and metrics, develop a software quality plan, understand quality assurance and control activities and techniques, understand various testing techniques including being able to verify and test a unit of code and comprehend ISO standards, SPICE, CMM and CMMI.

ELEC5619
Object Oriented Application Frameworks

Credit points: 6 **Session:** Semester 2 **Classes:** Project Work - in class 3 hrs; Project Work - own time 6 hrs; Presentation 2 hrs; Tutorial 3 hrs. **Assumed knowledge:** Java programming, and some web development experience are essential. Databases strongly recommended **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to introduce students to the main issues involved in producing large Internet systems by using and building application frameworks. Frameworks allow great reuse so developers do not have to design and implement applications from scratch, as students have done in ELEC3610 The unit lays down the basic concepts and hands on experience on the design and development of enterprise systems, emphasizing the development of systems using design patterns and application frameworks.

A project-based approach will introduce the problems often found when building such systems, and will require students to take control of their learning. A project-based approach will introduce the problems often found when building such systems, and will require students to take control of their learning. Several development Java frameworks will be used, including Spring, Hibernate, and others. Principles of design patterns will also be studied.

ELEC5620
Model Based Software Engineering

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Laboratory - Project Work - in class 2 hrs/week; Project Work - own time 2 hrs. **Assumed knowledge:** A programming language, basic maths. **Assessment:** Through semester assessment (80%) Final Exam (20%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

Model-Based Software Engineering focuses on modern software engineering methods, technologies, and processes used in professional development projects. It covers both the pragmatic engineering elements and the underlying theory of the model-based approach to the analysis, design, implementation, and maintenance of complex software-intensive systems.

Students will participate in a group project, which will entail developing and/or evolving a software system, following a full development cycle from requirements specification through to implementation and testing using up-to-date industrial development tools and processes. At the end of the course they will provide a presentation and demonstration of their project work to the class. There is no formal teaching of a programming language in this unit, although students will be expected to demonstrate through their project work their general software engineering and architectural skills as well as their mastery of model-based methods and technologies.

Students successfully completing this unit will have a strong practical and theoretical understanding of the modern software development cycle as applied in industrial settings. In particular, they will be familiar with the latest model-based software engineering approaches necessary for successfully dealing with today's highly complex and challenging software systems.

The pedagogic grounds for this course and its focus on model-based approaches are to arm new software engineers with skills and perspectives that extend beyond the level of basic programming. Such skills are essential to success in software development nowadays, and are in great demand but very low supply. The dearth of such expertise is one of the key reasons behind the alarmingly high failure rate of industrial software projects (currently estimated at being greater than 40%). Therefore, this unit complements SQE and strengthens a key area in the program.

Honours (CS and IS streams)

The BIT may be awarded as an Honours degree. Students may enrol in the Honours course after completion of 144 credit points, if they meet the specified entry conditions.All students in BIT(Honours) must complete the following 24 credit points oAll students in BIT(Honours) must complete the following 24 credit points of corerequirements plus 24 credit points from the fourth year recommended elective list of their respective stream. These core units are only available to students enrolled in Honours degrees, those in Research Higher degrees, or those in the Research track in postgraduate coursework degreesf core requirements plus 24 credit points from the fourth year selected core list of their respective stream. These units are only available to students enrolled in Honours degrees, those in Research Higher degrees, or those in the Research track in postgraduate coursework degrees. In addition to the core units students must also complete 24 credit points of elective units of study, please refer to the Fourth year selected core units listed in this table.

Honours core units of study

INFO4991
IT Research Thesis A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research 12 hrs/week. **Corequisites:** INFO5993 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: INFO4991 and INFO4992 together form the Honours Research thesis. It is allowed to enrol in one of these units in one semester, and the other the following semester; the same mark and grade is given for both once they have both been completed.

Students enrolled in the Honours programs study various advanced aspects of Information Technology. The program may include lectures, tutorials, seminars and practicals. They will undertake a research project. Assessment will include the project and may include examinations and classwork.

INFO4992
IT Research Thesis B

Credit points: 12 **Session:** Semester 1, Semester 2 **Classes:** Research 24 hrs/week. **Corequisites:** INFO4991 and INFO5993 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: INFO4991 and INFO4992 together form the Honours Research thesis. It is allowed to enrol in one of these units in one semester, and the other the following semester; the same mark and grade is given for both once they have both been completed.

Students enrolled in the Honours programs study various advanced aspects of Information Technology. The program may include lectures, tutorials, seminars and practicals. They will undertake a research project. Assessment will include the project and may include examinations and classwork.

INFO4999
Computer Science Honours Result

Session: Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

All SIT Honours students must enrol in this non assessable unit of study in their final semester.

INFO5993
IT Research Methods

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Seminar 2 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will provide an overview of the different research methods that are used in IT. Students will learn to find and evaluate research on their topic and to present their own research plan or results for evaluation by others. The unit will develop a better understanding of what research in IT is and how it differs from other projects in IT. This unit of study is required for students in IT who are enrolled in a research project as part of their Honours or MIT/MITM degree. It is also recommended for students enrolled or planning to do a research degree in IT and Engineering.

For a standard enrolment plan for Bachelor of Information Technology visit CUSP.

Project Management Program

Project management is becoming a highly regarded discipline in its own right. 'On-the-job' training alone can no longer meet the needs of organisations or provide the fundamental project management skills required in today's dynamic and complex environment. Project managers help organisations deliver new products, services and infrastructure. They manage and implement new systems and processes and they effect change within organisations.

This degree is unlike any other project management degree in Australia. Based on a complex systems approach, it uses multidisciplinary theories and methods to investigate a particular phenomenon from a holistic viewpoint. The Project Management program covers the fundamentals of project management in an industry context, and will provide you with fundamental project management skills that can be applied across any industry.

Core subjects include project management, project finance, complex project coordination, analytics, statistics, risk management, organisational behaviour and psychology. These subjects are integrated with units of study from your chosen stream from the start of your studies. This degree is also an ideal complement to the Bachelor of Engineering Honours and is offered as a combined degree.

Career opportunities are varied as project management skills are transferable across industries. Graduates will be highly sought after and could work in professional and management roles in property development, construction, mining, IT, banking and finance, state or federal government or in consultancy roles in the engineering, water, health or energy sector. Project management skills and methodologies can be applied to a variety of situations, including disease and disaster recovery scenarios where an innovative and dynamic approach is required.

The Bachelor of Project Management is offered in three streams:

- The Built Environment stream typically focuses on the Architectural field.
- The stream of Civil Engineering Science typically focuses on the civil engineering field.
- Software Engineering Science focuses on the application of learning to the Computer and IT industry.

For a standard enrolment plans for the various Project Management streams visit http://cusp.sydney.edu.au/engineering

Bachelor of Engineering Honours and Project Management

Course Overview

This combined degree provides students with the opportunity to develop both the technical expertise required in the engineering stream of their choice and the project management expertise to manage large projects. Many of the Bachelor of Engineering Honours specialisations can be combined with the Bachelor of Project Management. Core project management subjects include project finance, project management, complex project coordination, analytics, statistics, risk management, organisational behaviour and psychology.

The Bachelor of Engineering Honours/Bachelor of Project Management is available in the following Engineering streams:

- Aeronautical Engineering
- Aeronautical (Space) Engineering
- Biomedical Engineering
- Chemical and Biomolecular Engineering
- Civil Engineering
- Electrical Engineering
- Mechanical Engineering
- Mechanical (Biomedical) Engineering
- Mechanical (Space) Engineering
- Mechatronic Engineering
- Mechatronic (Space) Engineering
- Electrical (Power) Engineering
- Software Engineering

Course Requirements

To meet the requirements of the Bachelor of Engineering Honours and Project Management, a candidate must successfully complete 240 credit points, comprising:

1. the core units of study as set out in the Bachelor of Project Management unit of study table;
2. the units of study specified for the relevant stream of Engineering and
3. any additional elective units of study as may be necessary to gain credit to complete the requirements of the degree.

For a standard enrolment plan for the various Project Management streams visit http://cusp.sydney.edu.au/engineering

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Bachelor of Engineering Honours and Bachelor of Project Management			
Candidates for the degree of Bachelor of Engineering Honours and Bachelor of Project Management are required to gain credit for the Project Management core units of study set out below. Any additional credit necessary to satisfy the degree requirement of not less than 96 credit points in Project Management shall be gained by completing additional elective units of study, as recommended by the School.			
Core units of study			
First Year			
MATH1001 **Differential Calculus**	3	**A** HSC Mathematics Extension 1 **N** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001	Semester 1 Summer Main
MATH1002 **Linear Algebra**	3	**A** HSC Mathematics or MATH1111 **N** MATH1902, MATH1012, MATH1014	Semester 1 Summer Main
MATH1003 **Integral Calculus and Modelling**	3	**A** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **N** MATH1013, MATH1903, MATH1907	Semester 2 Summer Main
MATH1005 **Statistics**	3	**A** HSC Mathematics **N** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021	Semester 2 Summer Main Winter Main
ENGG1850 **Introduction to Project Management**	6	**N** QBUS2350, CIVL3805	Semester 1
ENGG1801 **Engineering Computing**	6		Semester 1 Summer Late
BUSS1040 **Economics for Business Decision Making**	6	**N** ECOF1005 *This unit of study is a compulsory part of the Bachelor of Commerce and combined Bachelor of Commerce degrees.*	Semester 1 Semester 2
PSYC1002 **Psychology 1002**	6		Semester 2 Summer Main
Second Year			
ENGG2850 **Introduction to Project Finance**	6	**N** CIVL3812	Semester 1
ENGG2851 **Data Analytics for Project Management**	6	**P** ENGG1850 AND (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 or MATH1905)	Semester 1
ENGG2852 **Project Based Organisational Behaviour**	6	**P** ENGG1850 AND PSYC1002	Semester 2
ENGG2855 **Project Quality Management**	6	**P** ENGG1850	Semester 2
Third Year			
ENGG3853 **Project Risk Mgnt Tools & Techniques**	6	**P** ENGG2851. **N** CIVL4810	Semester 1
PMGT3858 **Complex Project Coordination**	6	**P** ENGG1850 AND ENGG2852.	Semester 1
ENGG3854 **Negotiating and Contracting**	6	**P** ENGG1850 AND ENGG2850 AND ENGG2852. **N** CIVL3813	Semester 2
PMGT3855 **Project Variance Analysis**	6	**P** ENGG2851	Semester 2
Honours Year			
The following units of study will be available for students wishing to enter the BPM Honours program in 2015. PMGT4850: Project Management Honours Project A PMGT4851: Project Management Honours Project B Select 24 cp from the following list of electives:			
PMGT5875 **Project Innovation Management**	6		Semester 1 Semester 2
PMGT5876 **Strategic Delivery of Change**	6	**N** WORK6026	Semester 1 Semester 2
PMGT5879 **Strategic Portfolio & Program Management**	6		Semester 1 Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
PMGT5886 **System Dynamics Modelling for PM**	6		Semester 2
PMGT5893 **Statistical Methods in PM** *This unit of study is not available in 2015*	6	*Note: Department permission required for enrolment*	Semester 1
PMGT6867 **Quantitative Methods: Project Management**	6	**A** Expect the basic understanding of the organisational context of projects and limited experience of working in a project team. Also, familiarity of different quantitative methods applied in the context of different project environments.	Semester 1 Semester 2

Notes

1. The Honours program is completed as an additional year. Students are required to achieve a minimum 65% average mark in the Intermediate and Senior units of the above program to be eligible for entry to Project Management Honours.

