THE UNIVERSITY OF SYDNEY

Engineering and Information Technologies Undergraduate **Handbook 2018**

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Contents

Welcome

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

Studying with us will provide you with the skills to develop innovative, creative and sustainable solutions that promote positive change worldwide.

Our degrees are accredited by the relevant professional bodies and you will graduate with globally recognised qualifications, making you highly sought after by employers all over the world.

At Sydney, we take your university experience beyond the lab and lecture theatre. You'll have the opportunity to take part in extracurricular activities, like participating in team competitions, joining one of our many student societies or volunteering with one of our outreach programs.

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 an enthusiastic group of students who are all interested in making a genuine difference within our own community and beyond.

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 holistic and well-rounded understanding of your disciplinary area of interest, so that you may fulfill your academic and vocational ambitions.

When you browse the tabs from left-to-right, you will observe a General tab, a Unit of Study tab, and tabs for each of the three main areas of study. These are:

- Engineering
- Project Management and
- Advanced Computing.

The menu sets under each of the areas of study consist of general information about the courses and units of study on offer.

Unit of Study Tables and Descriptions

Unit of study descriptions for all units can be found under the Units of Study tab.

Unit of study tables for each undergraduate degree can be found under the tab corresponding to the area of study.

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 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 2014 (the 'Coursework Rule'), the Coursework Policy 2014 (the 'Coursework Policy'), the resolutions for the course of enrolment, the University of Sydney (Student Appeals against Academic Decisions) Rule 2006 (as amended), the Academic Honesty in Coursework Policy 2015 and the Academic Honesty Procedures 2016. Up to date versions of all such documents are available from the Policy Register: http://sydney.edu.au/policies.

Part 1: Course Enrolment

1 Enrolment Restrictions

(1) Except where explicitly listed in a Faculty recommended program of enrolment, or with the permission of the Dean or delegate, an undergraduate student shall satisfy the following enrolment requirements.
(a) No more than 26 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) A student may enrol only:
(i) in level 1000 units of study during their first year;
(ii) in level 1000 or 2000 units of study during their second year;
(d) 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.
(e) Any student subject to the requirements of the Professional Engagement Program (PEP) shall successfully complete each required stage of the Program prior to enrolling in units that could extend their completed credit points past the specified level for that stage.

2 Transferring Between Streams or Degrees

(1) Students admitted to specific postgraduate degrees or streams wishing to transfer between degrees or streams managed by the Faculty need to apply to the Faculty and obtain the approval of the Dean (or delegate). Students will be assessed based on their progress in their current degree or stream and must be able to show that they meet the criteria that apply to commencing students.

3 Time Limits

(1) Except where specific course resolutions specify alternative requirements, the following conditions must be met:
(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 or combined BAdvComp within ten calendar years of first enrolment;
(c) A student must complete all the requirements for a single (non combined) BEHons, BAdvComp, BComp 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; completing in 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; completing in 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; completing in 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 may exceed 10 years from first enrolment.
(3) Credit will not be granted for prior learning older than 10 years at the time of first enrolment.

4 Suspension, Discontinuation and Lapse of Candidature

The Coursework Rule and Coursework Policy specify the conditions for suspending or discontinuing candidature, and return to candidature after these events. The Rule and Policy also define the circumstances when candidature is deemed to have lapsed. Students seeking to suspend, discontinue or apply for a return to candidature after a lapse must apply to the Dean of Engineering and Information Technologies or their delegate for permission, supplying detailed reasons and evidence to support the request.

5 Credit for Previous Study

(1) Conditions for the granting of credit for previous study are in accordance with the Coursework Rule and Policy, except:
(a) the maximum credit that may be granted to the Bachelor of Engineering Honours degree, Bachelor of Engineering Honours combined degrees, Bachelor of Advanced Computing degree or Bachelor of Advanced Computing combined degrees is 96 credit points;
(b) the maximum credit that may be granted to the Bachelor of Computing or Bachelor of Project Management is 48 credit points; and
(c) credit for prior learning at the University of Sydney at postgraduate level 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) credit for prior learning at postgraduate level at an external institution recognised by the University of Sydney may be granted as follows:
(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) where 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.
(f) that credit must not be awarded where it would result in less than 50% of the course being undertaken at the University of Sydney.

Part 2: Unit of Study Enrolment

6 Cross-institutional Study

(1) Provided permission has been obtained in advance, the Dean (or delegate) 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 either

(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.

7 International Exchange

The Faculty encourages students to participate in international exchange programs, except where 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. International exchange must not exceed 12 months / 48cp and must not be approved where it would result in less than 50% of the normal course requirements being completed at the University of Sydney.

Part 3: Studying and Assessment

8 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.

9 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 Policy provides full details of the University policy and procedures.

10 Concessional Pass

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

11 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

12 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 and Coursework Policy, students must pass any unit of study identified in the course resolutions as being critical to progression through the course.

13 Award of the Bachelor's Degree with Honours

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

14 Faculty of Engineering and Information Technologies Specific Weighted Average Mark Indicators.

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

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

where

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

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

(2) The Engineering Integrated Honours Weighted Average Mark (EIHWAM) is calculated by the formula:

Formula
EIHWAM= (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. Thesis units of study are given a double weighting of 8.

(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: units of study assessed on a pass/fail basis; units of study with a grade of DC; and credited units of study from other institutions. The mark used for units of study with a grade of AF or DF is zero.

15 University Medal

A student who has qualified for the award with first class honours and has an EIHWAM of 85 or above, and who has demonstrated excellence in their honours thesis will be considered for the award of a University Medal. The Medal is awarded at the discretion of the Dean or relevant Associate Dean, after the recommendation of the relevant Head of School, to the highest achieving students who in the opinion of the Faculty have an outstanding academic record, in accordance with the Coursework Rule and Coursework Policy.

Part 5: Other

16 Transitional Provisions

(1) These resolutions apply to students who commenced their candidature on or after 1 January, 2018.

(2) Students who commenced prior to 1 January, 2018 may:

(a) complete the requirements in accordance with the resolutions governing their candidature immediately prior to these changes; or

(b) where approved by the Faculty, elect to proceed under these resolutions provided appropriate programs of study can be identified.

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, 2017. 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
MAHLTCIN	Master of Health Technology Innovation	MHTI	96
MADATASC	Master of Data Science	MDS	48
	Master of Complex Systems	MCXS	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
BHENGINE	Bachelor of Engineering Honours		
	Aeronautical Engineering	BEHons(Aeronautical)	192
	Biomedical Engineering	BEHons(Biomedical)	192
	Chemical and Biomolecular Engineering	BEHons(Chemical and Biomolecular)	192
	Civil Engineering	BEHons(Civil)	192
	Electrical Engineering	BEHons(Electrical)	192
	Mechanical Engineering	BEHons(Mechanical)	192
	Mechatronic Engineering	BEHons(Mechatronic)	192
	Software Engineering	BEHons(Software)	192
BPENCHBM	Bachelor of Project Management*	BPM	144

Code	Course title & stream	Abbreviation	Credit points
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
MAINFITM	Master of Information Technology/Master of Information Technology Management	MIT/MITM	96
BHENGART	Bachelor of Engineering Honours/Bachelor of Arts	BEHons/BA	240
BHENGCOM	Bachelor of Engineering Honours/Bachelor of Commerce	BEHons/BCom	240
BHENGDAR	Bachelor of Engineering Honours/Bachelor of Design in Architecture	BEHons/BDesArch	240
BHENGLAW	Bachelor of Engineering Honours/Bachelor of Laws	BEHons/LLB	288
BHENGMSC	Bachelor of Engineering Honours/Bachelor of Medical Science	BEHons/BMedSci	240
BHENGSCI	Bachelor of Engineering Honours/Bachelor of Science	BEHons/BSc	240
BPITCART	Bachelor of Information Technology^/Bachelor of Arts*	BIT/BA	240
BPITCCOM	Bachelor of Information Technology^/Bachelor of Commerce*	BIT/BCom	240
BPITCLAW	Bachelor of Information Technology^/Bachelor of Laws^	BIT/LLB	288
BPITCMSC	Bachelor of Information Technology^/Bachelor of Medical Science*	BIT/BMedSc	240
BPITCSCI	Bachelor of Information Technology^/Bachelor of Science*	BIT/BSc	240
BHENGPRM	Bachelor of Engineering Honours^/Bachelor of Project Management*	BEHons/BPM	240
BHENGMST	Bachelor of Engineering Honours^/Bachelor of Music Studies*	BEHons/BMusStudies	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	Graduate Diploma in Computing	GradDipComp	~~60~~ 48
GNENGINE	Graduate Diploma in Engineering	GradDipEng	36
GNENPROF	Graduate Diploma in Engineering (Professional Engineering) *(Last intake 2013)*	GradDipEng(ProfEng)	48
GNINFTEC	Graduate Diploma in Information Technology	GradDipIT	48
GNINFTMG	Graduate Diploma in Information Technology Management	GradDipITM	48
GNPRJMGT	Graduate Diploma in Project Management	GradDipPM	48
GNPRJLEA	Graduate Diploma in Project Leadership	GradDipPL	36
GNHLTCIN	Graduate Diploma in Health Technology Innovation	GradDipH	60
	Graduate Diploma in Complex Systems	GradDipCXS	48

5 Graduate certificates

Code	Course title	Abbreviation	Credit points
GCENGINE	Graduate Certificate in Engineering	GradCertEng	24
GCINFTEC	Graduate Certificate in Information Technology	GradCertIT	24

Code	Course title	Abbreviation	Credit points
GCINFTMG	Graduate Certificate in Information Technology Management	GradCertITM	24
GCDATASC	Graduate Certificate in Data Science	GradCertDS	24
GCPRJMGT	Graduate Certificate in Project Management	GradCertPM	24
GCPRJLEA	Graduate Certificate in Project Leadership	GradCertPL	24
GCCOMPUT	Graduate Certificate in Computing	GradCertComp	24

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 2014 (the 'Coursework Rule'), the Coursework Policy 2014, the Resolutions of the Faculty, the University of Sydney (Student Appeals against Academic Decisions) Rule 2006 (as amended), the Academic Honesty in Coursework Policy 2015 and the Academic Honesty Procedures 2016. Up to date versions of all such documents are available from the Policy Register: http://sydney.edu.au/policies.

Course resolutions

The Bachelor of Engineering Honours provides students with advanced knowledge and special proficiency in the professional work of engineering.

1 Course codes

Code	Course title
BHENGINE	Bachelor of Engineering Honours

2 Attendance Pattern

The attendance pattern for this course is full-time or part-time. Part-time students must still satisfy 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) Aeronautical Engineering
(b) Biomedical Engineering
(c) Chemical and Biomolecular Engineering
(d) Civil Engineering
(e) Electrical Engineering
(f) Mechanical Engineering
(g) Mechatronic Engineering
(h) Software Engineering
(i) With Space Engineering Major
(j) Dalyell
(2) Completion of a stream is a requirement of the course. Candidates who qualify for the Dalyell stream must complete another stream in conjunction with the Dalyell stream. The requirements for the completion of each stream are as specified in the relevant degree tables and in Table S of the Shared Pool for Undergraduate Degrees for the Dalyell stream.
(3) Students may apply to change streams by direct application to the Faculty Office. Approval is required from the relevant Associate Dean for any case. Students will be assessed based on the 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.
(4) Flexible First Year
(a) Undergraduate students entering first year of the Engineering courses in Semester 1 may apply to undertake the Flexible First Year program, instead of choosing a particular stream.
(b) The Flexible First Year Program is listed in the Flexible First Year Table. At the end of Semester 1 Students may transfer into approved streams as defined in the following clause, or may choose to continue in the Flexible First Year Program for Semester 2, though Semester 2 units may or may not count towards their course, depending on the final choice of stream.
(c) Those students who have met the requirements for first year entry (ATAR cut-off or equivalent) into a particular Engineering program will be guaranteed approval to transfer into that program even though they chose the Flexible First Year Program. Students who did not meet the first year entry requirements for specific streams, but subsequently attained average marks in the Flexible First Year Program that met or surpassed the specified requirements for those streams will also be eligible to apply for transfer into those streams. The transfer requirements will be approved by the Dean or nominee. These conditions will also apply for combined degree candidates.