2. For core units of study offered by other than the Faculty of Engineering, any assumed knowledge, prerequisite and corequisite requirements will be as prescribed by the Faculty.

3. Most Mathematics, Chemistry, Physics and Computer Science units of study offered by the Faculty of Science can be replaced by equivalent advanced level units of study subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing advanced options should seek advice from the relevant department before enrolling.

Project Management Recommended Electives

In addition to the core units in the above table, students will need to complete 12 credit points of electives to gain a total of 96 credit points as required for the degree. The following list are recommend units.

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
PMGT2854 **Implementing Concurrent Projects**	6	**P** ENGG1850 AND ENGG2850	Semester 2
PMGT3856 **Sustainable Project Management**	6		Semester 1
PMGT3857 **International Project Management**	6		Semester 2

Alternative elective units may be taken with approval of the Head of School.

For a standard enrolment plans for the various Project Management streams visit http://cusp.sydney.edu.au/engineering

Unit of Study Descriptions

Bachelor of Engineering Honours and Bachelor of Project Management

Candidates for the degree of Bachelor of Engineering Honours and Bachelor of Project Management are required to gain credit for the Project Management core units of study set out below. Any additional credit necessary to satisfy the degree requirement of not less than 96 credit points in Project Management shall be gained by completing additional elective units of study, as recommended by the School.

Core units of study

First Year

MATH1001
Differential Calculus

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001 **Assumed knowledge:** HSC Mathematics Extension 1 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1001 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study looks at complex numbers, functions of a single variable, limits and continuity, vector functions and functions of two variables. Differential calculus is extended to functions of two variables. Taylor's theorem as a higher order mean value theorem.

Textbooks
As set out in the Junior Mathematics Handbook.

MATH1002
Linear Algebra

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1902, MATH1012, MATH1014 **Assumed knowledge:** HSC Mathematics or MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1002 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study introduces vectors and vector algebra, linear algebra including solutions of linear systems, matrices, determinants, eigenvalues and eigenvectors.

Textbooks
As set out in the Junior Mathematics Handbook

MATH1003
Integral Calculus and Modelling

Credit points: 3 **Session:** Semester 2, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1013, MATH1903, MATH1907 **Assumed knowledge:** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1003 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.This unit of study first develops the idea of the definite integral from Riemann sums, leading to the Fundamental Theorem of Calculus. Various techniques of integration are considered, such as integration by parts.The second part is an introduction to the use of first and second order differential equations to model a variety of scientific phenomena.

Textbooks
As set out in the Junior Mathematics Handbook

MATH1005
Statistics

Credit points: 3 **Session:** Semester 2, Summer Main, Winter Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021 **Assumed knowledge:** HSC Mathematics **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1005 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit offers a comprehensive introduction to data analysis, probability, sampling, and inference including t-tests, confidence intervals and chi-squared goodness of fit tests.

Textbooks
As set out in the Junior Mathematics Handbook

ENGG1850
Introduction to Project Management

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Laboratory 1 hr/week. **Prohibitions:** QBUS2350, CIVL3805 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Organisations today are heavily reliant on projects as part of their daily operations. A project is a temporary endeavour undertaken with limited resources to achieve organisational goals that are linked to broader organisational strategies and missions. Project management is therefore the process of planning, scheduling, resourcing, budgeting and monitoring the various phases of a project.

"Introduction to Project Management" is an introductory course that teaches students essential principles and concepts of project management, its application and related technologies. Students will learn about the project organisation, its structure, and role of the project manager, project sponsor and project committee. In addition, students will also learn how to identify business problems that require project-based solutions, how to select and evaluate projects, develop a business case, and manage the project at a basic level.

At completion of the course, students will have a high-level understanding of project management concepts, which equips them with basic technical and managerial skills required for project-based organisations.

ENGG1801
Engineering Computing

Credit points: 6 **Session:** Semester 1, Summer Late **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will introduce students to fundamental principles of programming. The language used will be Matlab but the principles taught are readily portable to other languages like C and Java. The unit material will be presented in a manner which will help students to draw a connection between programming constructs and real engineering applications. The unit will use engineering inspired case-studies : especially from Civil, Chemical, Aerospace and Mechanical streams, to motivate new material. There will be a major project which uses programming to solve a real world engineering problem. The extensive Matlab library for visualization will also be introduced. Matlab will cover two-thirds of the unit. The remaining one-third will be devoted to the use of Excel in engineering scenarios. Furthermore, cross integration between Matlab and Excel will also be highlighted.

BUSS1040
Economics for Business Decision Making

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** 1x 2hr lecture and 1x 1hr tutorial per week **Prohibitions:** ECOF1005 **Assessment:** written assignment (15%), on-line quizzes (10%), mid-semester exam (20%), and final exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This unit of study is a compulsory part of the Bachelor of Commerce and combined Bachelor of Commerce degrees.

Economics underlies all business decisions, from pricing, to product development, to negotiations, to understanding the general economic environment. This unit provides an introduction to economic analysis with a particular focus on concepts and applications relevant to business. This unit addresses how individual consumers and firms make decisions and how they interact in markets. It also introduces a framework for understanding and analysing the broader economic and public policy environment in which a business competes. This unit provides a rigorous platform for further study and a major in economics as well as providing valuable tools of analysis that complement a student's general business training, regardless of their area of specialisation.

PSYC1002
Psychology 1002

Credit points: 6 **Teacher/Coordinator:** Dr Caleb Owens **Session:** Semester 2, Summer Main **Classes:** Three 1 hour lectures and one 1 hour tutorial per week, plus 1 hour per week of additional web-based (self-paced) material related to the tutorial. **Assessment:** One 2.5 hour exam, one 1250 word research report, multiple tutorial tests, experimental participation (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Psychology 1002 is a further general introduction to the main topics and methods of psychology, and it is the basis for advanced work as well as being of use to those not proceeding with the subject. Psychology 1002 covers the following areas: human mental abilities; learning, motivation and emotion; visual perception; cognitive processes; abnormal psychology.

This unit is also offered in the Sydney Summer School. For more information consult the web site:

http://sydney.edu.au/summer_school/

Textbooks
Course Coordinator will advise

Second Year

ENGG2850
Introduction to Project Finance

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Laboratory 1 hr/week. **Prohibitions:** CIVL3812 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is a theory and case study based UoS providing students with a unified approach to the analysis of project value, supported by explicit methods for ranking and selection of projects on the basis of returns and sensitivity. The UoS uses "Project Finance" as a vehicle for descibing the fundamentals of project management financing and contrasts it with "Direct Financing", a more traditional approach to funding projects.

ENGG2851
Data Analytics for Project Management

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Laboratory 1 hr/week. **Prerequisites:** ENGG1850 AND (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 or MATH1905) **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Project Management Data analytics (DA) provides extensive coverage related to examining raw data with the purpose of drawing conclusions about that information. It is used in many industries to allow companies and organization to make better business decisions and in the sciences to verify or disprove existing models or theories. Here, we focus our effort on providing in-depth knowledge and skills to students focusing on inference, process of deriving a conclusion based solely on what is already known by the project manager.

ENGG2852
Project Based Organisational Behaviour

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Laboratory 1 hr/week. **Prerequisites:** ENGG1850 AND PSYC1002 **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Project based organisational behaviour focuses on human behaviour in organisational and project based context, with a focus on individual and group processes and actions. It involves an exploration of organisational and managerial processes in the dynamic context of organisation and is primarily concerned with human implications of project based activity. In this UOS, we offer a succinct, lively and robust introduction to the subject of organizational behaviour. It aims to encourage critical examination of the theory of organisational behaviour whilst also enabling students to interpret and deal with real organisational problems in project management and combines relative brevity with thorough coverage and plentiful real-world examples.

ENGG2855
Project Quality Management

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 1 hr/week; Tutorial 1 hr/week. **Prerequisites:** ENGG1850 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Project Quality Management offers a specific, succinct, step-by-step project quality management process. It offers an immediate hands-on capability to improve project implementation and customer satisfaction in any project domain and will help maintain cost and schedule constraints to ensure a quality project. This UOS introduces tools and techniques that implement the general methods defined in A Guide to the Project Management Body of Knowledge-Third Edition (PMBOK) published by the Project Management Institute (PMI), and augment those methods with more detailed, hands-on procedures that have been proven through actual practice. This UOS is aimed at providing students an explicit step-by-step quality management process, along with a coherent set of quality tools organised and explained according to their application within this process that can be applied immediately in any project context. It further introduces a Wheel of Quality that codifies in one complete image the contributing elements of contemporary quality management. It also help in understanding the process for establishing a new quality tool, the pillar diagram, that provides a needed capability to identify root causes of undesirable effects.

Third Year

ENGG3853
Project Risk Mgnt Tools & Techniques

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Laboratory 1 hr/week. **Prerequisites:** ENGG2851. **Prohibitions:** CIVL4810 **Assessment:** Through semester assessment (70%) Final Exam (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Project risk management is considered to be one of the most vital of the nine content areas of the Project Management Body of Knowledge

(PMBOK) as also developed by ISO/IEC 31010 (The International Organization for Standardization and The International Electrotechnical Commission (IEC)): Risk management - Risk assessment techniques. Important projects tend to be time constrained, pose significant technological and sociological challenges, and suffer from a lack of adequate resources and understanding of the risks involved at varying scales and different times. This UOS covers most relevant tools and techniques for identifying and managing project risk from a theoretical and practical perspective so that possibility of failure in critical projects can be minimised - e.g. through failure mode and effect analysis (FMEA). It offers students a step by step systematic approach through every phase of a project, showing them how to consider the possible risks involved at every stage in the process. Drawing on real-world situations and examples, this UOS outlines proven methods, demonstrating key ideas for project risk planning and showing how to use system-level risk assessment tools. It further offers guidance related to analysis aspects such as available resources, project scope, and scheduling, and also explores the growing area of Enterprise Risk Management.

PMGT3858
Complex Project Coordination

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** ENGG1850 AND ENGG2852. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Complex projects have always existed, but their frequency and importance are increasing in a complex, intertwined world. 'Complex' is qualitatively different from 'complicated.' Complex projects are characterised by a web of interactions between their elements that lead to non-linearity, emergence, adaptiveness and other novel features. That is to say, they behave as Complex Adaptive Systems, and they should be managed as such. The majority of projects demonstrate some degree of complexity. The traditional model of projects is expressed in standard methodologies such as PMBoK, Prince2, and MS Project. While absolutely necessary as a basis for effective project management, the limitations of these methodologies become evident when uncertainty - structural, technical, directional or temporal - begins to intrude on a project. In these situations, a systemic pluralist approach is to be preferred. Project management then becomes less like painting by numbers, and more like selecting from a rich and broad palette of methods, tools and techniques. Such competencies can make a substantial difference, in a complex world with an unacceptably high rate of project failure.

ENGG3854
Negotiating and Contracting

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 1 hr/week; Tutorial 1 hr/week. **Prerequisites:** ENGG1850 AND ENGG2850 AND ENGG2852. **Prohibitions:** CIVL3813 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

In this UOS, we draw on examples on project negotiation and contracting from "real-life" business situations and provide practical information on what to do and what not to do. Student would be exposed to the complexity involved in negotiation and contracting from initiation to formalization of final form of contract which is agreed upon and executed by all parties. Students will be taught how to understand each party's interests and then working towards reaching a common goal. In particular, dealing with complex characters including situations will be covered.

We will provide a basic understanding of commercial contracts and all their ramifications every step of the way. This UOS also explains the basics of commercial contract law, highlights how to spot potential issues before they become a problem and then how to work with a lawyer more effectively if things go wrong which is intended for corporate managers rather than lawyers. This UOS further contains coverage on forming contracts, restitution, contract interpretation, modification and dispute resolution. We also discuss remedies, performance, and third-party beneficiaries.

PMGT3855
Project Variance Analysis

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 1 hr/week; Tutorial 1 hr/week. **Prerequisites:** ENGG2851 **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Project variance analysis uniquely shows project managers how to effectively integrate technical, schedule, and cost objectives by improving earned value management (EVM) practices. Providing innovative guidelines, methods, examples, and templates consistent with capability models and standards, this UOS approaches EVM from a practical level with understandable techniques that are applicable to the management of any project. It also explains how to incorporate EVM with key systems engineering, software engineering, and project management processes such as establishing the technical or quality baseline, requirements management, using product metrics, and meeting success criteria for technical reviews. Detailed information is included on linking product requirements, project work products, the project plan, and the Performance Measurement Baseline (PMB), as well as correlating technical performance measures (TPM) with EVM.

Honours Year

The following units of study will be available for students wishing to enter the BPM Honours program in 2015.PMGT4850: Project Management Honours Project APMGT4851: Project Management Honours Project BSelect 24 cp from the following list of electives:

PMGT5875
Project Innovation Management

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 10 hrs; Tutorial 4 hrs. May also be offered in block mode. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Online

This course focus on the impact of innovation into the project management practice. Important trends in innovation in project organisation, management and delivery are identified and their implications for project management explored. Major topics include: trends, such as ``open source``model rather than protected intellectual property innovation structure; impact of the open innovation structure on organisational project management; improved understanding of the client requirements and achievement of quality goals through tools and methodologies based on an user driven approach; distribution of innovation over many independent but collaborating actors; and the importance of diverse thinking toolkits(for example: design thinking, systems thinking, integrative thinking, and hybrid thinking) that empower users to innovate for themselves.

PMGT5876
Strategic Delivery of Change

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Seminar 16 hrs. May also be offered in block mode. **Prohibitions:** WORK6026 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Online

Welcome to PMGT5876 Strategic Delivery of Change. This course is designed to foster and promote critical thinking and the application of good theory to inform good practice in the strategic delivery of organisational change. The philosophy underpinning this course is design thinking. You will learn quite a bit about this idea over the duration of the course, and why it is increasingly important to change management. The course develops capabilities that will differentiate you from the average project manager and change agent, and which are in high demand in forward thinking organisations.

PMGT5879
Strategic Portfolio & Program Management

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. May also be offered in block mode. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Online

This unit specifically addresses the selection and prioritisation of multiple programmes and projects which have been grouped to support an organisation's strategic portfolio. The allocation of programmes of work within a multi-project environment, governing, controlling and supporting the organisation's strategy, are considered. The aim is to formulate and manage the delivery of the portfolio of strategies using programme management. Students will learn and practice the issues to be considered in selecting an effective organisation portfolio and how to implement a Portfolio Management Framework. Also they will encounter the many conflicting issues facing Program Managers as they seek to implement organisation strategy through programs and learn how to balance these to obtain desired outcomes.

PMGT5886
System Dynamics Modelling for PM

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) evening

Students should achieve an understanding of the roles of statistical methods, coordinate transformations, and mathematical analysis in mapping complex, unpredictable dynamical systems. Systems Thinking is a more natural and better way to think, learn, act, and achieve desired results. Effectively implemented, it can dramatically improve a manager`s effectiveness in today`s complex and interconnected business world. This course provides managers with many practical new Systems Thinking tools and the main concepts of Systems Thinking to enhance individual, team, and organizational learning, change, and performance.

PMGT5893
Statistical Methods in PM

Credit points: 6 **Session:** Semester 1 **Classes:** 3hrs Weekly (evening) **Assessment:** Through semester assessment (40%), Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) evening

Note: Department permission required for enrolment.

Aims: Students should achieve an understanding of the applications of statistical methods in project environments.

Objectives: Students should be able to:

- Conduct hypothesis test and draw conclusions;
- Apply regression analysis to examine relationships between variables;
- Explain the relationships between variables;
- Describe the distributions of variables;
- Draw conclusions based on results observed in a sample;
- Discuss the application of statistical model for project selection;
- Appl the statistical techniques learned to a range of different "real world" situations;
- Apply R in analyzing and evaluating statisitcal information.

By the end of this unit of study, students should be able to:

- Discuss the applications of statistical methods;
- Evaluate a project situation based on statistical results; and
- Apply simple statistical methods to problem-solving in project management.

PMGT6867
Quantitative Methods: Project Management

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1.75 hrs/week; Tutorial 1.25 hrs/week. **Assumed knowledge:** Expect the basic understanding of the organisational context of projects and limited experience of working in a project team. Also, familiarity of different quantitative methods applied in the context of different project environments. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Online

Methods studied in this unit are used in a wide range of project management tasks and problems. The unit explains why and where particular methods are used and provides examples and opportunities to apply these methods in practice. This UoS will also facilitate the understanding of the mechanics of these methods and their underlying theory.

Notes

1. The Honours program is completed as an additional year. Students are required to achieve a minimum 65% average mark in the Intermediate and Senior units of the above program to be eligible for entry to Project Management Honours.2. For core units of study offered by other than the Faculty of Engineering, any assumed knowledge, prerequisite and corequisite requirements will be as prescribed by the Faculty.3. Most Mathematics, Chemistry, Physics and Computer Science units of study offered by the Faculty of Science can be replaced by equivalent advanced level units of study subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing advanced options should seek advice from the relevant department before enrolling.

Project Management Recommended Electives

In addition to the core units in the above table, students will need to complete 12 credit points of electives to gain a total of 96 credit points as required for the degree. The following list are recommend units.

PMGT2854
Implementing Concurrent Projects

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 1 hr/week; Tutorial 1 hr/week. **Prerequisites:** ENGG1850 AND ENGG2850 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

What is concurrent engineering? What are the different components? Why do we need to get products to market fast? What really matters? Starting with a vision, creating great teams that work and creating processes that work effectively around the teams. Teams need to complement processes, and processes need to complement teams. Individuals and teams also evolve processes. In fact great systems are those that can evolve and adapt without a centralised management. The artist that creates a great system is the one that can make a sustainable design.

PMGT3856
Sustainable Project Management

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The concepts of sustainability and corporate responsibility are gaining importance in our globalised economy. They have been increasingly influencing business and project objectives and it is becoming imperative that they are incorporated into the practice of project management.

This unit of study embraces this new reality by providing students with an expanded understanding of value creation and how this is delivered through projects. The emphasis is on using projects to deliver value in terms of economic capital whilst also developing social capital and preserving natural capital. These will be underpinned by an appreciation of the standards, principles and frameworks that exist, both in Australia and internationally, to govern the preservation of the environment and increase the development of social capital.

Case studies will be used to create learning processes as students consider and confront the dilemmas that project managers face as they strive to deliver shareholder value via fiscal project objectives as well as face increasing pressure to deliver to reduce environmental impacts. Cases discussed in this UOS will allow students to explore both the opportunities and pitfalls companies and non-government organisations face in targeting sustainability issues and how their values and core assumptions impact their business strategies.

Concepts such as corporate responsibility, the triple bottom line, the business case for sustainability, supply chain management and responsible purchasing and knowledge management will be discussed and students will consider how these influence project delivery.

PMGT3857
International Project Management

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 1 hr/week; Tutorial 1 hr/week. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This UOS provides specific guidelines for achieving greater international project success. It addresses the need for modern techniques in project management geared and suited to international projects. It provides opportunity to students to have orientation towards lessons learned from failures and problems in international projects, and suggest alternative solutions for project issues. The critical success factors for managing international projects together with management issues related to vendors and outsourcing across national boundaries are also discussed. It further deals with managing businesses effectively address cross- cultural, social, and political issues.

Alternative elective units may be taken with approval of the Head of School.
For a standard enrolment plans for the various Project Management streams visit http://cusp.sydney.edu.au/engineering

Bachelor of Project Management

Course Overview

The Bachelor of Project Management uses multidisciplinary theories and methods to investigate a particular phenomenon from a holistic viewpoint. The program covers the fundamentals of project management in an industry context, and will provide you with fundamental project management skills that can be applied across any industry.

Core subject areas include project management, project finance, complex project coordination, analytics, statistics, risk management, organisational behaviour and psychology. These subjects are integrated with units of study from your chosen stream from the start of your studies.

The Bachelor of Project Management is offered in three streams:

- The Built Environment stream typically focuses on the Architectural field.
- The stream of Civil Engineering Science typically focuses on the civil engineering field.
- Software Engineering Science focuses on the application of learning to the Computer and IT industry.

Course Requirements

To meet the requirements of the Bachelor of Project Management, a candidate must successfully complete 144 credit points, comprising:

1. the core units of study as set out in the Bachelor of Project Management unit of study table;
2. the units of study specified for the relevant stream of the degree and
3. any additional elective units

For a standard enrolment plan for the various Project Management streams visit http://cusp.sydney.edu.au/engineering