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, 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 requirements are found in the Coursework Rule and Coursework Policy.
(2) Admission to the Dalyell stream requires achievement of a minimum tertiary admission rank (ATAR) set by the Board of Interdisciplinary Studies, or equivalent standard.

5 Requirements for Award

(1) The units of study that may be taken for the course are set out in the Bachelor of Engineering Honours Flexible First Year Table of units of study, the Bachelor of Engineering Honours Core Table, the Bachelor of Engineering Honours Stream Core Tables, and the Bachelor of Engineering Honours Stream Specialist 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) A minimum of 36 credit points from the Engineering Core Table, including all required units;

(ii) A minimum of 108 credit points from the Engineering Stream Table pertaining to the specialist stream being undertaken, including all required units;
(iii) A minimum of 48 credit points of additional units from the Engineering Stream Specialist Table pertaining to the specialist stream being undertaken, including satisfying any additional requirements specified for the Specialist Table.
(b) Successfully complete the requirements of the Professional Engagement Program.
(3) The class of Honours will be determined by the EIHWAM.

6 Progression rules

(1) *Progression within the Dalyell Stream*
(a) With the permission of the Dalyell coordinator, candidates in the Dalyell Stream may attempt units at higher levels than the usual sequence.
(b) Candidates must achieve an Annual Average Mark (AAM) at a level determined by the Board of Interdisciplinary Studies in each year of study to continue in the Dalyell Stream. Candidates who do not maintain an Annual Average Mark at the level determined by the Board of Interdisciplinary Studies may continue in any other stream into which they were admitted, major, program or minor but will not remain in the Dalyell Stream.

7 Level of Honours Awarded

(1) The Bachelor of Engineering Honours degree is awarded in classes ranging from First Class to Third Class. 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
Honours Class III	EIHWAM < 65

8 Majors

(1) There is no requirement to complete a major.
(2) Availability of Majors:
(a) Except where otherwise specified in the details of a specific major, a major will be available to all students who satisfy the requirements of that major. The availability of the major does not however mean that the units of study listed in the table for the major (or required prerequisite units of study) will be available to all students, or that students in all streams will have sufficient free electives to complete the required units.
(b) Students can be awarded multiple majors where those majors are available without the limits specified in clause (2) and where they satisfy the requirements for those majors. When completing multiple majors, no 3000-level or higher unit may be counted towards satisfying the requirements of more than one major.
(c) Students cannot be awarded a major that has a title directly associated with the name of their stream.
(d) Students are eligible to attempt the Space Engineering major based on either a separate and specific admission pathway or on application at the end of any calendar year having achieved an AAM approved by the Dean or nominee.
(e) There are no restrictions on students attempting majors other than the Space Engineering major.
(3) A major requires:
(a) the completion of 24 credit points, chosen from units of study listed in the table for that major;
(b) satisfying any additional requirements specified for the major, and listed with the table of units for the major;
(c) the completion of a thesis project that has been approved by the Head of School (or delegate) as relevant to the topic of the major.
(4) The majors available are:
(a) Chemical Engineering
(b) Computer Engineering
(c) Construction Management
(d) Electrical Engineering
(e) Environmental Engineering
(f) Geotechnical Engineering
(g) Humanitarian Engineering
(h) Information Technology
(i) Internet of Things
(j) Materials
(k) Mechanical Engineering
(l) Mechatronic Engineering
(m) Power Engineering
(o) Space Engineering
(p) Structures
(q) Telecommunications Engineering
(r) Transport Engineering

9 Transitional Provisions

(1) These resolutions will take effect from 1 January 2018.
(2) Candidates who commenced prior to 1 January, 2018 may:
(a) complete the requirements in accordance with the resolutions governing their candidature immediately prior to these changes: or
(b) where approved by the Faculty, elect to proceed under these resolution provided appropriate programs of study can be identified.

Bachelor of Engineering Honours combined

Bachelor of Engineering Honours combined degrees

Bachelor of Engineering Honours combined degrees

Bachelor of Engineering Honours and Bachelor of Arts

Bachelor of Engineering Honours and Bachelor of Commerce

Bachelor of Engineering Honours and Bachelor of Science

Bachelor of Engineering Honours and Bachelor of Design in Architecture

Bachelor of Engineering Honours and Bachelor of Laws

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 2014 (the 'Coursework Rule'), the Coursework Policy 2014, the Resolutions of the Faculty, the University of Sydney (Student Appeals against Academic Decisions) Rule 2006 (as amended), the Academic Honesty in Coursework Policy 2015 and the Academic Honesty Procedures 2016. Up to date versions of all such documents are available from the Policy Register: http://sydney.edu.au/policies.

Course Resolutions

1 Course codes

Code	Course title
BHENGART	Bachelor of Engineering Honours and Bachelor of Arts
BHENGCOM	Bachelor of Engineering Honours and Bachelor of Commerce
BHENGDAR	Bachelor of Engineering Honours and Bachelor of Design in Architecture
BHENGLAW	Bachelor of Engineering Honours and Bachelor of Laws
BHENGPRM	Bachelor of Engineering Honours and Bachelor of Project Management
BHENGSCI	Bachelor of Engineering and Bachelor of Science

2 Attendance Pattern

(1) The attendance pattern for the following programs is full-time only. The attendance pattern for all other Bachelor of Engineering Honours combined courses is full time or part time.
(a) Bachelor of Engineering Honours and Bachelor of Design in Architecture
(b) Bachelor of Engineering Honours and Bachelor of Laws
(2) Part time students must still satisfy 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 Engineering Honours and students in combined degrees are subject to the stream requirements in the Bachelor of Engineering Honours course resolutions.
(2) Students in the Bachelor of Engineering Honours combined degrees can change the stream of the Bachelor of Engineering Honours portion of their combined degree in accordance with the same requirements specified in the Bachelor of Engineering Honours resolutions.
(3) *Flexible First Year*
Students gaining entry to any of the Bachelor of Engineering Honours combined degrees may also choose to undertake the Flexible First Year program under the same requirements as specified in the Bachelor of Engineering Honours resolutions.
(4) Within the Bachelor of Engineering Honours and Bachelor of Design in Architecture, the Bachelor of Engineering Honours is available only in the Civil Engineering stream. For all other Bachelor of Engineering Honours combined degrees, the streams available for the Bachelor of Engineering Honours are listed under the course resolution for the Bachelor of Engineering Honours.
(5) The Bachelor of Science degree is available in the following streams:
(a) Health
(b) Medical Science
(c) Dalyell
(6) The Bachelor of Arts degree is available in the following streams:
(a) Dalyell
(7) The Bachelor of Commerce degree is available in the following streams:
(a) Dalyell
(8) Completion of a stream is not a requirement of the Bachelor of Science, the Bachelor of Arts, or the Bachelor of Commerce. The requirements for the completion of each stream are as specified in Table A for the relevant degree, or, in the case of the Dalyell stream, Table S of the Shared Pool for Undergraduate Degrees.

(9) Candidates wishing to transfer between streams should contact the Student Centre. Candidates who qualify for the Dalyell stream may complete that stream while also completing another stream.

4 Cross-Faculty Management

(1) Candidates in the combined Engineering and Law courses 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 Honours. They will then be under the supervision of the University of Sydney Law School. Candidates in all other combined degree programs will be under the general supervision of the Faculty of Engineering and Information Technologies for the duration of the combined program.

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

5 Admission to Candidature

(1) Admission to these degrees 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 applicants. 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) Admission to the Dalyell stream requires achievement of a minimum tertiary admission rank (ATAR) set by the Board of Interdisciplinary Studies or above in or equivalent standard.

6 Requirements for Award

(1) *To qualify for the award of the combined degree:*

(a) For all Bachelor of Engineering Honours combined degrees except the Bachelor of Engineering Honours and Bachelor of Laws, a candidate must complete 240 credit points and satisfy any additional requirements specified in the following clauses.

(b) For the Bachelor of Engineering Honours and Bachelor of Laws combined degree, a candidate must complete 288 credit points and any additional requirements specified in the following clauses.

(c) Where the requirements specified in the following clauses account for less than the total required credit, candidates must complete additional units of study (not including general electives) from the relevant Bachelor of Engineering Honours specialist stream table subject to any conditions specified in that table as may be necessary to satisfy the requirements of the degree.

(2) *For the Bachelor of Engineering Honours component of a combined degree:*

(a) The units of study that may be taken for the Bachelor of Engineering Honours component of the combined degree are set out in the tables of units of study for the Bachelor of Engineering Honours single degree;

(b) Except where varied by other clauses of these resolutions, all candidates must complete a minimum of 144 credit points comprising:

(i) 36 credit points from the Engineering Core Table, including all required units;

(ii) 108 credit points from the Engineering Stream Core Table pertaining to the specialist stream being undertaken, including all required units;

(c) The Faculty Board may approve, based on appropriate academic justification, a list of approved unit alternatives. These alternatives specify, for particular Engineering stream / combined degree combinations, units within the normal requirements for the Bachelor of Engineering Honours component of the combined degree that can be replaced by specified alternative units that would form part of the normal program for single degree students in that stream.

(3) *For the Bachelor of Arts, Bachelor of Science or Bachelor of Commerce component of a combined degree:*

(a) The units of study that may be taken are set out in Table A for the Bachelor of Arts, Bachelor of Science or Bachelor of Commerce degrees, and Table S and Table O of the Shared Pool for Undergraduate Degrees.

(b) In these resolutions Table A refers to Table A of the Bachelor of Arts, Bachelor of Science or Bachelor of Commerce according to the degree in which the candidate is enrolled as a component of one of the combined degrees, (respectively) Bachelor of Engineering Honours and Bachelor of Arts, Bachelor of Engineering Honours and Bachelor of Science, or Bachelor of Engineering Honours and Bachelor of Commerce; Table S and Table O refers to Table S and Table O as stated here.

(c) Candidates must complete 96 credit points in the Bachelor of Arts, or the Bachelor of Science or the Bachelor of Commerce including:

(i) any required degree core units as set out in Table A of the degree in which the candidate is enrolled; and

(ii) a major (48 credit points) or a 3-year program with an embedded major <u>(except for the Professional Accounting Program)</u> from Table A of the degree in which the candidate is enrolled; and

(iii) 12 credit points of units of study in the Open Learning Environment as listed in Table O; and

(iv) where appropriate, additional electives from Table A of the degree in which the candidate is enrolled or Table S;

(v) If enrolled in a stream, complete the requirements for the stream as specified in Table A of the degree in which the candidate is enrolled.

(4) *For the Bachelor of Design in Architecture component of a combined degree:*

(a) Candidates must complete 96 credit points of units of study from the Bachelor of Engineering Honours (Civil) and Bachelor of Design in Architecture - Architecture Table.