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Bachelor of Project Management			
Candidates for the degree of Bachelor of Project Management are required to gain credit points for the core units of study set out below. Any additional credit necessary to satisfy the degree requirement of not less than 144 credit points shall be gained by completing additional elective units of study, as recommended by the School (as set out below). Students in BPM must complete the requirements of one of the three streams; Civil Engineering Science; Built Environment; Software. Requirements for each stream are shown below.			
Core units of study			
First year: all streams			
MATH1001 **Differential Calculus**	3	**A** HSC Mathematics Extension 1 **N** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001	Semester 1 Summer Main
MATH1002 **Linear Algebra**	3	**A** HSC Mathematics or MATH1111 **N** MATH1902, MATH1012, MATH1014	Semester 1 Summer Main
MATH1003 **Integral Calculus and Modelling**	3	**A** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **N** MATH1013, MATH1903, MATH1907	Semester 2 Summer Main
MATH1005 **Statistics**	3	**A** HSC Mathematics **N** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021	Semester 2 Summer Main Winter Main
ENGG1850 **Introduction to Project Management**	6	**N** QBUS2350, CIVL3805	Semester 1
ENGG1801 **Engineering Computing**	6		Semester 1 Summer Late
BUSS1040 **Economics for Business Decision Making**	6	**N** ECOF1005 *This unit of study is a compulsory part of the Bachelor of Commerce and combined Bachelor of Commerce degrees.*	Semester 1 Semester 2
PSYC1002 **Psychology 1002**	6		Semester 2 Summer Main
First year: Civil Engineering Science stream			
ENGG1800 **Engineering Disciplines (Intro) Stream A**	6		Semester 1
ENGG1802 **Engineering Mechanics**	6		Semester 2 Summer Main
First Year: Built Environment stream			
DAAE2001 **20th Century Australian Architecture**	6	**N** DESA2305	Semester 2
DAAE2002 **Architecture, Place and Society**	6	**N** DESA2211	Semester 1
First Year: Software stream			
INFO1103 **Introduction to Programming**	6		Semester 1 Semester 2
INFO1105 **Data Structures**	6	**P** INFO1003 or INFO1103 or INFO1903 or INFS1000	Semester 2
Second year: All streams			
ENGG2850 **Introduction to Project Finance**	6	**N** CIVL3812	Semester 1
ENGG2851 **Data Analytics for Project Management**	6	**P** ENGG1850 AND (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 or MATH1905)	Semester 1
ENGG2852 **Project Based Organisational Behaviour**	6	**P** ENGG1850 AND PSYC1002	Semester 2
ENGG2855 **Project Quality Management**	6	**P** ENGG1850	Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Second Year: Civil Engineering Science stream			
CIVL2201 **Structural Mechanics**	6	**A** From ENGG1802 Engineering Mechanics, students should be competent in the following areas. 1. The concept of force and momentum equilibrium in two and three dimensions. 2. Drawing free body diagrams. 3. Establishing and solving the equations of equilibrium from the FBD. 4. Setting out solutions logically, clearly and neatly. Students should be competent incertain mathematical skills. 1. Solving algebraic equations. 2. Differentiation and integration (including double integrals). 3. Drawing graphs of polynomials (especially) and other mathematical function. 4. Trigonometry. **P** ENGG1802 **N** AMME2301	Semester 1
CIVL2230 **Intro to Structural Concepts and Design**	6	**A** CIVL2110 AND CIVL2201 AND ENGG1802. Structural mechanics, first year mathematics, but these are not prerequisites *Basic structural elements include beams, columns slabs and simple frames.*	Semester 2
Second Year: Built Environment stream			
DESP1001 **Introductory Urban Design and Planning**	6	**N** DESP1201	Semester 2
DESC9014 **Building Construction Technology**	6		Semester 1
Second Year: Software stream			
INFO2120 **Database Systems 1**	6	**P** INFO1003 OR INFO1103 OR INFO1903 OR INFS1000 OR DECO1012. **N** INFO2820, INFO2905, COMP5138	Semester 1
INFO2110 **Systems Analysis and Modelling**	6	**A** Experience with a data model as in INFO1003 or INFO1103 or INFS1000	Semester 2
Third year: All streams			
ENGG3853 **Project Risk Mgnt Tools & Techniques**	6	**P** ENGG2851. **N** CIVL4810	Semester 1
ENGG3854 **Negotiating and Contracting**	6	**P** ENGG1850 AND ENGG2850 AND ENGG2852. **N** CIVL3813	Semester 2
PMGT3850 **Project Management Capstone Project A**	6	**P** 30 credits of 2nd year units of study *It is expected that the project will be conducted over two consecutive semesters and that the majority of students will start in Semester 1. Commencement in Semester 2 requires permission of the course coordinator and School`s Director of Learning & Teaching and will only be allowed where there are good reasons for doing so. Students considering this option should discuss it with the the course coordinator at least one semester before they intend to start.*	Semester 1
PMGT3851 **Project Management Capstone Project B**	6	**P** 30 credits of 2nd year units of study	Semester 2
PMGT3855 **Project Variance Analysis**	6	**P** ENGG2851	Semester 2
PMGT3858 **Complex Project Coordination**	6	**P** ENGG1850 AND ENGG2852.	Semester 1
Third Year: Civil Engineering Science stream			
CIVL2810 **Engineering Construction and Surveying**	6	**A** MATH1001, MATH1002, MATH1003, MATH1005 *In recent years - the course has included a 1.5 day camp at Webbs Creek (about 80km from Sydney). The camp is located in a bushland setting. It aims to provide valuable practice in practical field survey and has a secondary aim of providing a basis for social gathering (this aspect being requested in student feedback over recent years)*	Semester 1
Select one of the following units			
CIVL2410 **Soil Mechanics**	6	**A** Knowledge: CIVL2201 AND GEOL1501. An understanding of simple statics, equilibrium, forces and bending moments, and of stress and strain and the relationship between them. This is covered by University of Sydney courses ENGG 1802 Engineering Mechanics, CIVL2201 Structural Mechanics. Familiarity with the use of spreadsheets (Excel, Mathcad) to obtain solutions to engineering problems, and with the graphical presentation of this data. Familiarity with word processing packages for report presentation. Some of this is covered in the University of Sydney course ENGG1801 Engineering Computing. Familiarity with partial differential equations, and their analytical and numerical solution.	Semester 2
CIVL2611 **Introductory Fluid Mechanics**	6	**A** CIVL2201 AND ENGG1802 AND MATH1001. Students are expected to have a strong understanding of fundamental physics, statics, equilibrium, forces, and dimensional analysis. Familiarity with simple calculus, partial differential equations, and the analytical and numerical solutions.	Semester 2
Third Year: Built Environment stream			
DESC9074 **Project Management**	6	*Note: Department permission required for enrolment*	Semester 2
DESC9200 **Introduction to Architectural Science**	6		Semester 1
Third Year: Software stream			
ELEC3609 **Internet Software Platforms**	6	**P** INFO1103, INFO2110, (INFO2120 or INFO2820) **N** EBUS4001	Semester 2
ELEC3610 **E-Business Analysis and Design**	6	**N** EBUS3003	Semester 1

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Project Management Honours			
Student undertaking Honours in Project Management enrol in the following Honours Project units.			
PMGT4850 **Project Management Honours Project A**	12	**P** Students are required to achieve a minimum 65% average mark in the Intermediate and Senior units of the normal BPM program to be eligible for entry to Honours. *Note: Department permission required for enrolment* *It is expected that the Thesis will be conducted over two consecutive semesters and that the majority of students will start in Semester 1. Commencement in Semester 2 requires permission of Thesis coordinator (who may consult the Undergraduate or Program)*	Semester 1 Semester 2
PMGT4851 **Project Management Honours Project B**	12	*Note: Department permission required for enrolment* *It is expected that the Thesis will be conducted over two consecutive semesters and that the majority of students will start in Semester 1. Commencement in Semester 2 requires permission of Thesis coordinator (who may consult the Undergraduate or Program)*	Semester 1 Semester 2
Select 24 credit points from the following list of electives.			
PMGT5875 **Project Innovation Management**	6		Semester 1 Semester 2
PMGT5876 **Strategic Delivery of Change**	6	**N** WORK6026	Semester 1 Semester 2
PMGT5879 **Strategic Portfolio & Program Management**	6		Semester 1 Semester 2
PMGT5886 **System Dynamics Modelling for PM**	6		Semester 2
PMGT6867 **Quantitative Methods: Project Management**	6	**A** Expect the basic understanding of the organisational context of projects and limited experience of working in a project team. Also, familiarity of different quantitative methods applied in the context of different project environments.	Semester 1 Semester 2

Notes

1. The Honours program is completed as an additional year. Students are required to achieve a minimum 65% average mark in the Intermediate and Senior units of the above program to be eligible for entry to Honours.

2. For core units of study offered by other than the Faculty of Engineering, any assumed knowledge, prerequisite and corequisite requirements will be as prescribed by the faculty.

3. Candidates for the degree of Bachelor of Project Management are expected to complete all the core units of study listed above. They are also required to gain additional 12 credit points from a choice of free elective units offered by the University of Sydney.

4. Most Mathematics, Chemistry, Physics and Computer Science units of study offered by the Faculty of Science can be replaced by equivalent advanced level units of study subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing advanced options should seek advice from the relevant department before enrolling.

5. Students undertaking the Honours program may enrol in alternative postgraduate Project Management units with permission of the Program Director.

Project Management Recommended Electives

In addition to the core units in the above table students will need to complete electives to gain a total of 144 credit points as required for the degree. The following list are recommend units.

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
PMGT2854 **Implementing Concurrent Projects**	6	**P** ENGG1850 AND ENGG2850	Semester 2
PMGT3856 **Sustainable Project Management**	6		Semester 1
PMGT3857 **International Project Management**	6		Semester 2
Alternative elective units may be taken with approval of the Head of School.			

For a standard enrolment plans for the various Project Management streams visit http://cusp.sydney.edu.au/engineering

Unit of Study Descriptions

Bachelor of Project Management

Candidates for the degree of Bachelor of Project Management are required to gain credit points for the core units of study set out below. Any additional credit necessary to satisfy the degree requirement of not less than 144 credit points shall be gained by completing additional elective units of study, as recommended by the School (as set out below).Students in BPM must complete the requirements of one of the three streams; Civil Engineering Science; Built Environment; Software. Requirements for each stream are shown below.

Core units of study

First year: all streams

MATH1001
Differential Calculus

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1111, MATH1901, MATH1906, MATH1011, ENVX1001 **Assumed knowledge:** HSC Mathematics Extension 1 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1001 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study looks at complex numbers, functions of a single variable, limits and continuity, vector functions and functions of two variables. Differential calculus is extended to functions of two variables. Taylor's theorem as a higher order mean value theorem.

Textbooks
As set out in the Junior Mathematics Handbook.

MATH1002
Linear Algebra

Credit points: 3 **Session:** Semester 1, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1902, MATH1012, MATH1014 **Assumed knowledge:** HSC Mathematics or MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1002 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit of study introduces vectors and vector algebra, linear algebra including solutions of linear systems, matrices, determinants, eigenvalues and eigenvectors.

Textbooks
As set out in the Junior Mathematics Handbook

MATH1003
Integral Calculus and Modelling

Credit points: 3 **Session:** Semester 2, Summer Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** MATH1013, MATH1903, MATH1907 **Assumed knowledge:** HSC Mathematics Extension 1 or MATH1001 or MATH1011 or a credit or higher in MATH1111 **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1003 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.This unit of study first develops the idea of the definite integral from Riemann sums, leading to the Fundamental Theorem of Calculus. Various techniques of integration are considered, such as integration by parts.The second part is an introduction to the use of first and second order differential equations to model a variety of scientific phenomena.

Textbooks
As set out in the Junior Mathematics Handbook

MATH1005
Statistics

Credit points: 3 **Session:** Semester 2, Summer Main, Winter Main **Classes:** Two 1 hour lectures and one 1 hour tutorial per week. **Prohibitions:** STAT1022, ECMT1010, MATH1015, ENVX1001, MATH1905, BUSS1020, STAT1021 **Assumed knowledge:** HSC Mathematics **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MATH1005 is designed to provide a thorough preparation for further study in mathematics and statistics. It is a core unit of study providing three of the twelve credit points required by the Faculty of Science as well as a Junior level requirement in the Faculty of Engineering.

This unit offers a comprehensive introduction to data analysis, probability, sampling, and inference including t-tests, confidence intervals and chi-squared goodness of fit tests.

Textbooks
As set out in the Junior Mathematics Handbook

ENGG1850
Introduction to Project Management

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Laboratory 1 hr/week. **Prohibitions:** QBUS2350, CIVL3805 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Organisations today are heavily reliant on projects as part of their daily operations. A project is a temporary endeavour undertaken with limited resources to achieve organisational goals that are linked to broader organisational strategies and missions. Project management is therefore the process of planning, scheduling, resourcing, budgeting and monitoring the various phases of a project.

"Introduction to Project Management" is an introductory course that teaches students essential principles and concepts of project management, its application and related technologies. Students will learn about the project organisation, its structure, and role of the project manager, project sponsor and project committee. In addition, students will also learn how to identify business problems that require project-based solutions, how to select and evaluate projects, develop a business case, and manage the project at a basic level.

At completion of the course, students will have a high-level understanding of project management concepts, which equips them with basic technical and managerial skills required for project-based organisations.

ENGG1801
Engineering Computing

Credit points: 6 **Session:** Semester 1, Summer Late **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will introduce students to fundamental principles of programming. The language used will be Matlab but the principles taught are readily portable to other languages like C and Java. The unit material will be presented in a manner which will help students to draw a connection between programming constructs and real engineering applications. The unit will use engineering inspired case-studies : especially from Civil, Chemical, Aerospace and Mechanical streams, to motivate new material. There will be a major project which uses programming to solve a real world engineering problem. The extensive Matlab library for visualization will also be introduced. Matlab will cover two-thirds of the unit. The remaining one-third will be devoted to the use of Excel in engineering scenarios. Furthermore, cross integration between Matlab and Excel will also be highlighted.

BUSS1040
Economics for Business Decision Making

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** 1x 2hr lecture and 1x 1hr tutorial per week **Prohibitions:** ECOF1005 **Assessment:** written assignment (15%), on-line quizzes (10%), mid-semester exam (20%), and final exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This unit of study is a compulsory part of the Bachelor of Commerce and combined Bachelor of Commerce degrees.

Economics underlies all business decisions, from pricing, to product development, to negotiations, to understanding the general economic environment. This unit provides an introduction to economic analysis with a particular focus on concepts and applications relevant to business. This unit addresses how individual consumers and firms make decisions and how they interact in markets. It also introduces a framework for understanding and analysing the broader economic and public policy environment in which a business competes. This unit provides a rigorous platform for further study and a major in economics as well as providing valuable tools of analysis that complement a student's general business training, regardless of their area of specialisation.

PSYC1002
Psychology 1002

Credit points: 6 **Teacher/Coordinator:** Dr Caleb Owens **Session:** Semester 2, Summer Main **Classes:** Three 1 hour lectures and one 1 hour tutorial per week, plus 1 hour per week of additional web-based (self-paced) material related to the tutorial. **Assessment:** One 2.5 hour exam, one 1250 word research report, multiple tutorial tests, experimental participation (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Psychology 1002 is a further general introduction to the main topics and methods of psychology, and it is the basis for advanced work as well as being of use to those not proceeding with the subject. Psychology 1002 covers the following areas: human mental abilities; learning, motivation and emotion; visual perception; cognitive processes; abnormal psychology.

This unit is also offered in the Sydney Summer School. For more information consult the web site:

http://sydney.edu.au/summer_school/

Textbooks
Course Coordinator will advise

First year: Civil Engineering Science stream

ENGG1800
Engineering Disciplines (Intro) Stream A

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 1 hr/week; Laboratory 3 hrs/week. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces students to specialisations in the Engineering discipline areas of Aeronautical, Biomedical Chemical, Civil, Mechanical and Mechatronic Engineering, and Project Engineering and Management. By providing first-year students with an experience of these various engineering streams, the unit aims to develop the students' professional identity as an engineer and thus provide a suitable basis on which students can choose their discipline for further study.

Introductory sessions in the School of Aerospace,

Mechanical and Mechatronic Engineering

-4 weeks-

An overview of the degree requirements in each stream. The roles of the engineer in each stream (employments, skills, etc). How each of the subjects taught relate to the skills/knowledge and applications required of the engineers. Basically make sure students fully understand what engineers are in the discipline areas and why the students do the subjects they do. In each stream, one engineering technical topic will be taught as a problem solving exercise, and this topic will be the focus of the laboratory.

School of Civil Engineering

-4 weeks-

Introductory lectures in Engineering Economics and Construction Planning, Foundation Engineering, Structural Engineering, Materials, Environmental Engineering. Each student will be involved in the erection and dismantling of an 8 metre high steel and timber tower in the Civil Engineering Courtyard. Preliminary lectures related to the tower will include safety issues, loading, statical analysis, foundation calculations, construction management, engineering drawings and detailing, geometric calculations, and survey measurements. Exercises related to these issues will be performed before assembly and disassembly of the tower.

School of Chemical and Biomolecular Engineering

-4 weeks-

This course will enable students to gain an appreciation of: the methods and materials of construction of items of process equipment; the role of this equipment in building an entire chemical processing plant: its operation and maintenance and safety requirements and procedures. Students will dismantle, disassemble and operate items of process equipment. They will present written answers to questions, supplemented by drawings of process flowsheets, diagrams of dismantled equipment, and discussions of heat and mass balances and of process parameters.

ENGG1802
Engineering Mechanics

Credit points: 6 **Session:** Semester 2, Summer Main **Classes:** Lecture 2 hrs/week; Tutorial 3 hrs/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit aims to provide students with an understanding of and competence in solving statics and introductory dynamics problems in engineering. Tutorial sessions will help students to improve their group work and problem solving skills, and gain competency in extracting a simplified version of a problem from a complex situation. Emphasis is placed on the ability to work in 3D as well as 2D, including the 2D and 3D visualization of structures and structural components, and the vectorial 2D and 3D representations of spatial points, forces and moments. Introduction to kinematics and dynamics topics includes position, velocity and acceleration of a point; relative motion, force and acceleration, momentum, collisions and energy methods.

First Year: Built Environment stream

DAAE2001
20th Century Australian Architecture

Credit points: 6 **Teacher/Coordinator:** Dr Akin Sevinc **Session:** Semester 2 **Classes:** Lecture and tutorial contact, plus self-directed preparation and assignments, for a minimum total student commitment averaging 9 hours per week. **Prohibitions:** DESA2305 **Assessment:** One seminar presentation and one 3,000 word essay (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will introduce students to a range of architectural styles and aspirations in Australia. Lectures and seminars will cover key buildings representative of their period. At the conclusion, students will be familiar with a range of styles and their characteristics. They will undertake individual self-directed research and learn how to record and present the results of this research. Students will also acquire an appreciation of the ideals and aspirations that support the architectural styles examined, and how these are related to wider social and cultural movements. On successful completion of this unit, students will be able to demonstrate: a familiarity with a range of Australian buildings and styles. Site tours will examine specific buildings, and these will be recorded in a site visit log; the ability to research, record and present a specific building in Sydney; the ability to link a specific building to other works of a similar style and period. This will be assessed in the seminar presentation and in the submitted essay.

DAAE2002
Architecture, Place and Society

Credit points: 6 **Teacher/Coordinator:** Dr Akin Sevinc **Session:** Semester 1 **Classes:** Lecture and tutorial contact, plus self-directed preparation and assignments, for a minimum total student commitment averaging 9 hours per week. **Prohibitions:** DESA2211 **Assessment:** Graphic and Written Pressentation on Research (40%); Final Research Essay (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to investigate the relationship between architecture, place and society and to explore the meaning of cultural and social sustainability in architectural design. The unit assumes that designers will increasingly work in places where cultures are unfamiliar at home or in a global context, and that an ability to understand, and interpret, diverse cultures, and the way design occurs in diverse locations, is an important area of knowledge for designers. A key aspect of social sustainability is the practice of social responsibility, and the unit explores how this may occur, including involving people in the design process. On completion of this unit students will be able to demonstrate: an ability to better understand the connections between architecture place and society, and the social, cultural, political and economic factors affecting sustainable environments; skills and knowledge in participatory processes necessary for effective communication about environmental design issues; increased critical awareness about social responsibility in relation to the practice of architecture and the design of the built environment, and an ability to exercise this awareness. This unit will provide architecture students with knowledge of the relationship between culture and architecture, as well as practical knowledge of the social aspects of design practice. It is intended that students from other disciplines will develop a critical awareness of the built environment as a form of cultural production, and the possibilities for their participation in its production.

First Year: Software stream

INFO1103
Introduction to Programming

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1 hr/week; Laboratory 2 hrs/week. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Programming in a legible, maintainable, reusable way is essential to solve complex problems in the pervasive computing environments. This unit will equip students with foundation of programming concepts that are common to widely used programming languages. The "fundamentals-first & objects-later" strategy is used to progressively guide this introductory unit from necessary and important building blocks of programming to the object-oriented approach. Java, one of the most popular programming languages, is used in this unit. It provides interdisciplinary approaches, applications and examples to support students from broad backgrounds such as science, engineering, and mathematics.

INFO1105
Data Structures

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** INFO1003 or INFO1103 or INFO1903 or INFS1000 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit will teach some powerful ideas that are central to quality software: data abstraction and recursion. It will also show how one can analyse the scalability of algorithms using mathematical tools of asymptotic notation. Contents include: both external "interface" view, and internal "implementation" details, for commonly used data structures, including lists, stacks, queues, priority queues, search trees, hash tables, and graphs; asymptotic analysis of algorithm scalability, including use of recurrence relations to analyse recursive code. This unit covers the way information is represented in each structure, algorithms for manipulating the structure, and analysis of asymptotic complexity of the operations. Outcomes include: ability to write code that recursively performs an operation on a data structure; experience designing an algorithmic solution to a problem using appropriate data structures, coding the solution, and analysing its complexity.

Second year: All streams

ENGG2850
Introduction to Project Finance

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Laboratory 1 hr/week. **Prohibitions:** CIVL3812 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is a theory and case study based UoS providing students with a unified approach to the analysis of project value, supported by explicit methods for ranking and selection of projects on the basis of returns and sensitivity. The UoS uses "Project Finance" as a vehicle for descibing the fundamentals of project management financing and contrasts it with "Direct Financing", a more traditional approach to funding projects.

ENGG2851
Data Analytics for Project Management

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Laboratory 1 hr/week. **Prerequisites:** ENGG1850 AND (MATH1001 OR MATH1901) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1903) AND (MATH1005 or MATH1905) **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Project Management Data analytics (DA) provides extensive coverage related to examining raw data with the purpose of drawing conclusions about that information. It is used in many industries to allow companies and organization to make better business decisions and in the sciences to verify or disprove existing models or theories. Here, we focus our effort on providing in-depth knowledge and skills to students focusing on inference, process of deriving a conclusion based solely on what is already known by the project manager.

ENGG2852
Project Based Organisational Behaviour

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Laboratory 1 hr/week. **Prerequisites:** ENGG1850 AND PSYC1002 **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Project based organisational behaviour focuses on human behaviour in organisational and project based context, with a focus on individual and group processes and actions. It involves an exploration of organisational and managerial processes in the dynamic context of organisation and is primarily concerned with human implications of project based activity. In this UOS, we offer a succinct, lively and robust introduction to the subject of organizational behaviour. It aims to encourage critical examination of the theory of organisational behaviour whilst also enabling students to interpret and deal with real organisational problems in project management and combines relative brevity with thorough coverage and plentiful real-world examples.