(5) For the Bachelor of Laws component of a combined degree candidates must complete 144 credit points of Law units of study taken from the University of Sydney School of Law Undergraduate Table, comprising:

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

(b) 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.

(c) Students may apply to take up to a maximum of 24 credit points of LAWS6000/JURS6000 units of study as elective units of study:

(i) enrolment in LAWS6000/JURS6000 units of study will be subject to availability and any unit pre-requisites or assumed knowledge, which may include relevant industry experience or prior specialist study.

(ii) enrolment in LAWS6000/JURS6000 units is only permitted after a candidate has completed 96 credit points towards the Bachelor of Laws.

(iii) students may only enrol in LAWS6000/JURS6000 units listed in the Bachelor of Laws Elective units of study Table.

(6) *For the Bachelor of Project Management component of a combined degree:*

(a) Candidates must complete the core and elective units of study as set out in the Bachelor of Project Management Unit of Study Table.

7 Majors and Programs

(1) For the Bachelor of Engineering Honours component of a combined degree:

(a) The conditions for awarding of a major, and the majors available, are the same as for the Bachelor of Engineering Honours degree.

(b) Where a candidate wishes to complete a major, and that major requires completion of additional credit points beyond the standard requirements, then such enrolment will be allowed for the first major to be completed, up to 24cp in total, provided the candidate utilises all allowed elective components in satisfying the requirements of the major.

(2) For the Bachelor of Arts, Bachelor of Science or Bachelor of Commerce component of a combined degree:

(a) Completion of a major or a program which contains a major from Table A of the degree in which the candidate is enrolled is a requirement. The majors and programs available and requirements for completing the majors and programs are as specified in Table A of the degree in which the candidate is enrolled.

8 Requirements for Honours

(1) Honours in the Bachelor of Arts, Bachelor of Science or Bachelor of Commerce is available to meritorious candidates as part of the combined degree with the Bachelor of Engineering Honours by enrolling in the Bachelor of Advanced Studies and taking an embedded honours component, after completing 240 credit points and satisfying requirements for the combined degree.
(2) For candidates completing the Bachelor of Arts, Bachelor of Commerce or Bachelor of Science in a combined degree with the Bachelor of Engineering Honours and also completing an embedded honours component in the Bachelor of Advanced Studies, the requirement in the Bachelor of Advanced Studies for completion of a second major shall be deemed to be met by the 144 credit points of Engineering units specified in 6 (2) above.
(3) The grade of honours awarded on the basis of an embedded component in the Bachelor of Advanced Studies will be determined by an honours mark calculated from work in the embedded honours component as specified in the relevant faculty resolutions and degree resolutions for the honours component taken and Table A for the degree in which the candidate was enrolled as a component of the combined degree.

9 Award of the Degrees

(1) Candidates will be awarded a separate testamur for the Bachelor of Engineering Honours and for the partner bachelor degree.
(2) Candidates who successfully complete the Bachelor of Arts, Bachelor of Science or Bachelor of Commerce component as specified in 6 (3) and also complete an embedded honours component with the Bachelor of Advanced Studies shall be awarded the Bachelor of Advanced Studies separately with honours in the appropriate discipline.
(3) Candidates for the Bachelor of Arts, Bachelor of Science or Bachelor of Commerce with an embedded honours component in the Bachelor of Advanced Studies with honours who do not meet the requirements for honours but who meet the requirement for the pass degree, may be awarded the relevant degrees for which they fulfill requirements at pass level.
(4) The award grades, and the criteria for the grades, are as defined in the resolutions for the constituent degrees.
(5) 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 Bachelor of Design in Architecture pass degree.
(6) The Bachelor of Laws can be awarded in the grades of either Pass or Honours. 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

(1) For the Bachelor of Engineering Honours combined with Bachelor of Arts, Bachelor of Science, Bachelor of Design in Architecture and Bachelor of Project Management, a candidate may abandon the combined program and elect to complete either the Bachelor of Engineering Honours or the associated combined degree in accordance with the resolutions governing that degree.
(2) For the Bachelor of Engineering Honours combined with Bachelor of Laws, a candidate may withdraw from the combined degree program and elect to transfer to the Bachelor of Engineering Honours, 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.
(3) For the Bachelor of Engineering Honours combined with Bachelor of Commerce a candidate may abandon the combined program and elect to complete either the Bachelor of Engineering Honours 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.
(4) 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.
(5) A candidate who has enrolled in the Bachelor of Advanced Studies to complete requirements for an embedded honours component or a stream may abandon the Bachelor of Advanced Studies and return to the combined degree.

11 Progression Rules

(1) General progression rules for the combined degrees are covered by the resolutions of the Faculty of Engineering and Information Technologies.
(2) Candidates in a combined law program:
(a) must successfully complete LAWS1006 Foundations of Law before enrolling in any other Bachelor of Laws units of study;
(b) except with permission of the Dean of the University of Sydney Law School, candidates must complete the requirements for the Bachelor of Engineering Honours before proceeding to Year Five of the Bachelor of Laws.
(3) *Progression within the Dalyell Stream*
(a) With the permission of the Dalyell coordinator, candidates in the Dalyell Stream may attempt units at higher levels than the usual sequence.
(b) Candidates must achieve an Annual Average Mark at a level determined by the Board of Interdisciplinary Studies in each year of study or over for each 48 credit-point block to continue in the Dalyell Stream. Candidates who do not maintain an Annual Average Mark at the level determined by the Board of Interdisciplinary Studies may continue in any other stream into which they were admitted, major, program or minor but will not remain in the Dalyell Stream.
(4) *Progression within the Bachelor of Science (Medical Science) Stream*

Students in this stream will be required to meet the progression requirements for the stream.

12 Transitional Provisions

(1) These resolutions apply to students who commenced their candidature on or after 1 January 2018.
(2) Students who commenced their candidature prior to 1 January 2018 may:
(a) complete the requirements in accordance with the resolutions governing their candidature immediately prior to these changes; or
(b) where approved by the Faculty, elect to proceed under these resolutions provided appropriate programs of study can be identified. For the Bachelor of Science, Bachelor of Commerce and Bachelor of Arts, transitional arrangements will be as specified in the relevant set of resolutions.

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 2014 (the 'Coursework Rule'), the Coursework Policy 2014, the Resolutions of the Faculty, the University of Sydney (Student Appeals against Academic Decisions) Rule 2006 (as amended), the Academic Honesty in Coursework Policy 2015 and the Academic Honesty Procedures 2016. Up to date versions of all such documents are available from the Policy Register: http://sydney.edu.au/policies.

Course resolutions

1 Course codes

Code	Course title
BPPRJMGT	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 <= HWAM < 70
Honours not awarded	HWAM < 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.

Faculty of Engineering Schools

The Faculty of Engineering and Information Technologies offers a diverse range of undergraduate and postgraduate degree offerings across a wide range of study areas.

As a graduate, you will have excellent employment prospects and work-ready qualifications that are recognised worldwide.

The five Schools which comprise the Faculty are:

- School of Aerospace, Mechanical and Mechatronic Engineering
- School of Chemical and Biomolecular Engineering
- School of Civil Engineering
- School of Electrical and Information Engineering
- School of Information Technologies

School of Aerospace, Mechanical and Mechatronic Engineering

The School of Aerospace, Mechanical and Mechatronic Engineering encompasses five 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.

Biomedical Engineering covers all aspects of biomedical engineering, including: biomedical technology, biology, biomechanics, biomaterials, orthopaedic engineering, tissue engineering, medical regulation, bioelectronics, medical instrumentation, and computational simulation of biomedical systems.

The degree includes electives that provide opportunities for both breadth and depth as well as the option of a wide range of majors, including chemical engineering, information technology, electrical, mechanical, or mechatronic 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, small and large scale manufacturing 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 a 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 major at the University of Sydney is the only program of its kind offered in Australia.

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

- Aeronautical
- Biomedical
- Mechanical
- Mechatronic
- Combined degrees with Science (including Medical Science), Commerce, Arts, Project Management and Law.

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 (including Medical Science), Commerce, Arts, Project Management and Law.

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
- Combined degrees with Science (including Medical Science), Commerce, Arts, Project Management and Law.

School of Electrical and Information Engineering

With rapid transformation occurring across industries and a greater emphasis on green technologies, electrical engineers are set to play a vital role in building our future society.

Electrical engineers design, develop, install and maintain systems in areas as diverse as computer systems, power systems, electronics and telecommunications. They also deal with computer architecture, digital communications, embedded systems, instrumentation, lasers, microelectronics, microwaves and antennas, optical communications, satellite mobile communications, signal processing and systems design.

As an electrical engineering graduate, you will have the opportunity to positively contribute to many of today's challenges including climate change, environmental preservation, sustainability, renewable energy generation and healthcare.

Electrical engineering programs provide the scientific, mathematical and engineering foundations required to design systems across diverse areas like satellite communications, high-performance computing, telecommunications, signal processing, energy generation and biomedical engineering.

Software engineering involves all aspects of software production from the strategy and design to coding, quality and management of large scale, complex software systems.

With the growth in cloud computing and the increasing demand for sophisticated business solutions which access massive databases across wide networks, the need for highly-skilled software engineers is growing rapidly.

Software Engineering programs include foundation studies in mathematics, computer science and computer system principles, on which further studies in software design, development, security and management are built, including programming languages, databases, operating systems and enterprise and internet scale systems.

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

- Electrical
- Software, and
- Combined degrees with Science (including Medical Science), Commerce, Arts, Project Management and Law.

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 computing 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 degrees:

- The Bachelor of Advanced Computing. Its normal duration is four year (192 credit points).
- The Bachelor of Computing. This is an exit option only. Its normal duration is three years (144 credit points).

In addition, the school offers the following combined degrees:

- Bachelor of Advanced Computing and Bachelor of Commerce (BAdvComp/BCom) (240 credit points)
- Bachelor of Advanced Computing and Bachelor of Science (BAdvComp/BSc) (240 credit points)

Bachelor of Engineering Honours unit of study tables

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Bachelor of Engineering Honours Core Unit Table			
Candidates for the Bachelor of Engineering Honours are required to complete a total of not less than 192 credit points, consisting of the following:			
1. 36 credit points of Engineering Core units of study, as set out below;			
2. 108 credit points of Stream Core units of study from the relevant Bachelor of Engineering Honours stream table;			
3. 48 credit points of Stream Specialist units of study.			
Candidates intending to complete a major (optional for the Bachelor of Engineering Honours) must complete a minimum of 24 credit points from the table of units of study for that major.			
Maths Units of Study			
Candidates for the Bachelor of Engineering Honours must complete all Maths units of study listed below. MATH 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.			
MATH1021 **Calculus Of One Variable**	3	**A** HSC Mathematics Extension 1. Students who have not completed HSC Extension 1 Mathematics (or equivalent) are strongly advised to take the Extension 1 Mathematics Bridging Course (offered in February). **N** MATH1011 or MATH1901 or MATH1906 or MATH1111 or ENVX1001 or MATH1001 or MATH1921 or MATH1931	Semester 1
MATH1002 **Linear Algebra**	3	**A** HSC Mathematics or MATH1111. Students who have not completed HSC Mathematics (or equivalent) are strongly advised to take the Mathematics Bridging Course (offered in February). **N** MATH1012 or MATH1014 or MATH1902	Semester 1 Summer Main
MATH1023 **Multivariable Calculus and Modelling**	3	**A** HSC Mathematics Extension 1. Students who have not completed HSC Extension 1 Mathematics (or equivalent) are strongly advised to take the Extension 1 Mathematics Bridging Course (offered in February). **N** MATH1013 or MATH1903 or MATH1907 or MATH1003 or MATH1923 or MATH1933	Semester 2
MATH1005 **Statistical Thinking with Data**	3	**A** HSC Mathematics. Students who have not completed HSC Mathematics (or equivalent) are strongly advised to take the Mathematics Bridging Course (offered in February). **N** MATH1015 or MATH1905 or STAT1021 or STAT1022 or ECMT1010 or ENVX1001 or ENVX1002 or BUSS1020	Semester 2 Summer Main Winter Main
Professional Engagement Program			
Candidates for the Bachelor of Engineering Honours must complete the Professional Engagement Program units of study.			
ENGP1000 **Professional Engagement Program 1**		**N** ENGG4000 OR ENGG5217	Semester 1 Semester 2
ENGP2000 **Professional Engagement Program 2**		**P** ENGP1000 **N** ENGG4000 OR ENGG5217	Semester 2
ENGP3000 Professional Engagement Program 3 will be available from 2019 and must be completed by the end of the degree.			
Thesis Units of Study			
Candidates must complete either the two thesis units of study (12 credit points) or the Major Industrial Project belonging to the stream in which they are enrolled.			
AMME4111 **Thesis A**	6	**P** 36 credit points of at least third year units of study **N** AMME4010 or AMME4122 or AMME4121 *Prospective students in 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
AMME4112 **Thesis B**	6	**P** 36 credit points of at least third year units of study **N** AMME4121 or AMME4010 or AMME4122	Semester 1 Semester 2
CHNG4811 **Thesis A**	6	**A** CHNG3801 AND CHNG3802 AND CHNG3803 AND CHNG3805 AND CHNG3806 AND CHNG3807. 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** CHNG4813 OR CHNG4814 OR CHNG4203 *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 **Thesis B**	6	**A** CHNG3801 AND CHNG3802 AND CHNG3803 AND CHNG3805 AND CHNG3806 AND CHNG3807. 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** CHNG4813 OR CHNG4814 OR CHNG4203 *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 1.*	Semester 1 Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
CIVL4022 **Thesis A**	6	**P** 30 Credit points of at least 3rd year units of study, and ISWAM 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 and 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 **Thesis B**	6	**P** 30 Credit points of at least 3rd year units of study *Note: Department permission required for enrolment*	Semester 1 Semester 2
ELEC4712 **Thesis A**	6	**P** 36 credits of at least 3rd year units of study **N** ELEC4714 *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 **Thesis B**	6	**N** ELEC4714 *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
AMME4010 **Major Industrial Project**	24	**P** 36 credits of at least 3rd year units of study with 65% average **N** AMME4111 OR AMME4112 OR AMME4121 OR AMME4122 OR ENGG4000 OR MECH4601 *Note: Department permission required for enrolment*	Semester 1 Semester 2
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 **N** CHNG4811 OR CHNG4812 OR ENGG4000 OR CHNG4802 *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 Semester 2
ELEC4714 **Major Industrial Project**	24	**P** 36 credits of at least 3rd year units of study **N** ELEC4710 OR ELEC4711 OR ELEC4712 OR ELEC4713 OR ENGG4000 *Note: Department permission required for enrolment*	Semester 1 Semester 2

Integrated Engineering Units of Study

Candidates for the Bachelor of Engineering Honours must complete all Integrated Engineering units of study.

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
ENGG1111 **Integrated Engineering 1**	6	**N** ENGG1803 or ENGG1061	Semester 1 Semester 2
ENGG2111 **Integrated Engineering 2**	2	**P** ENGG1111 or ENGG1061	Intensive February Semester 2
ENGG3111 **Integrated Engineering 3**	2	**P** ENGG2111 AND (84cp UoS from Engineering) **N** ENGG3062	Semester 1
ENGG4111 **Integrated Engineering 4**	2	**P** ENGG2111 AND (84cp UoS from Engineering) **N** ENGG4064 OR ENGG4065	Semester 2

Integrated Engineering Exceptions

Aeronautical stream combined degree with Commerce or Law

Candidates enrolled in BE Honours (Aeronautical) in a combined degree with Commerce or Law are exempt from the Integrated Engineering units and must instead enrol in 12 credit points from the following Aeronautical Advanced Specialist units:

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
AERO4260 **Aerodynamics 2**	6	**P** AMME2200 OR AMME2261	Semester 1
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 2

Mechanical stream combined degree with Commerce or Law

Candidates enrolled in BE Honours (Mechanical) in a combined degree with Commerce or Law are exempt from the Integrated Engineering units and must instead enrol in 12 credit points from the following Mechanical Specialist units:

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
AMME5101 **Energy and the Environment**	6	**A** Students are expected to be familiar with the basic laws of thermodynamics, fluid mechanics and heat transfer **P** MECH3260 OR MECH9260 OR AERO3261 OR AERO9261 *Note: Department permission required for enrolment*	Semester 1
AMME5202 **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. *Note: Department permission required for enrolment*	Semester 1
AMME5271 **Computational Nanotechnology**	6	**A** Understanding of basic principles of Newtonian mechanics, physics and chemistry, fluid mechanics and solid mechanics. General knowledge of how to operate a computer and work with different software is also required. *Note: Department permission required for enrolment*	Semester 2
AMME5310 **Engineering Tribology**	6	**A** (AMME2302 OR AMME9302) AND (AMME2301 OR AMME9301) AND (MECH3261 OR MECH9261) *Note: Department permission required for enrolment*	Semester 1
AMME5510 **Vibration and Acoustics**	6	**P** (AMME2301 OR AMME9301) AND (AMME2200 OR AMME2261 OR AMME9261) AND (AMME2500 OR AMME9500)	Semester 2

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
AMME5520 **Advanced Control and Optimisation**	6	**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
AMME5912 **Crash Analysis and Design**	6	**A** Computer Aided Drafting, Basic FEA principles and Solid Mechanics *Note: Department permission required for enrolment*	Semester 1
MECH4460 **Mechanical Design 3**	6	**A** ENGG1802, AMME2301, AMME2500, MECH3361 **P** MECH2400 and MECH3460	Semester 1
MECH5255 **Air Conditioning and Refrigeration**	6	**A** Students are expected to be familiar with the basic laws of thermodynamics, fluid mechanics and heat transfer. **P** MECH3260 OR MECH9260 OR MECH5262 **N** MECH4255	Semester 2
MECH5265 **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
MECH5275 **Renewable Energy**	6	**A** The student will need a sound background in advanced level fluid mechanics, thermodynamics and heat transfer. In particular, students should be able to analyse fluid flow in turbomachinery; perform first and second law thermodynamic analysis of energy conversion systems, including chemically reacting systems; and perform advanced level calculations of conductive and convective and radiative heat transfer, including radiative spectral analysis. **P** (MECH3260 AND MECH3261) OR (AERO3260 AND AERO3261) OR (MECH5262 AND MECH5261) OR (MECH9260 AND MECH9261) OR (AERO9260 AND AERO9261). Students claiming to have prerequisite knowledge based on study at other institutions must contact the unit of study coordinator before enrolling in this unit and may be required to sit a pre-exam to demonstrate that they have the necessary knowledge and skills to undertake this advanced level unit. *Note: Department permission required for enrolment*	Semester 2
MECH5310 **Advanced Engineering Materials**	6	**P** (AMME2301 OR AMME9301) AND (AMME2302 OR AMME1362 OR AMME9302) AND (MECH3362 OR MECH9362) **N** MECH4310	Semester 1
Mechatronic stream combined degree with Commerce or Law			
Candidates enrolled in BE Honours (Mechatronic) in a combined degree with Commerce or Law are exempt from the Integrated Engineering units and must instead enrol in 12 credit points from the following Mechatronic Advanced Specialist units:			
AMME4710 **Computer Vision and Image Processing**	6	**P** MTRX3700 OR MECH4720 OR MECH5720	Semester 2
AMME5520 **Advanced Control and Optimisation**	6	**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
AMME5790 **Introduction to Biomechatronics**	6	**A** A good practical knowledge in mechanical and electronic engineering; adequate maths and applied maths skills; background knowledge of physics, chemistry and biology; Some programming capability, MATLAB, C, C++; able to use common software tools used by engineers including CAD and EDA packages. **P** MECH3921 OR MTRX3700 OR AMME5921 **N** AMME4790 *AMME5790 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 specialised biomechatronic applications that will be encountered by Mechatronic Engineers who enter this broad field on graduation.*	Semester 2
MECH5720 **Sensors and Signals**	6	**A** Strong MATLAB skills **P** MTRX3700 **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 AMME5501 OR AMME9501) AND MTRX3700.	Semester 1

For standard enrolment plans for all Engineering streams visit CUSP https://cusp.sydney.edu.au

Bachelor of Engineering Honours Electives unit of study tables

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
Engineering elective units of study			
General Elective Unit Table			
ENGG1000 **History and Philosophy of Engineering**	6		Semester 1 Semester 2
ENGG3800 **Industry and Community Projects**	6	*Note: Department permission required for enrolment*	Semester 1
CHNG1108 **Introduction to Chemical Engineering**	6	**A** HSC Mathematics and Chemistry **N** ENGG1800 OR CIVL1900 OR MECH1560 OR AERO1560 OR AMME1960 OR MTRX1701 OR ENGG1960	Semester 1
The following units are approved as general electives for Bachelor of Engineering Honours Students, provided that students are able to meet the enrolment requirements specified by the relevant faculty and provided that the unit of study is not substantially the same as a unit of study already completed.			
(1) Any units of study from the Faculties of Engineering and Information Technologies, Science, Arts or the Sydney Business School.			
(2) Any other units of study approved by the Faculty of Engineering and Information Technologies Courses Committee.			
(3) Any units of study approved by the Dean (or his/her delegate in these matters), or by the relevant Head of School or Program Director, on a case by case basis upon application by the student.			

Flexible First Year

The Flexible First Year Program 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 in your first semester before transferring to a stream.

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

- Aeronautical
- Biomedical
- Chemical and Biomolecular
- Civil
- Electrical
- Mechanical
- Mechatronic
- Software

In all streams, you will undertake the Professional Engagement Program, and enjoy opportunities for the development of significant professional relationships with industry partners.

The Flexible First Year Program has a common first semester. Students then transfer prior to Semester 2 into the stream of their choice.

Flexible first year is not available for mid year entry.

Flexible first year is not suited for students seeking to apply for credit for previous studies, and such students should apply directly for their chosen stream of engineering.