ENGG2855
Project Quality Management

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 1 hr/week; Tutorial 1 hr/week. **Prerequisites:** ENGG1850 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Project Quality Management offers a specific, succinct, step-by-step project quality management process. It offers an immediate hands-on capability to improve project implementation and customer satisfaction in any project domain and will help maintain cost and schedule constraints to ensure a quality project. This UOS introduces tools and techniques that implement the general methods defined in A Guide to the Project Management Body of Knowledge-Third Edition (PMBOK) published by the Project Management Institute (PMI), and augment those methods with more detailed, hands-on procedures that have been proven through actual practice. This UOS is aimed at providing students an explicit step-by-step quality management process, along with a coherent set of quality tools organised and explained according to their application within this process that can be applied immediately in any project context. It further introduces a Wheel of Quality that codifies in one complete image the contributing elements of contemporary quality management. It also help in understanding the process for establishing a new quality tool, the pillar diagram, that provides a needed capability to identify root causes of undesirable effects.

Second Year: Civil Engineering Science stream

CIVL2201
Structural Mechanics

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 3 hrs/week; Tutorial 2 hrs/week; Laboratory 2 hrs/week. **Prerequisites:** ENGG1802 **Prohibitions:** AMME2301 **Assumed knowledge:** From ENGG1802 Engineering Mechanics, students should be competent in the following areas. 1. The concept of force and momentum equilibrium in two and three dimensions. 2. Drawing free body diagrams. 3. Establishing and solving the equations of equilibrium from the FBD. 4. Setting out solutions logically, clearly and neatly. Students should be competent incertain mathematical skills. 1. Solving algebraic equations. 2. Differentiation and integration (including double integrals). 3. Drawing graphs of polynomials (especially) and other mathematical function. 4. Trigonometry. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The primary objective of this unit is to understand internal actions (forces and moments) in structures (deformable objects) under loads in three key areas: how structures resist external loads by internal actions; the distribution of internal actions within structures; and the deformations, stresses and strains associated with the internal actions. At the end of this unit, students should be able to understand the basic methods of load transfer in structures - tension, compression, bending, shear and torsion (internal actions); apply the equations of equilibrium to determine the distribution of internal actions in a simple structure by drawing BMDs, SFDs, AFDs, and TMDs; understand the significance and methods of calculation of the geometric properties of structural sections (I, Z, S, J etc); understand the effect of internal forces and deformations of bodies through the concept and calculation of strains and stresses; appreciate the behaviour of structures by analysing structures without numerical calculations; display a knowledge of basic material properties, combined stresses and failure criteria; and demonstrate their hands-on experience of the behaviour of structural members via experiments and the ability to prepare written reports on those experiments. Emphasis in the assessment scheme will be placed on understanding structural behaviour and solving problems, rather than remembering formulae or performing complex calculations. The course seeks to utilise and improve the generic skills of students, in areas such as problem solving, neat and logical setting out of solutions, report writing, and team work. The syllabus comprises introduction; equilibrium; internal actions: BMDs, SFDs, AFDs, and TMDs; elasticity, stress and strain, and basic material properties; axial forces: tension and compression; elastic bending of beams; shear force and shear stresses in beams; torsion; deflection of beams; pipes and pressure vessels; trusses; material properties, combined stresses and yield criteria; advanced bending; introduction to buckling and instability.

CIVL2230
Intro to Structural Concepts and Design

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1.5 hrs/week. **Assumed knowledge:** CIVL2110 AND CIVL2201 AND ENGG1802. Structural mechanics, first year mathematics, but these are not prerequisites **Assessment:** Through semester assessment (25%) Final Exam (75%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Basic structural elements include beams, columns slabs and simple frames.

The primary objective is to develop an understanding of design concepts and an introduction to the design of steel, concrete and composite structures. This involves calculation of loads on structures caused by gravity, wind and earthquake; and analysis and design of basic structural elements.

Second Year: Built Environment stream

DESP1001
Introductory Urban Design and Planning

Credit points: 6 **Teacher/Coordinator:** Martin Payne **Session:** Semester 2 **Classes:** Lecture 2 hrs/wk; tutorial 6 hrs/semester **Prohibitions:** DESP1201 **Assessment:** Assessment is based on a workbook, which will present background studies, a strategic analysis and a reasoned proposal in response to a planning and design problem, besides a review of literature. Literature review (40%); background studies (20%); strategic analysis (20%); proposal (20%). **Mode of delivery:** Normal (lecture/lab/tutorial) day

Students will develop knowledge of key planning ideas, and be able appreciate the context relevant to designing the built environment. They will be able to prepare strategic analyses of basic planning situations, and to prepare design proposals with supporting arguments. On successful completion of this unit, each student will be able to demonstrate their ability: to prepare short documents, using photos, maps, drawings and other illustrations, with annotated comments and supporting text, to present site analyses; to use basic ideas (such as: vistas, viewing and over-viewing, connectivity, legibility, enclosure, uses, activities, environs, links, built form, interest, amenity networks, nodes) in reviewing design situations and preparing simple site analyses; to apply a critical and reflective approach in understanding design situations, and in preparing informative reports. This is an elective unit, which introduces the Urban Design and Planning stream in the Bachelor of Design in Architecture. Elective in other programs. It is relevant to all architectural design students; it teaches students how to prepare planning studies and basic site plans as preparatory phases of designing buildings and places.

DESC9014
Building Construction Technology

Credit points: 6 **Teacher/Coordinator:** Michael Muir **Session:** Semester 1 **Classes:** 5 day intensive (9am - 5pm) **Assessment:** Two assignments (40%) and (60%) **Mode of delivery:** Block mode

This unit covers three related areas of investigation: basic building construction practices, advanced building construction practices & sustainable construction. It begins by introducing a number of recurrent themes in construction in Australia at the present time including the idea of building culture, the various modes of delivery and variety of classifications of buildings and building elements, rational construction & construction detailing from first principles. There follows a review of construction techniques of domestic scaled buildings using, where appropriate, examples of well documented and/or accessible exemplars. The second part of the unit reviews current approaches to building technologies employed in more complex public and commercial scaled buildings, particularly with regard to processes of structural system selection, façade systems design and construction and material performance. The fundamentals of heat transfer and effects of external conditions on indoor comfort, aspects of the BCA and integration of services into the building fabric relevant to building services engineers will also be reviewed. Again, accessible exemplars will be covered. Finally the unit will review current issues related to key attributes of buildings which make them sustainable, particularly with regard to material selection, appropriate detailing for energy and resources conservation and building reuse and recycling.

Second Year: Software stream

INFO2120
Database Systems 1

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Laboratory 2 hrs/week; Project Work - own time 3 hrs/week. **Prerequisites:** INFO1003 OR INFO1103 OR INFO1903 OR INFS1000 OR DECO1012. **Prohibitions:** INFO2820, INFO2905, COMP5138 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The ubiquitous use of information technology leaves us facing a tsunami of data produced by users, IT systems and mobile devices. The proper management of data is hence essential for all applications and for effective decision making within organizations.

This unit of study will introduce the basic concepts of database designs at the conceptual, logical and physical levels. We will place particular emphasis on introducing integrity constraints and the concept of data normalization which prevents data from being corrupted or duplicated in different parts of the database. This in turn helps in the data remaining consistent during its lifetime. Once a database design is in place, the emphasis shifts towards querying the data in order to extract useful information. The unit will introduce different query languages with a particular emphasis on SQL, which is industry standard. Other topics covered will include the important concept of transaction management, application development with a backend database, an overview of data warehousing and OLAP, and the use of XML as a data integration language.

INFO2110
Systems Analysis and Modelling

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** Experience with a data model as in INFO1003 or INFO1103 or INFS1000 **Assessment:** Through semester assessment (30%) Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides a comprehensive introduction to the analysis of complex systems. Key topics are the determination and expression of system requirements (both functional and on-functional), and the representation of structural and behavioural models of the system in UML notations. Students will be expected to evaluate requirements documents and models as well as producing them. This unit covers essential topics from the ACM/IEEE SE2004 curriculum, especially from MAA Software Modelling and Analysis.

Third year: All streams

ENGG3853
Project Risk Mgnt Tools & Techniques

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week; Laboratory 1 hr/week. **Prerequisites:** ENGG2851. **Prohibitions:** CIVL4810 **Assessment:** Through semester assessment (70%) Final Exam (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Project risk management is considered to be one of the most vital of the nine content areas of the Project Management Body of Knowledge (PMBOK) as also developed by ISO/IEC 31010 (The International Organization for Standardization and The International Electrotechnical Commission (IEC)): Risk management - Risk assessment techniques. Important projects tend to be time constrained, pose significant technological and sociological challenges, and suffer from a lack of adequate resources and understanding of the risks involved at varying scales and different times. This UOS covers most relevant tools and techniques for identifying and managing project risk from a theoretical and practical perspective so that possibility of failure in critical projects can be minimised - e.g. through failure mode and effect analysis (FMEA). It offers students a step by step systematic approach through every phase of a project, showing them how to consider the possible risks involved at every stage in the process. Drawing on real-world situations and examples, this UOS outlines proven methods, demonstrating key ideas for project risk planning and showing how to use system-level risk assessment tools. It further offers guidance related to analysis aspects such as available resources, project scope, and scheduling, and also explores the growing area of Enterprise Risk Management.

ENGG3854
Negotiating and Contracting

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 1 hr/week; Tutorial 1 hr/week. **Prerequisites:** ENGG1850 AND ENGG2850 AND ENGG2852. **Prohibitions:** CIVL3813 **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

In this UOS, we draw on examples on project negotiation and contracting from "real-life" business situations and provide practical information on what to do and what not to do. Student would be exposed to the complexity involved in negotiation and contracting from initiation to formalization of final form of contract which is agreed upon and executed by all parties. Students will be taught how to understand each party's interests and then working towards reaching a common goal. In particular, dealing with complex characters including situations will be covered.

We will provide a basic understanding of commercial contracts and all their ramifications every step of the way. This UOS also explains the basics of commercial contract law, highlights how to spot potential issues before they become a problem and then how to work with a lawyer more effectively if things go wrong which is intended for corporate managers rather than lawyers. This UOS further contains coverage on forming contracts, restitution, contract interpretation, modification and dispute resolution. We also discuss remedies, performance, and third-party beneficiaries.

PMGT3850
Project Management Capstone Project A

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 1 hr; Meeting, Project Work - own time 10 hrs. **Prerequisites:** 30 credits of 2nd year units of study **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: It is expected that the project will be conducted over two consecutive semesters and that the majority of students will start in Semester 1. Commencement in Semester 2 requires permission of the course coordinator and School`s Director of Learning & Teaching and will only be allowed where there are good reasons for doing so. Students considering this option should discuss it with the the course coordinator at least one semester before they intend to start.