For a standard enrolment plan for Flexible First Year visit CUSP https://cusp.sydney.edu.au

Flexible First Year 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			
Candidates wishing to proceed to the degree of Bachelor of Engineering (Honours) or combined degrees with Science, Arts, Commerce, Law or Project Management, may choose to enrol in the Flexible First Year program. For details on eligibility for entry to this program consult the course resolutions pertaining to Flexible First Year.			
Candidates decide on the stream of Engineering to pursue once they have completed the first semester of the Flexible First Year program.			
Flexible First Year Core units of study			
Semester 1			
ENGG1111 **Integrated Engineering 1**	6	**N** ENGG1803 or ENGG1061	Semester 1 Semester 2
ENGG1800 **Introduction to Engineering Disciplines**	6	**N** CIVL1900 OR CHNG1108 OR MECH1560 OR AERO1560 OR AMME1960 OR MTRX1701 OR ENGG1960	Semester 1
ENGG1801 **Engineering Computing**	6		Semester 1 Summer Main
MATH1021 **Calculus Of One Variable**	3	**A** HSC Mathematics Extension 1. Students who have not completed HSC Extension 1 Mathematics (or equivalent) are strongly advised to take the Extension 1 Mathematics Bridging Course (offered in February). **N** MATH1011 or MATH1901 or MATH1906 or MATH1111 or ENVX1001 or MATH1001 or MATH1921 or MATH1931	Semester 1
MATH1002 **Linear Algebra**	3	**A** HSC Mathematics or MATH1111. Students who have not completed HSC Mathematics (or equivalent) are strongly advised to take the Mathematics Bridging Course (offered in February). **N** MATH1012 or MATH1014 or MATH1902	Semester 1 Summer Main
Candidates enrolled in a combined degree should replace ENGG1801 with 6 credit points from their second degree. Refer to CUSP for details.			
Semester 2			
The suggested Semester 2 enrolment is a temporary enrolment only. Candidates transfer to their chosen stream for Semester 2 and must change their unit of study selection to the units listed in the appropriate stream table.			
ENGG1000 **History and Philosophy of Engineering**	6		Semester 1 Semester 2
ENGG1813 **Engineering Critical Thinking**	6	*Note: Department permission required for enrolment*	Semester 2
ENGG1802 **Engineering Mechanics**	6	*Note: Department permission required for enrolment*	Intensive January Semester 2 Summer Main
MATH1023 **Multivariable Calculus and Modelling**	3	**A** HSC Mathematics Extension 1. Students who have not completed HSC Extension 1 Mathematics (or equivalent) are strongly advised to take the Extension 1 Mathematics Bridging Course (offered in February). **N** MATH1013 or MATH1903 or MATH1907 or MATH1003 or MATH1923 or MATH1933	Semester 2
MATH1005 **Statistical Thinking with Data**	3	**A** HSC Mathematics. Students who have not completed HSC Mathematics (or equivalent) are strongly advised to take the Mathematics Bridging Course (offered in February). **N** MATH1015 or MATH1905 or STAT1021 or STAT1022 or ECMT1010 or ENVX1001 or ENVX1002 or BUSS1020	Semester 2 Summer Main Winter Main
Candidates enrolled in a combined degree should replace ENGG1813 with 6 credit points from their second degree. Refer to CUSP for details.			
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.			

For a standard enrolment plan for Flexible First Year visit CUSP https://cusp.sydney.edu.au

Exchange Units of Study

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Exchange units of study			
School of Aeronautical, Mechanical and Mechatronic Engineering			
AMME0011 **International Exchange B**	6	*Department permission required for enrolment.*	Intensive January Intensive July Semester 1 Semester 2
AMME0012 **International Exchange C**	6	*Department permission required for enrolment.*	Intensive January Intensive July 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 stream *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 stream *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
CHNG3043 **Exchange Program 3C**	6	*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.*	Intensive January Intensive July
CHNG3044 **Exchange Program 3D**	6	*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.*	Intensive July
CHNG4041 **Exchange Program 4A**	24	**P** 144 credit points in Chemical Engineering stream *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 stream, and at least 144 credit points towards the degree. *Department permission required for enrolment in sessions 1 and 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.*	Intensive January Intensive July Semester 1 Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
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.*	Intensive January Intensive July 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
School of Electrical and Information Engineering			
ELEC3901 **Electrical Exchange Unit 1A**	6		Intensive January Intensive July Semester 1
ELEC3902 **Electrical Exchange Unit 1B**	12		Semester 1
ELEC3903 **Electrical Exchange Unit 1C**	24		Semester 1
ELEC3904 **Electrical Exchange Unit 2A**	6		Intensive January Intensive July 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		Intensive January Intensive July 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		Intensive January Intensive July 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

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
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
INFO1591 Advanced Information Technology Exchange	6		Semester 1 Semester 1a Semester 1b Semester 2 Semester 2a Semester 2b
INFO1592 Advanced Information Technology Exchange	6		Semester 1 Semester 1a Semester 1b Semester 2 Semester 2a Semester 2b
INFO2551 Information Technology Exchange	6		Intensive January Intensive July Semester 1 Semester 2
INFO2552 Information Technology Exchange	6		Semester 1 Semester 2
INFO2591 Advanced Information Technology Exchange	6		Semester 1 Semester 1a Semester 1b Semester 2 Semester 2a Semester 2b
INFO2592 Advanced Information Technology Exchange	6		Semester 1 Semester 1a Semester 1b Semester 2 Semester 2a Semester 2b
INFO3551 Information Technology Exchange	6		Intensive January Intensive July Semester 1 Semester 2
INFO3552 Information Technology Exchange	6		Semester 1 Semester 2
INFO3553 Information Technology Exchange	6		Semester 1 Semester 2
INFO3591 Advanced Information Technology Exchange	6		Semester 1 Semester 1a Semester 1b Semester 2 Semester 2a Semester 2b
INFO3592 Advanced Information Technology Exchange	6		Semester 1 Semester 1a Semester 1b Semester 2 Semester 2a Semester 2b

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
INFO3593 **Advanced Information Technology Exchange**	6		Semester 1 Semester 1a Semester 1b Semester 2 Semester 2a Semester 2b
INFO3594 **Advanced Information Technology Exchange**	6		Semester 1 Semester 1a Semester 1b Semester 2 Semester 2a Semester 2b
ISYS1551 **Information Systems Exchange**	6		Semester 1 Semester 2
ISYS1552 **Information Systems Exchange**	6		Semester 1 Semester 2
ISYS2554 **Information Systems Exchange**	6		Intensive January Intensive July 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		Intensive January Intensive July 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. For further information refer to the [[http://sydney.edu.au/study/overseas-exchange.html||Study abroad and exchange website]].

School of Aeronautical, Mechanical and Mechatronic Engineering

AMME0011
International Exchange B

Credit points: 6 **Session:** Intensive January, Intensive July, 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:** Intensive January, Intensive July, 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 stream **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 stream **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.

CHNG3043
Exchange Program 3C

Credit points: 6 **Session:** Intensive January, Intensive July **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: 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.

The unit is a Year 3 elective unit of study for the Bachelor degree in Chemical Engineering. The unit enables Chemical Engineering undergraduates to undertake an overseas learning activity during the university's winter break while completing the academic and professional requirements of the University of Sydney degree program. The learning activity may comprise either a short project under academic or industry supervision or summer or winter unit of study at an approved overseas institution. The learning activity should demonstrate outcomes and workload equivalent to a 6 credit point senior unit in the student's current award program.

CHNG3044
Exchange Program 3D

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

Note: 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.

The unit is a Year 3 elective unit of study for the Bachelor degree in Chemical Engineering. The unit enables Chemical Engineering undergraduates to undertake an overseas learning activity during the university's summer or winter break while completing the academic and professional requirements of the University of Sydney degree program. The learning activity may comprise either a short project under academic or industry supervision or summer or winter school unit of study at an approved overseas institution. The learning activity should demonstrate outcomes and workload equivalent to a 6 credit point senior unit in the student's current award program.

CHNG4041
Exchange Program 4A

Credit points: 24 **Session:** Semester 1, Semester 2 **Prerequisites:** 144 credit points in Chemical Engineering stream **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 stream, 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:** Intensive January, Intensive July, 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:** Intensive January, Intensive July, 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

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.

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:** Intensive January, Intensive July, 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 and Information Engineering. The enrolment in this unit needs to be approved by the school. The enrolment 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 and Information Engineering. The enrolment in this unit needs to be approved by the school. The enrolment 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 and Information Engineering. The enrolment in this unit needs to be approved by the school. The enrolment 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:** Intensive January, Intensive July, 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 and Information Engineering. The enrolment in this unit needs to be approved by the school. The enrolment 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 and Information Engineering. The enrolment in this unit needs to be approved by the school. The enrolment 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 and Information Engineering. The enrolment in this unit needs to be approved by the school. The enrolment 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:** Intensive January, Intensive July, 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:** Intensive January, Intensive July, 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.

INFO1591
Advanced Information Technology 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.

INFO1592
Advanced Information Technology 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.

INFO2551
Information Technology Exchange

Credit points: 6 **Session:** Intensive January, Intensive July, 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.

INFO2591
Advanced Information Technology 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.

INFO2592
Advanced Information Technology 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.

INFO3551
Information Technology Exchange

Credit points: 6 **Session:** Intensive January, Intensive July, 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.

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.

INFO3591
Advanced Information Technology 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.

INFO3592
Advanced Information Technology 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.

INFO3593
Advanced Information Technology 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.

INFO3594
Advanced Information Technology 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.

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:** Intensive January, Intensive July, 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:** Intensive January, Intensive July, 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.

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 experience 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. A minimum of 36 credit points from the Engineering Core Table, including all required units;
2. A minimum of 108 credit points from the Aeronautical Stream Core Table, including all required units; and
3. A minimum of 48 credit points of additional units from the Aeronautical Stream Specialist Table, including satisfying any additional requirements specified for the Specialist Table.
4. A maximum of 6 credit points of general electives may be taken.

For a standard enrolment plan for Aeronautical Engineering visit CUSP (https://cusp.sydney.edu.au).

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Aeronautical Engineering Stream Table			
Aeronautical Stream Core units			
Complete all 108 credit points of the following units of study:			
AERO1560 **Introduction to Aerospace Engineering**	6	**N** ENGG1800 OR MECH1560 OR MTRX1701 OR CIVL1900 OR CHNG1108 OR AMME1960 OR ENGG1960	Semester 1
AMME1362 **Materials 1**	6	**N** CIVL2110 or AMME2302	Semester 2
ENGG1801 **Engineering Computing**	6		Semester 1 Summer Main
ENGG1802 **Engineering Mechanics**	6	*Note: Department permission required for enrolment*	Intensive January Semester 2 Summer Main
AERO2703 **Aircraft Performance and Operations**	6	**A** AERO1560 or ENGG1800, Familiarity with fundamental Aerospace concepts. **P** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923) AND ENGG1801	Semester 2
AMME2261 **Fluid Mechanics 1**	6	**A** Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **P** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) **N** AMME2200	Semester 1
AMME2262 **Thermal Engineering 1**	6	**A** Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **P** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) **N** AMME2200	Semester 2
AMME2301 **Mechanics of Solids**	6	**P** ENGG1802 AND (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) **N** CIVL2201	Semester 2
AMME2500 **Engineering Dynamics**	6	**A** Familiarity with the MATLAB programming environment **P** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) AND ENGG1802	Semester 1
AMME2700 **Instrumentation**	6	**A** Programming skills, 1st year maths skills, familiarity with fundamental Engineering concepts. **P** AERO1560 OR MECH1560 OR MTRX1701 OR ENGG1800	Semester 1
MECH2400 **Mechanical Design 1**	6	**A** ENGG1801 and ENGG1802, HSC Maths and Physics	Semester 2
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)	Semester 2
AERO3261 **Propulsion**	6	**A** Good knowledge of fluid dynamics and thermodynamics **P** AMME2200 or (AMME2261 and AMME2262)	Semester 1
AERO3360 **Aerospace Structures 1**	6	**P** AMME2301	Semester 1
AERO3460 **Aerospace Design 1**	6	**P** AMME2301 and MECH2400	Semester 1
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 2
AMME3500 **System Dynamics and Control**	6	**P** (AMME2000 OR MATH2067 OR (MATH2061 AND MATH2065) OR MATH2021) AND AMME2500	Semester 1
AERO4460 **Aerospace Design 3**	6	**A** AERO1400 and AERO2703 and AERO3465 **P** AERO3260 and AERO3261 and AERO3360 and AERO3460	Semester 1
Students undertaking the Space Major are exempt from AERO2703 and AERO4460.			

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Aeronautical Stream Specialist units			
Complete 48 credit points of the units listed below:			
Select a minimum of 12 credit points from the following Aeronautical Advanced Specialist units:			
AERO4260 **Aerodynamics 2**	6	**P** AMME2200 OR AMME2261	Semester 1
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 2
Select the remaining credit points from the following units:			
AERO1400 **Intro to Aircraft Construction and Design**	6	**A** Some basic skills with engineering workshop hand tools is desirable.	Semester 2
AMME2000 **Engineering Analysis**	6	**P** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) AND (ENGG1801 OR INFO1103 OR INFO1903 OR INFO1110 OR DATA1002)	Semester 1
MATH2021 **Vector Calculus and Differential Equations**	6	**P** (MATH1X21 or MATH1931 or MATH1X01 or MATH1906) and (MATH1XX2) and (MATH1X23 or MATH1933 or MATH1X03 or MATH1907) **N** MATH2921 or MATH2065 or MATH2965 or MATH2061 or MATH2961 or MATH2067	Semester 1
MATH2921 **Vector Calculus and Differential Eqs (Adv)**	6	**P** [(MATH1921 or MATH1931 or MATH1901 or MATH1906) or (a mark of 65 or above in MATH1021 or MATH1001)] and [MATH1902 or (a mark of 65 or above in MATH1002)] and [(MATH1923 or MATH1933 or MATH1903 or MATH1907) or (a mark of 65 or above in MATH1023 or MATH1003)] **N** MATH2021 or MATH2065 or MATH2965 or MATH2061 or MATH2961 or MATH2067	Semester 1
AERO3465 **Aerospace Design 2**	6	**A** AERO1400 AND AMME2302 AND AMME1362 **P** AMME2301 and MECH2400	Semester 2
AMME3060 **Engineering Methods**	6	**P** AMME2000 OR MATH2067 OR (MATH2061 AND MATH2065) OR MATH2021	Semester 2
AERO5200 **Advanced Aerodynamics**	6	**A** BE in the area of Aerospace Engineering or related Engineering field. **P** AERO5210 or AERO9260 or AERO3260	Semester 2
AERO5206 **Rotary Wing Aircraft**	6	**A** Concepts from Aerodynamics and Flight Mechanics will be applied to Rotary Wing Vehicles in this unit. **P** (AERO3260 OR AERO9260) AND (AERO3560 OR AERO9560)	Semester 2
AERO5400 **Advanced Aircraft Design Analysis**	6	**A** Undergraduate level 1, 2 and 3 or Foundation Masters units in Aerospace Design are expected to have been completed before undertaking this unit. **P** AERO3460 or AERO5410 or AERO9460 **N** AERO4491	Semester 2
AERO5500 **Flight Mechanics Test and Evaluation Adv**	6	**A** BE in area of Aerospace Engineering or related Engineering Field. **P** AERO5510 OR AERO9560 OR AERO3560 *Note: Department permission required for enrolment*	Semester 1
AMME5202 **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. *Note: Department permission required for enrolment*	Semester 1
AMME5510 **Vibration and Acoustics**	6	**P** (AMME2301 OR AMME9301) AND (AMME2200 OR AMME2261 OR AMME9261) AND (AMME2500 OR AMME9500)	Semester 2
A maximum of 6 credit points can be selected from the Engineering General Elective Table.			
Candidates enrolled in the Space major complete the following 18 credit points of units of study:			
AERO2705 **Space Engineering 1**	6	**A** ENGG1801. First Year Maths and basic MATLAB programming skills. **P** (AERO1560 OR MECH1560 OR MTRX1701 OR ENGG1800) AND (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923). Entry to this unit requires that students are eligible for the Space Engineering Major. *Note: Department permission required for enrolment*	Semester 2
AERO3760 **Space Engineering 2**	6	**P** Students must have a 65% average in (AMME2500 AND AMME2261 AND AMME2301 AND AERO2705) OR (AMME2500 AND AMME2301 AND MTRX2700 AND AERO2705). Note: MUST have passed AERO2705	Semester 2
AERO4701 **Space Engineering 3**	6	**P** [65% average in (AERO3460 AND AERO3360 AND AERO3560 AND AERO3760) OR (MECH3660 AND MECH3261 AND MECH3361 AND AERO3760) OR (MECH3660 AND AMME3500 AND MTRX3700 AND AERO3760)] AND [Must have passed AERO3760]. Students must have achieved a 65% average mark in 3rd year for enrolment in this unit.	Semester 1

For a standard enrolment plan for Aeronautical Engineering visit CUSP (https://cusp.sydney.edu.au).

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 Biomedical program can also be taken as a combined degree with either Science (including Medical Science), Arts, Commerce, Law, or Project Management.

Candidates for combined Engineering degrees are not required to complete a major.

Course Requirements

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

1. A minimum of 36 credit points from the Engineering Core Table, including all required units;
2. A minimum of 108 credit points from the Biomedical Stream Core Table, including all required units; and
3. A minimum of 48 credit points of additional units from the Biomedical Stream Specialist Table, including satisfying any additional requirements specified for the Specialist Table.
4. A maximum of 12 credit points of general electives may be taken.

For a standard enrolment plan for Biomedical Engineering visit CUSP (https://cusp.sydney.edu.au).

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Biomedical Engineering Stream Table			
Biomedical Engineering Stream Core units			
Complete a total of 108 credit points of units of study from the following unit groups:			
Complete 6 credit points of:			
ENGG1801 **Engineering Computing**	6		Semester 1 Summer Main
INFO1110 **Introduction to Programming**	6		Intensive July Semester 1 Semester 2
Complete 6 credit points of:			
ENGG1802 **Engineering Mechanics**	6	*Note: Department permission required for enrolment*	Intensive January Semester 2 Summer Main
PHYS1001 **Physics 1 (Regular)**	6	**A** HSC Physics or PHYS1003 or PHYS1004 or PHYS1902 or equivalent. Students who have not completed HSC Physics (or equivalent) are strongly advised to take the Physics Bridging Course (offered in February). Students are also encouraged to take (MATH1X21 or MATH1931 or MATH1X01 or MATH1906) and MATH1X02 concurrently. **N** PHYS1002 or PHYS1901 or EDUH1017 or PHYS1903	Semester 1
Complete 6 credit points of:			
AMME2200 **Introductory Thermofluids**	6	**A** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933). Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **N** AMME2261 OR AMME2262	Semester 2
CHNG2803 **Heat and Mass Transfer**	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 MATH1021 OR MATH1901 OR MATH1921) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923) AND (MATH1005 OR MATH1905) AND CHNG1103 AND ENGG1801 **C** (CHNG2802 OR AMME2960) AND CHNG2801	Semester 1
ELEC2302 **Signals and Systems**	6	**A** (MATH1001 OR MATH1021) AND MATH1002 AND (MATH1003 OR MATH1023). 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
Complete 6 credit points of:			
AMME5790 **Introduction to Biomechatronics**	6	**A** A good practical knowledge in mechanical and electronic engineering; adequate maths and applied maths skills; background knowledge of physics, chemistry and biology; Some programming capability, MATLAB, C, C++; able to use common software tools used by engineers including CAD and EDA packages. **P** MECH3921 OR MTRX3700 OR AMME5921 **N** AMME4790 *AMME5790 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 specialised biomechatronic applications that will be encountered by Mechatronic Engineers who enter this broad field on graduation.*	Semester 2
AMME5951 **Fundamentals of Neuromodulation**	6	**A** ELEC1103 or equivalent, (MECH2901 OR AMME9901), and (MECH3921 or AMME5921)	Semester 1
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
Complete all 72 credit points of:			
AMME1960 **Biomedical Engineering 1A**	6	**A** HSC Mathematics Extension 1 (3 Unit) **N** ENGG1960 or ENGG1800 or CIVL1900 or CHNG1108 or AERO1560 or MECH1560 or MTRX1701	Semester 1
AMME1961 **Biomedical Engineering 1B**	6	**A** HSC Biology and HSC Chemistry. Summer bridging courses are available for students who did not complete HSC Biology or Chemistry *Note: CHEM1101 is scheduled for semester 1 Year 1 and AMME1961 for Semester 2 Year 1. Students should ideally ensure that they follow this schedule.*	Semester 2

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
CHEM1111 **Chemistry 1A**	6	**A** Students who have not completed HSC Chemistry (or equivalent) and HSC Mathematics (or equivalent) are strongly advised to take the Chemistry and Mathematics Bridging Courses (offered in February) **N** CHEM1001 or CHEM1101 or CHEM1901 or CHEM1903 or CHEM1109 or CHEM1011 or CHEM1911 or CHEM1991 *Students who have not completed secondary school chemistry are strongly advised to instead complete Fundamentals of Chemistry 1A in the first semester of the calendar year (unless you require 12 credit points of Chemistry and are commencing in semester 2). You should also take the Chemistry Bridging Course in advance (offered in February, and online year-round http://sydney.edu.au/science/chemistry/studying-chemistry/bridging-course.shtml).*	Semester 1 Semester 2 Summer Main
AMME1362 **Materials 1**	6	**N** CIVL2110 or AMME2302	Semester 2
AMME2960 **Biomedical Engineering 2**	6	**A** AMME1960 AND AMME1961 **P** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923)	Semester 1
ELEC1103 **Fundamentals of Elec and Electronic Eng**	6	**A** Basic knowledge of differentiation & integration, and HSC Physics	Semester 1
MECH2901 **Anatomy and Physiology for Engineers**	6	**P** (AMME1960 OR ENGG1960 OR AMME1961 OR BIOL1xxx) AND (6CP 1000-level Chemistry)	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
AMME3660 **Biomanufacturing**	6	**P** MECH2400 OR ENGG1960 OR AMME1960 OR MECH1560 **N** MECH3660	Semester 1
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 OR AMME1960) **N** AMME5921	Semester 2
AMME4971 **Tissue Engineering**	6	**P** MECH2901 AND MECH3921	Semester 1
MECH4961 **Biomechanics and Biomaterials**	6	**P** (ENGG1960 OR ENGG1802 OR PHYS1001) AND (AMME2302 OR AMME1362) AND MECH2901 AND MECH3921	Semester 2
Also complete 12 credit points of units of study from the Biomedical Engineering Stream Specialist table below.			