In this intensive PM capstone project, students are required to apply all of the skills necessary to successfully initiate, plan, execute, control and close a project. Working as part of a team mid-sized, high-priority project, student will be responsible for developing the key project management deliverables, including the project charter, project plan, change control process, status reports and post-project reviews. Students will facilitate meetings, update the project plan with actuals and changes, present status to management, justify decisions to key stakeholders and determine the impacts of their actions on the project. Under the guidance of a project professional and their academic supervisor, students will be given direct feedback towards achieving project goals.

PM Capstone Project A & B provide an opportunity for students to undertake a major project in a specialised area relevant to project management. Students will generally work in groups, although assessment components such as reflective reports and participation are marked individually. Only in exceptional circumstances and by approval of PM Capstone Project course coordinator and the relevant academic supervisor concerned will a student be permitted to undertake a project individually.

PM Capstone Project is spread over a whole year, in two successive Units of Study of 6 credits points each, PM Capstone Project A (PMGT3850) and PM Capstone Project B (PMGT3851). This particular unit of study, which must precede PMGT3851 PM Capstone Project B, should cover the first half of the work required for a complete 'final year' project. In particular, it should include almost all project planning, a major proportion of the necessary background research, and a significant proportion of the investigative or design work required of the project.

PMGT3851
Project Management Capstone Project B

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs; Practical Work 10 hrs. **Prerequisites:** 30 credits of 2nd year units of study **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

In this intensive PM capstone project, students are required to apply all of the skills necessary to successfully initiate, plan, execute, control and close a project. Working as part of a team on a simulated four-month, mid-sized, high-priority project, student will be responsible for developing the key project management deliverables, including the project charter, project plan, change control process, status reports and post-project reviews. Students will facilitate meetings, update the project plan with actuals and changes, present status to management, justify your decisions to key stakeholders and determine the impacts of your actions on multiple projects. Under the guidance of a senior project manager and their academic supervisor, students will be given direct feedback and techniques to increase efficiency and effectiveness.

PM Capstone Project A & B provide an opportunity for students to undertake a major project in a specialised area relevant to civil engineering. Students will generally work in groups, although planning and writing of reports will be done individually; i.e., a separate report must be submitted by each student. Only in exceptional circumstances and by approval of PM Capstone Project course coordinator and the relevant academic supervisor concerned will a student be permitted to undertake a project individually.

PM Capstone Project is spread over a whole year, in two successive Units of Study of 6 credits points each, PM Capstone Project A (PMGT3850) and PM Capstone Project B (PMGT3851). This particular unit of study, which must be preceded by or be conducted concurrently with PMGT3850 PM Capstone Project A, should cover the second half of the required project work. In particular, it should include completion of all components planned but not undertaken or completed in PMGT3850 PM Capstone Project A.

PMGT3855
Project Variance Analysis

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 1 hr/week; Tutorial 1 hr/week. **Prerequisites:** ENGG2851 **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Project variance analysis uniquely shows project managers how to effectively integrate technical, schedule, and cost objectives by improving earned value management (EVM) practices. Providing innovative guidelines, methods, examples, and templates consistent with capability models and standards, this UOS approaches EVM from a practical level with understandable techniques that are applicable to the management of any project. It also explains how to incorporate EVM with key systems engineering, software engineering, and project management processes such as establishing the technical or quality baseline, requirements management, using product metrics, and meeting success criteria for technical reviews. Detailed information is included on linking product requirements, project work products, the project plan, and the Performance Measurement Baseline (PMB), as well as correlating technical performance measures (TPM) with EVM.

PMGT3858
Complex Project Coordination

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Prerequisites:** ENGG1850 AND ENGG2852. **Assessment:** Through semester assessment (50%) Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Complex projects have always existed, but their frequency and importance are increasing in a complex, intertwined world. 'Complex' is qualitatively different from 'complicated.' Complex projects are characterised by a web of interactions between their elements that lead to non-linearity, emergence, adaptiveness and other novel features. That is to say, they behave as Complex Adaptive Systems, and they should be managed as such. The majority of projects demonstrate some degree of complexity. The traditional model of projects is expressed in standard methodologies such as PMBoK, Prince2, and MS Project. While absolutely necessary as a basis for effective project management, the limitations of these methodologies become evident when uncertainty - structural, technical, directional or temporal - begins to intrude on a project. In these situations, a systemic pluralist approach is to be preferred. Project management then becomes less like painting by numbers, and more like selecting from a rich and broad palette of methods, tools and techniques. Such competencies can make a substantial difference, in a complex world with an unacceptably high rate of project failure.

Third Year: Civil Engineering Science stream

CIVL2810
Engineering Construction and Surveying

Credit points: 6 **Session:** Semester 1 **Classes:** Tutorial 2 hrs/week; Workgroup 3 hrs/week; Lecture 3 hrs/week. **Assumed knowledge:** MATH1001, MATH1002, MATH1003, MATH1005 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: In recent years - the course has included a 1.5 day camp at Webbs Creek (about 80km from Sydney). The camp is located in a bushland setting. It aims to provide valuable practice in practical field survey and has a secondary aim of providing a basis for social gathering (this aspect being requested in student feedback over recent years)

The objectives of this unit are to gain an understanding of the fundamentals of engineering construction including

- design, control, management, measurement and construction methods for excavation, embankments and other earthworks, hauling and associated operations.

- building construction fundamentals, including reinforced concrete, masonry, steel and timber.

- drilling and blasting

Engineering Survey topics aim (a) to provide basic analogue methods of distance, angle and height measurement and (b) to provide an understanding of three dimensional mapping using basic total station electronic field equipment with associated data capture ability and (c) to give an insight into future trends in the use of GPS and GIS systems.

At the end of this unit, students should develop basic competency in earthwork engineering and economic optimisation of related construction, including proposing and analysing systems and methods, estimation of probable output, unit cost and productivity evaluation. Students should have a basic knowledge of vertical construction in reinforced concrete, masonry, steel and timber. Students should also develop proficiency in the design and implementation of mapping systems in Civil Engineering, using analogue and electronic field equipment and associated software packages.

The syllabus comprises introduction to the framework under which construction projects are formulated and analysed; construction engineering fundamentals; construction systems related to excavation, hauling and embankment construction, including selection and evaluation of plant and methods as well as the expected output and cost; introduction to construction operations management. Introduction to engineering surveying, distance measurement, angle measurement, levelling, traversing, topographic surveys, electronic surveying equipment, future surveying technologies.

Select one of the following units

CIVL2410
Soil Mechanics

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 3 hrs/week; Tutorial 1 hr/week; Laboratory 2 hrs/week. **Assumed knowledge:** Knowledge: CIVL2201 AND GEOL1501. An understanding of simple statics, equilibrium, forces and bending moments, and of stress and strain and the relationship between them. This is covered by University of Sydney courses ENGG 1802 Engineering Mechanics, CIVL2201 Structural Mechanics. Familiarity with the use of spreadsheets (Excel, Mathcad) to obtain solutions to engineering problems, and with the graphical presentation of this data. Familiarity with word processing packages for report presentation. Some of this is covered in the University of Sydney course ENGG1801 Engineering Computing. Familiarity with partial differential equations, and their analytical and numerical solution. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course provides an elementary introduction to Geotechnical Engineering, and provides the basic mechanics necessary for the detailed study of Geotechnical Engineering. This course aims to provide an understanding of: the nature of soils as engineering materials; common soil classification schemes; the importance of water in the soil and the effects of water movement; methods of predicting soil settlements, the stress-strain-strength response of soils, and earth pressures.

CIVL2611
Introductory Fluid Mechanics

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Laboratory 1 hr/week. **Assumed knowledge:** CIVL2201 AND ENGG1802 AND MATH1001. Students are expected to have a strong understanding of fundamental physics, statics, equilibrium, forces, and dimensional analysis. Familiarity with simple calculus, partial differential equations, and the analytical and numerical solutions. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The objective of this unit of study is to develop an understanding of basic fluid concepts for inviscid and incompressible fluids. Topics to be covered will include: basic fluid properties, hydrostatics, buoyancy, stability, pressure distribution in a fluid with rigid body motion, fluid dynamics, conservation of mass and momentum, dimensional analysis, open channel flow, and pipe flow.

This core unit of study together with CIVL3612 forms the basis for further studies in the applied areas of ocean, coastal and wind engineering and other elective fluid mechanics units which may be offered.

Third Year: Built Environment stream

DESC9074
Project Management

Credit points: 6 **Teacher/Coordinator:** Prof Richard de Dear **Session:** Semester 2 **Classes:** 5 day intensive (9am-5pm) **Assessment:** Two assignments (1 x 40%, 1 x 60%) **Mode of delivery:** Block mode

Note: Department permission required for enrolment.

Project Management is specific form of establishing, programming, and coordinating an activity having a specific start point and end point. This body of knowledge - as for example in the Project Management Book of Knowledge (PMBOK) - needs to be understood in general terms. Initially project managers must identify and define the services that are needed, (scope) and that their employers are willing to endorse. The activities requiring to be carried out need to be sorted and sequenced; the materials, labour and plant required need to be estimated and procured. Projects involve the management of information, and communications. This unit will develop the student's ability to ascertain and document the scope of a project, schedule a programme, and understand the difficulties in directing it. This unit approaches the profession of Project Management as a cooperative undertaking rather than adversarial: It promotes the adoption of soft-skills rather than that of forceful command and supervision.

DESC9200
Introduction to Architectural Science

Credit points: 6 **Teacher/Coordinator:** Dr Francesco Fiorito **Session:** Semester 1 **Classes:** 5 day intensive (9am-5pm) **Assessment:** Assignment (40%), Exam (60%) **Mode of delivery:** Block mode

This unit aims to explore the scientific concepts of heat, light and sound, and from this develops foundational principles and methods applicable to buildings. It is divided into five topics: climate and resources: thermal environment: building services: lighting; and acoustics. Students will gain an understanding of the terminology, physical values and metrics in each of these topics, and how they apply to the design and function of buildings. Theoretical models to predict key physical values in buildings are presented and used in assessments. Learning is supported by measurement exercises. This unit has a focused pedagogy intended for all graduate students in Architectural Science. It is a common core unit for all of the programs (Audio and Acoustics, High Performance Buildings, Illumination Design and Sustainable Design). Students within these programs should undertake this unit in their first semester of study if possible.

Third Year: Software stream

ELEC3609
Internet Software Platforms

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week; Project Work - own time 4 hrs. **Prerequisites:** INFO1103, INFO2110, (INFO2120 or INFO2820) **Prohibitions:** EBUS4001 **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study will focus on the design, the architecture and the development of web applications using technologies currently popular in the marketplace including Java and .NET environments. There are three key themes examined in the unit: Presentation layer, Persistence layer, and Interoperability. The unit will examine practical technologies such as JSP and Servlets, the model-view-controller (MVC) architecture, database programming with ADO.NET and JDBC, advanced persistence using ORM, XML for interoperability, and XML-based SOAP services and Ajax, in support of the theoretical themes identified.

On completion the students should be able to:

- Compare Java/J2EE web application development with Microsoft .NET web application development.
- Exposure to relevant developer tools (e.g. Eclipse and VS.NET)
- Be able to develop a real application on one of those environments.
- Use XML to implement simple web services and AJAX applications.