Biomedical Engineering Stream Specialist units

Select a minimum of 12 credit points from the following units of study:			
AMME2262 **Thermal Engineering 1**	6	**A** Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **P** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) **N** AMME2200	Semester 2
AMME4710 **Computer Vision and Image Processing**	6	**P** MTRX3700 OR MECH4720 OR MECH5720	Semester 2
AMME4981 **Applied Biomedical Engineering**	6	**A** MECH3361 AND MECH2400 AND MECH2901 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 **P** AMME2301 AND AMME2500 AND (AMME1362 OR AMME2302) **N** AMME9981	Semester 1
AMME4990 **Biomedical Product Development**	6	**A** 1000-level chemistry, 2000-level biology, and specific knowledge of cell biology at least at the 1000-level, and preferably at the 2000-level. **P** MECH2901 AND MECH3921	Semester 1
AMME5931 **Nanomaterials in Medicine**	6	**A** 1000-level Biology and Chemistry; 3000-level or higher Engineering Design Practice and Biomedical Engineering; AMME1362 or 6cp 1000-level Materials Science; MECH2901 or 6cp 2000-level Anatomy and Physiology.	Semester 1
AMME5951 **Fundamentals of Neuromodulation**	6	**A** ELEC1103 or equivalent, (MECH2901 OR AMME9901), and (MECH3921 or AMME5921)	Semester 1
AMME5962 **Introduction to Mechanobiology**	6	**A** 6 credit points of 1000-level biology, 6 credit points of 1000-level chemistry and 6 credit points of 2000-level physiology or equivalent	Semester 2
AMME5992 **Regulatory Affairs in the Medical Industry**	6	**A** 6cp of 1000-level Chemistry, and 6cp of Biology units **P** (AMME9901 OR MECH2901) AND (MECH3921 OR AMME5921) **N** AMME4992 *Note: Department permission required for enrolment*	Semester 2
AMME5958 **Nanotechnology in Biomedical Engineering**	6	**P** (AMME1362 OR AMME9302) AND (MECH3921 OR AMME5921)	Semester 2
AMME5995 **Advanced Bionics**	6	**P** AMME5921 OR MECH3921	Semester 1
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: (MATH1001 OR MATH1021) AND (MATH1003 OR MATH1023) *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.*	Semester 1

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
CHNG5604 **Advanced Membrane Engineering**	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
COMP5048 **Visual Analytics**	6	**A** It is assumed that students will have basic knowledge of data structures, algorithms and programming skills.	Semester 2
COMP5424 **Information Technology in Biomedicine**	6		Semester 1
ELEC3305 **Digital Signal Processing**	6	**A** 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
ELEC5514 **Networked Embedded Systems**	6	**A** ELEC3305, ELEC3506, ELEC3607 and ELEC5508 **P** ELEC5509	Semester 2
ELEC5701 **Technology Venture Creation**	6	**N** ENGG5102	Semester 2
HTIN5002 **Quality Frameworks for Health Innovation**	6	**P** at least 36cp of 3000-level or higher units and a WAM of 70+	Semester 2
MECH5720 **Sensors and Signals**	6	**A** Strong MATLAB skills **P** MTRX3700 **N** MECH4720	Semester 2
MECH5907 **Orthopaedic and Surgical Engineering**	6	**A** 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** (AMME2302 OR AMME9302 OR AMME1362) AND (MECH2901 OR AMME9901) AND (MECH3921 OR AMME5921) **N** MECH4902	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 AMME5501 OR AMME9501) AND MTRX3700.	Semester 1
Biomedical Engineering Stream Elective units			
Select the remaining credit points from the following units of study. Biomedical Specialist Electives may also be counted as Stream Electives.			
AMME2200 **Introductory Thermofluids**	6	**A** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933). Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **N** AMME2261 OR AMME2262	Semester 2
AMME2261 **Fluid Mechanics 1**	6	**A** Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **P** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) **N** AMME2200	Semester 1
AMME2262 **Thermal Engineering 1**	6	**A** Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **P** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) **N** AMME2200	Semester 2
AMME2301 **Mechanics of Solids**	6	**P** ENGG1802 AND (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) **N** CIVL2201	Semester 2
AMME2500 **Engineering Dynamics**	6	**A** Familiarity with the MATLAB programming environment **P** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) AND ENGG1802	Semester 1
AMME3500 **System Dynamics and Control**	6	**P** (AMME2000 OR MATH2067 OR (MATH2061 AND MATH2065) OR MATH2021) AND AMME2500	Semester 1
CHNG1103 **Conservation of Mass and Energy**	6		Semester 2
CHNG2801 **Fluid Mechanics**	6	**A** Calculus, Computations (Matlab, Excel), Mass and Energy Balances. **P** CHNG1103 **C** CHNG2802 OR AMME2960	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 MATH1021 OR MATH1901 OR MATH1921) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923) AND (MATH1005 OR MATH1015 OR MATH1905) AND CHNG1103	Semester 1
CHNG2804 **Chemical Engineering Thermodynamics**	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** CHNG1103 AND (CHEM1101 OR CHEM1111) AND (CHEM1102 OR CHEM1112) **C** (CHNG2805 AND CHNG2806) OR MECH2901	Semester 2

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
CHNG2805 **Engineering for a Sustainable Society**	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** CHNG1103	Semester 2
CHNG2806 **Separation Processes**	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** CHNG1103 AND CHNG2803 **C** CHNG2804	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 AND CHNG2802 AND CHNG2803 AND CHNG2804 AND CHNG2805 AND CHNG2806) OR (CHNG2801 AND CHNG2803 AND CHNG2804 AND AMME2960) **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 AND CHNG2802 AND CHNG2803 AND CHNG2804 AND CHNG2805 AND CHNG2806) OR (CHNG2801 AND CHNG2803 AND CHNG2804 AND AMME2960) **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 AND CHNG2802 AND CHNG2803 AND CHNG2804 AND CHNG2805 AND CHNG2806) OR (CHNG2801 AND CHNG2803 AND CHNG2804 AND AMME2960) **C** CHNG3801 and CHNG3802	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** (CHNG2801 AND CHNG2802 AND CHNG2803 AND CHNG2804 AND CHNG2805 AND CHNG2806) OR (CHNG2801 AND CHNG2803 AND CHNG2804 AND AMME2960)	Semester 2
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
CHNG3808 **Engineering Macromolecules and Nanocomposites**	6	**A** Knowledge of reaction engineering, fluid flow, heat transfer and mass transfer. **P** CHNG2801 AND CHNG2806 **C** CHNG3802	Semester 1
CHNG3809 **Laboratory and Industrial Practice**	6	**P** CHNG1103, CHNG2801, CHNG2802, CHNG2803, CHNG2804, CHNG2805 AND CHNG2806 **C** CHNG3801, CHNG3802, CHNG3803	Semester 1
CHNG4802 **Chemical Engineering Design A**	6	**A** CHNG3801 AND CHNG3802 AND CHNG3803 AND CHNG3805 AND CHNG3806 AND CHNG3807. 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	Semester 1
CHNG4806 **Chemical Engineering Design B**	6	**A** CHNG3801 AND CHNG3802 AND CHNG3803 AND CHNG3805 AND CHNG3806 AND CHNG3807. 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 *Department permission required for enrolment prior to CHNG4802 in the case of Mid-Year Entry students.*	Semester 2
CIVL3310 **Humanitarian Engineering**	6		Semester 1
CIVL5320 **Engineering for Sustainable Development**	6	**P** CIVL3310 OR CIVL9310	Semester 2
CIVL5330 **Global Engineering Field Work**	6	*Note: Department permission required for enrolment*	Intensive December Intensive July
COMP2017 **Systems Programming**	6	**P** INFO1113 OR INFO1105 OR INFO1905 OR INFO1103 **C** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **N** COMP2129	Semester 1

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
COMP2022 **Programming Languages, Logic and Models**	6	**A** MATH1004 OR MATH1904 OR MATH1064 OR MATH2069 OR MATH2969 **P** INFO1103 OR INFO1903 OR INFO1113 **N** COMP2922	Semester 2
COMP2123 **Data Structures and Algorithms**	6	**P** INFO1110 OR INFO1113 OR DATA1002 OR INFO1103 OR INFO1903 **N** INFO1105 OR INFO1905 OR COMP2823	Semester 1
COMP2823 **Data Structures and Algorithms (Adv)**	6	**A** Distinction-level result in at least one the listed 1000 level programming units **P** Distinction level result in at least one of INFO1110 OR INFO1113 OR DATA1002 OR INFO1103 OR INFO1903 **N** INFO1105 OR INFO1905 OR COMP2123 *Note: Department permission required for enrolment*	Semester 1
COMP2922 **Programming Languages, Logic and Models (Adv)**	6	**A** MATH1004 OR MATH1904 OR MATH1064 OR MATH2069 OR MATH2969 **P** Distinction level result in INFO1103 OR INFO1903 OR INFO1113 **N** COMP2022 *Note: Department permission required for enrolment*	Semester 2
COMP3027 **Algorithm Design**	6	**A** MATH1004 OR MATH1904 OR MATH1064 **P** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **N** COMP2007 OR COMP2907 OR COMP3927	Semester 1
COMP3221 **Distributed Systems**	6	**P** (INFO1105 OR INFO1905) OR ((INFO1103 OR INFO1113) AND (COMP2123 OR COMP2823)) **N** COMP2121	Semester 1
COMP3308 **Introduction to Artificial Intelligence**	6	**A** Algorithms. Programming skills (e.g. Java, Python, C, C++, Matlab) **N** COMP3608	Semester 1
COMP3419 **Graphics and Multimedia**	6	**A** Programming skills **P** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905	Semester 2
COMP3520 **Operating Systems Internals**	6	**P** (COMP2017 OR COMP2129) AND (COMP2123 OR COMP2823 OR INFO1105 OR INFO1905)	Semester 2
COMP3608 **Introduction to Artificial Intelligence (Adv)**	6	**A** Algorithms. Programming skills (e.g. Java, Python, C, C++, Matlab) **P** Distinction-level results in some 2nd year COMP or MATH or SOFT units. **N** COMP3308 *COMP3308 and COMP3608 share the same lectures, but have different tutorials and assessment (the same type but more challenging).*	Semester 1
COMP3615 **Computer Science Project**	6	**P** (COMP2123 OR COMP2823) AND COMP2017 AND (COMP2022 OR COMP2922) **N** INFO3600 OR COMP3600	Semester 2
COMP3927 **Algorithm Design (Adv)**	6	**A** MATH1004 OR MATH1904 OR MATH1064 **P** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **N** COMP2007 OR COMP2907 OR COMP3027 *Note: Department permission required for enrolment*	Semester 1
DATA2001 **Data Science: Big Data and Data Diversity**	6	**P** DATA1002 OR INFO1110 OR INFO1903 OR INFO1103	Semester 1
DATA2002 **Data Analytics: Learning from Data**	6	**A** (Basic Linear Algebra and some coding) or QBUS1040 **P** [DATA1001 or ENVX1001 or ENVX1002] or [MATH10X5 and MATH1115] or [MATH10X5 and STAT2011] or [MATH1905 and MATH1XXX (except MATH1XX5)] or [BUSS1020 or ECMT1010 or STAT1021] **N** STAT2012 or STAT2912	Semester 2
DATA3404 **Data Science Platforms**	6	**A** This unit of study assumes that students have previous knowledge of database structures and of SQL. The prerequisite material is covered in DATA2001 or ISYS2120. Familiarity with a programming language (e.g. Java or C) is also expected. **P** DATA2001 OR ISYS2120 OR INFO2120 OR INFO2820 **N** INFO3504 OR INFO3404	Semester 1
ELEC2103 **Simulation and 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** COSC1001 or COSC1901	Semester 2
ELEC2302 **Signals and Systems**	6	**A** (MATH1001 OR MATH1021) AND MATH1002 AND (MATH1003 OR MATH1023). 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
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
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. **P** ELEC3203	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** ELEC2302 AND (MATH2061 OR MATH2067 OR MATH2021 OR MATH2961 OR AMME2000) **N** AMME3500	Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
ELEC3305 **Digital Signal Processing**	6	**A** 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
ELEC3405 **Communications Electronics and Photonics**	6	**A** ELEC2104. A background in basic electronics and circuit theory is assumed.	Semester 2
ELEC3505 **Communications**	6	**P** ELEC2302. 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
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 AND COMP2017	Semester 1
ELEC3608 **Computer Architecture**	6	**A** ELEC3607. Basic knowledge of assembly language and microprocessor systems is required. **P** ELEC2602	Semester 2
ELEC3609 **Internet Software Platforms**	6	**P** (INFO1103 OR INFO1110) AND (INFO2110 OR ISYS2110) AND (INFO2120 OR INFO2820 OR ISYS2120) **N** EBUS4001	Semester 2
ELEC3610 **E-Business Analysis and Design**	6	**N** EBUS3003	Semester 1
ELEC3702 **Management for Engineers**	6	**N** ENGG3005 or MECH3661	Semester 2
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
ELEC3803 **Bioelectronics**	6	**P** ELEC2104 OR ELEC2602.	Semester 2
ENGG3800 **Industry and Community Projects**	6	*Note: Department permission required for enrolment*	Semester 1
INFO1113 **Object-Oriented Programming**	6	**P** INFO1110 **N** INFO1103 OR INFO1105 OR INFO1905	Semester 1 Semester 2
INFO2150 **Introduction to Health Data Science**	6	**A** Basic knowledge of Entity Relationship Modelling, database technology and SQL **P** (INFO1003 OR INFO1903 OR INFO1103 OR INFO1110 OR DATA1002) AND (DATA1001 OR MATH1005 OR MATH1905 OR MATH1015) **C** DATA2001 or ISYS2120 OR INFO2120 OR INFO2820 OR INFO1903	Semester 2
INFO2911 **IT Special Project 2A**	6	**P** [85% average in IT units of study in previous year] AND [Permission from the School of IT] *Note: Department permission required for enrolment*	Semester 1
INFO2912 **IT Special Project 2B**	6	**P** [85% average in IT units of study in previous year] AND [Permission from the School of IT] *Note: Department permission required for enrolment*	Semester 2
INFO3315 **Human-Computer Interaction**	6		Semester 2
INFO3616 **Principles of Security and Security Eng**	6	**A** INFO1110 AND INFO1112 AND INFO1113 AND MATH1064. Knowledge equivalent to the above units is assumed; this means good programming skills in Python or a C-related language, basic networking knowledge, skills from discrete mathematics. A technical orientation is expected. **N** ELEC5616	Semester 1
INFO3911 **IT Special Project 3A**	6	**P** [85% average in IT units of study in previous year] AND [Permission from the School of IT] *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	**P** [85% average in IT units of study in previous year] AND [Permission from the School of IT] *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
ISYS2110 **Analysis and Design of Web Info Systems**	6	**P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 **N** INFO2110	Semester 1
ISYS2120 **Data and Information Management**	6	**A** Programming skills **P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 OR INFO1003 OR INFO1903 OR DECO1012 **N** INFO2120 OR INFO2820 OR COMP5138	Semester 2
ISYS2160 **Information Systems in the Internet Age**	6	**A** INFO1003 OR INFO1103 OR INFO1903 OR INFO1113 **N** ISYS2140	Semester 2
ISYS3400 **Information Systems Project**	6	**P** (INFO2110 OR ISYS2110) AND (INFO2120 OR ISYS2120) AND (ISYS2140 OR ISYS2160) **N** INFO3600 or ISYS3207	Semester 2
ISYS3401 **Information Technology Evaluation**	6	**A** INFO2110 and ISYS2140 **P** (INFO2110 OR ISYS2110) AND (INFO2120 OR ISYS2120) AND (ISYS2140 OR ISYS2160)	Semester 1
ISYS3402 **Decision Analytics and Support Systems**	6	**A** Database Management AND Systems Analysis and Modelling **P** (ISYS2110 OR INFO2110) AND (ISYS2120 OR INFO2120)	Semester 2