ELEC3610
E-Business Analysis and Design

Credit points: 6 **Session:** Semester 1 **Classes:** Project Work - in class 2 hrs; Project Work - own time 4 hrs; Presentation 3 hrs; Tutorial 1 hr/week. **Prohibitions:** EBUS3003 **Assessment:** Through semester assessment (70%) Final Exam (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit examines the essential pre-production stages of designing successful internet websites and services. It focuses on the aspects of analysis, project specification, design, and prototype that lead up to the actual build of a website or application. Topics include, B2C, B2B and B2E systems, business models, methodologies, modeling with use cases / UML and WebML, the Project Proposal and Project Specification Document, Information Architecture and User-Centred Design, legal issues, and standards-based web development. Students build a simple use-case based e-business website prototype with web standards. A final presentation of the analysis, design and prototype are presented in a role play environment where students try to win funding from a venture capitalist. An understanding of these pre-production fundamentals is critical for future IT and Software Engineering Consultants, Project Managers, Analysts and CTOs.

Project Management Honours

Student undertaking Honours in Project Management enrol in the following Honours Project units.

PMGT4850
Project Management Honours Project A

Credit points: 12 **Session:** Semester 1, Semester 2 **Classes:** Research: 10 hours per week. Lecture 1 hour per week. **Prerequisites:** Students are required to achieve a minimum 65% average mark in the Intermediate and Senior units of the normal BPM program to be eligible for entry to Honours. **Assessment:** Through semester assessment (100%). **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: It is expected that the Thesis will be conducted over two consecutive semesters and that the majority of students will start in Semester 1. Commencement in Semester 2 requires permission of Thesis coordinator (who may consult the Undergraduate or Program)

The ability to plan, systematically conduct and report on a major research project is an important skill for Project Managers. The most important deliverable in PMGT4850 and PMGT4851 is a formally written, academic-based research thesis. This is a major task that is to be conducted over the year in two successive units of study of 12 credit points each. Students will build on technical competencies previously obtained from years 1, 2 and 3 of the BPM course, as well as make use of the academic writing and communication skills they have developed. In PMGT4850, students are required to plan and begin work on a research project, in consultation and close supervision by an academic staff member. Some of the projects will be experimental in nature, while others may involve computer-based simulation, design or literature surveys. In this unit, through close supervision and independent research, students will learn how to examine published and experimental literature and data, write reviews of literature, set down specific and achievable research objectives, organise a program of work and devise an experimental, developmental, or exploratory program of research using specific research methods or a combination of them (e.g. qualitative interviews, surveys, statistical analysis, mixed-method, etc.). In PMGT4851, students are required to have completed most of their literature review and be in the "execution" phase of their research. This is where the bulk of the investigative work and data collection/analyses/validation takes place and much of the writing of the final thesis begins to eventuate. From both units, the skills acquired will be invaluable to students undertaking project management work as it broadens their repertoire of skills including critical thinking, ability to ask good questions, ability to think "outside the box", critical review of existing literature, research and analytical skills and written and oral presentation. Students are expected to take the initiative and learn to be independent thinkers when pursuing their research project.

PMGT4851
Project Management Honours Project B

Credit points: 12 **Session:** Semester 1, Semester 2 **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: It is expected that the Thesis will be conducted over two consecutive semesters and that the majority of students will start in Semester 1. Commencement in Semester 2 requires permission of Thesis coordinator (who may consult the Undergraduate or Program)

The ability to plan, systematically conduct and report on a major research project is an important skill for Project Managers. The most important deliverable in PMGT4850 and PMGT4851 is a formally written, academic-based research thesis. This is a major task that is to be conducted over the year in two successive units of study of 12 credit points each. Students will build on technical competencies previously obtained from years 1, 2 and 3 of the BPM course, as well as make use of the academic writing and communication skills they have developed. In PMGT4850, students are required to plan and begin work on a research project, in consultation and close supervision by an academic staff member. Some of the projects will be experimental in nature, while others may involve computer-based simulation, design or literature surveys. In this unit, through close supervision and independent research, students will learn how to examine published and experimental literature and data, write reviews of literature, set down specific and achievable research objectives, organise a program of work and devise an experimental, developmental, or exploratory program of research using specific research methods or a combination of them (e.g. qualitative interviews, surveys, statistical analysis, mixed-method, etc.). In PMGT4851, students are required to have completed most of their literature review and be in the "execution" phase of their research. This is where the bulk of the investigative work and data collection/analyses/validation takes place and much of the writing of the final thesis begins to eventuate. From both units, the skills acquired will be invaluable to students undertaking project management work as it broadens their repertoire of skills including critical thinking, ability to ask good questions, ability to think "outside the box", critical review of existing literature, research and analytical skills and written and oral presentation. Students are expected to take the initiative and learn to be independent thinkers when pursuing their research project.

Select 24 credit points from the following list of electives.

PMGT5875
Project Innovation Management

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 10 hrs; Tutorial 4 hrs. May also be offered in block mode. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Online

This course focus on the impact of innovation into the project management practice. Important trends in innovation in project organisation, management and delivery are identified and their implications for project management explored. Major topics include: trends, such as ``open source``model rather than protected intellectual property innovation structure; impact of the open innovation structure on organisational project management; improved understanding of the client requirements and achievement of quality goals through tools and methodologies based on an user driven approach; distribution of innovation over many independent but collaborating actors; and the importance of diverse thinking toolkits(for example: design thinking, systems thinking, integrative thinking, and hybrid thinking) that empower users to innovate for themselves.

PMGT5876
Strategic Delivery of Change

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Seminar 16 hrs. May also be offered in block mode. **Prohibitions:** WORK6026 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Online

Welcome to PMGT5876 Strategic Delivery of Change. This course is designed to foster and promote critical thinking and the application of good theory to inform good practice in the strategic delivery of organisational change. The philosophy underpinning this course is design thinking. You will learn quite a bit about this idea over the duration of the course, and why it is increasingly important to change management. The course develops capabilities that will differentiate you from the average project manager and change agent, and which are in high demand in forward thinking organisations.

PMGT5879
Strategic Portfolio & Program Management

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. May also be offered in block mode. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Online

This unit specifically addresses the selection and prioritisation of multiple programmes and projects which have been grouped to support an organisation's strategic portfolio. The allocation of programmes of work within a multi-project environment, governing, controlling and supporting the organisation's strategy, are considered. The aim is to formulate and manage the delivery of the portfolio of strategies using programme management. Students will learn and practice the issues to be considered in selecting an effective organisation portfolio and how to implement a Portfolio Management Framework. Also they will encounter the many conflicting issues facing Program Managers as they seek to implement organisation strategy through programs and learn how to balance these to obtain desired outcomes.

PMGT5886
System Dynamics Modelling for PM

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) evening

Students should achieve an understanding of the roles of statistical methods, coordinate transformations, and mathematical analysis in mapping complex, unpredictable dynamical systems. Systems Thinking is a more natural and better way to think, learn, act, and achieve desired results. Effectively implemented, it can dramatically improve a manager`s effectiveness in today`s complex and interconnected business world. This course provides managers with many practical new Systems Thinking tools and the main concepts of Systems Thinking to enhance individual, team, and organizational learning, change, and performance.

PMGT6867
Quantitative Methods: Project Management

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lecture 1.75 hrs/week; Tutorial 1.25 hrs/week. **Assumed knowledge:** Expect the basic understanding of the organisational context of projects and limited experience of working in a project team. Also, familiarity of different quantitative methods applied in the context of different project environments. **Assessment:** Through semester assessment (40%) Final Exam (60%) **Mode of delivery:** Online

Methods studied in this unit are used in a wide range of project management tasks and problems. The unit explains why and where particular methods are used and provides examples and opportunities to apply these methods in practice. This UoS will also facilitate the understanding of the mechanics of these methods and their underlying theory.

Notes

1. The Honours program is completed as an additional year. Students are required to achieve a minimum 65% average mark in the Intermediate and Senior units of the above program to be eligible for entry to Honours.2. For core units of study offered by other than the Faculty of Engineering, any assumed knowledge, prerequisite and corequisite requirements will be as prescribed by the faculty.3. Candidates for the degree of Bachelor of Project Management are expected to complete all the core units of study listed above. They are also required to gain additional 12 credit points from a choice of free elective units offered by the University of Sydney.4. Most Mathematics, Chemistry, Physics and Computer Science units of study offered by the Faculty of Science can be replaced by equivalent advanced level units of study subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing advanced options should seek advice from the relevant department before enrolling.5. Students undertaking the Honours program may enrol in alternative postgraduate Project Management units with permission of the Program Director.

Project Management Recommended Electives

In addition to the core units in the above table students will need to complete electives to gain a total of 144 credit points as required for the degree. The following list are recommend units.

PMGT2854
Implementing Concurrent Projects

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 1 hr/week; Tutorial 1 hr/week. **Prerequisites:** ENGG1850 AND ENGG2850 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

What is concurrent engineering? What are the different components? Why do we need to get products to market fast? What really matters? Starting with a vision, creating great teams that work and creating processes that work effectively around the teams. Teams need to complement processes, and processes need to complement teams. Individuals and teams also evolve processes. In fact great systems are those that can evolve and adapt without a centralised management. The artist that creates a great system is the one that can make a sustainable design.

PMGT3856
Sustainable Project Management

Credit points: 6 **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The concepts of sustainability and corporate responsibility are gaining importance in our globalised economy. They have been increasingly influencing business and project objectives and it is becoming imperative that they are incorporated into the practice of project management.

This unit of study embraces this new reality by providing students with an expanded understanding of value creation and how this is delivered through projects. The emphasis is on using projects to deliver value in terms of economic capital whilst also developing social capital and preserving natural capital. These will be underpinned by an appreciation of the standards, principles and frameworks that exist, both in Australia and internationally, to govern the preservation of the environment and increase the development of social capital.

Case studies will be used to create learning processes as students consider and confront the dilemmas that project managers face as they strive to deliver shareholder value via fiscal project objectives as well as face increasing pressure to deliver to reduce environmental impacts. Cases discussed in this UOS will allow students to explore both the opportunities and pitfalls companies and non-government organisations face in targeting sustainability issues and how their values and core assumptions impact their business strategies.

Concepts such as corporate responsibility, the triple bottom line, the business case for sustainability, supply chain management and responsible purchasing and knowledge management will be discussed and students will consider how these influence project delivery.

PMGT3857
International Project Management

Credit points: 6 **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Laboratory 1 hr/week; Tutorial 1 hr/week. **Assessment:** Through semester assessment (60%) Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This UOS provides specific guidelines for achieving greater international project success. It addresses the need for modern techniques in project management geared and suited to international projects. It provides opportunity to students to have orientation towards lessons learned from failures and problems in international projects, and suggest alternative solutions for project issues. The critical success factors for managing international projects together with management issues related to vendors and outsourcing across national boundaries are also discussed. It further deals with managing businesses effectively address cross- cultural, social, and political issues.

Alternative elective units may be taken with approval of the Head of School.
For a standard enrolment plans for the various Project Management streams visit http://cusp.sydney.edu.au/engineering

Index by alpha code

A

B

Index by name