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
MECH2400 **Mechanical Design 1**	6	**A** ENGG1801 and ENGG1802, HSC Maths and Physics	Semester 2
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 AND AMME2262)	Semester 1
MECH3361 **Mechanics of Solids 2**	6	**P** AMME2301 AND (AMME1362 OR AMME2302 OR CIVL2110)	Semester 2
MECH3362 **Materials 2**	6	**A** (1) A good understanding of basic knowledge and principles of material science and engineering from Materials I and mechanics of solids for simple structural elements (in tension, bending, torsion); (2) Reasonable mathematical skills in calculation of stresses and strains in simple structural elements. **P** AMME2301 AND (AMME2302 OR AMME1362 OR CIVL2110)	Semester 1
MTRX1702 **Mechatronics 1**	6	**A** MTRX1701 **N** ELEC1101 or ELEC2602 or COSC1902 or COSC1002	Semester 2
MTRX1705 **Introduction to Mechatronic Design**	6		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 AND MTRX1705 **N** ELEC2601 or ELEC3607	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
MTRX3760 **Mechatronic Systems Design**	6	**P** MTRX2700 *Note: Department permission required for enrolment*	Semester 2
SOFT2201 **Software Construction and Design 1**	6	**P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 **N** INFO3220	Semester 2
SOFT2412 **Agile Software Development Practices**	6	**P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905	Semester 2
SOFT3202 **Software Construction and Design 2**	6	**P** SOFT2201 **N** INFO3220	Semester 1
SOFT3410 **Concurrency for Software Development**	6	**P** (INFO1105 OR INFO1905) OR ((INFO1103 OR INFO1113) AND (COMP2123 OR COMP2823))	Semester 2
SOFT3413 **Software Development Project**	6	**A** SOFT3202 **P** 18CP 2000-level or above units from SOFT, COMP or INFO *Note: Department permission required for enrolment*	Semester 2
A maximum of 48 credit points should be chosen from the Biomedical Stream Electives. A maximum of 12 credit points can be taken as General Engineering Electives.			
Refer to the relevant Major Table for requirements to complete that major within the Biomedical Engineering stream.			

For a standard enrolment plan for Biomedical Engineering visit CUSP (https://cusp.sydney.edu.au).

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 (including Medical Science), Commerce, Arts, Project Management and Law.

From 2019 majors will be offered in:

- Process Intensification
- Water and Environmental Treatment Processes

Course Requirements

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

1. A minimum of 36 credit points from the Engineering Core Table, including all required units;
2. A minimum of 108 credit points from the Chemical and Biomolecular Stream Core Table, including all required units; and
3. A minimum of 48 credit points of additional units from the Chemical and Biomolecular Stream Specialist Table, including satisfying any additional requirements specified for the Specialist Table.
4. A maximum of 12 credit points of general electives may be taken.

For a standard enrolment plan for Chemical and Biomolecular Engineering visit CUSP (https://cusp.sydney.edu.au).

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Chemical Engineering Stream Table			
Chemical and Biomolecular Stream Core units			
Complete all 108 credit points of the following units of study:			
ENGG1801 **Engineering Computing**	6		Semester 1 Summer Main
CHEM1111 **Chemistry 1A**	6	**A** Students who have not completed HSC Chemistry (or equivalent) and HSC Mathematics (or equivalent) are strongly advised to take the Chemistry and Mathematics Bridging Courses (offered in February) **N** CHEM1001 or CHEM1101 or CHEM1901 or CHEM1903 or CHEM1109 or CHEM1011 or CHEM1911 or CHEM1991 *Students who have not completed secondary school chemistry are strongly advised to instead complete Fundamentals of Chemistry 1A in the first semester of the calendar year (unless you require 12 credit points of Chemistry and are commencing in semester 2). You should also take the Chemistry Bridging Course in advance (offered in February, and online year-round http://sydney.edu.au/science/chemistry/studying-chemistry/bridging-course.shtml).*	Semester 1 Semester 2 Summer Main
CHEM1112 **Chemistry 1B**	6	**P** CHEM1111 or CHEM1911 or CHEM1101 or CHEM1901 or (75 or above in CHEM1011 or CHEM1001) **N** CHEM1002 or CHEM1102 or CHEM1902 or CHEM1904 or CHEM1108 or CHEM1012 or CHEM1912 or CHEM1992	Semester 1 Semester 2
CHNG1103 **Conservation of Mass and Energy**	6		Semester 2
CHNG2801 **Fluid Mechanics**	6	**A** Calculus, Computations (Matlab, Excel), Mass and Energy Balances. **P** CHNG1103 **C** CHNG2802 OR AMME2960	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 MATH1021 OR MATH1901 OR MATH1921) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923) AND (MATH1005 OR MATH1015 OR MATH1905) AND CHNG1103	Semester 1
CHNG2803 **Heat and Mass Transfer**	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 MATH1021 OR MATH1901 OR MATH1921) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923) AND (MATH1005 OR MATH1905) AND CHNG1103 AND ENGG1801 **C** (CHNG2802 OR AMME2960) AND CHNG2801	Semester 1
CHNG2804 **Chemical Engineering Thermodynamics**	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** CHNG1103 AND (CHEM1101 OR CHEM1111) AND (CHEM1102 OR CHEM1112) **C** (CHNG2805 AND CHNG2806) OR MECH2901	Semester 2
CHNG2805 **Engineering for a Sustainable Society**	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** CHNG1103	Semester 2
CHNG2806 **Separation Processes**	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** CHNG1103 AND CHNG2803 **C** CHNG2804	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 AND CHNG2802 AND CHNG2803 AND CHNG2804 AND CHNG2805 AND CHNG2806) OR (CHNG2801 AND CHNG2803 AND CHNG2804 AND AMME2960) **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 AND CHNG2802 AND CHNG2803 AND CHNG2804 AND CHNG2805 AND CHNG2806) OR (CHNG2801 AND CHNG2803 AND CHNG2804 AND AMME2960) **C** CHNG3801; CHNG3803	Semester 1

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
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 AND CHNG2802 AND CHNG2803 AND CHNG2804 AND CHNG2805 AND CHNG2806) OR (CHNG2801 AND CHNG2803 AND CHNG2804 AND AMME2960) **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
CHNG4802 **Chemical Engineering Design A**	6	**A** CHNG3801 AND CHNG3802 AND CHNG3803 AND CHNG3805 AND CHNG3806 AND CHNG3807. 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	Semester 1
CHNG4806 **Chemical Engineering Design B**	6	**A** CHNG3801 AND CHNG3802 AND CHNG3803 AND CHNG3805 AND CHNG3806 AND CHNG3807. 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 *Department permission required for enrolment prior to CHNG4802 in the case of Mid-Year Entry students.*	Semester 2

Chemical and Biomolecular Stream Specialist units

Complete 48 credit points from the following:

Select a maximum of 12 credit points from the following units of study:

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
BIOL1006 **Life and Evolution**	6	**A** HSC Biology. Students who have not completed HSC Biology (or equivalent) are strongly advised to take the Biology Bridging Course (offered in February). **N** BIOL1001 or BIOL1911 or BIOL1991 or BIOL1906 or BIOL1996	Semester 1 Summer Main
BIOL1906 **Life and Evolution (Advanced)**	6	**A** 85 or above in HSC Biology or equivalent. **N** BIOL1001 or BIOL1911 or BIOL1991 or BIOL1006 or BIOL1996 *Note: Department permission required for enrolment*	Semester 1
BIOL1996 **Life and Evolution (SSP)**	6	**A** 90 or above in HSC Biology or equivalent **N** BIOL1001 or BIOL1911 or BIOL1991 or BIOL1006 or BIOL1906 or BIOL1993 or BIOL1998 *Note: Department permission required for enrolment*	Semester 1
BIOL1007 **From Molecules to Ecosystems**	6	**A** HSC Biology. Students who have not completed HSC Biology (or equivalent) are strongly advised to take the Biology Bridging Course (offered in February). **N** BIOL1907 or BIOL1997	Semester 2 Summer Main
BIOL1907 **From Molecules to Ecosystems (Advanced)**	6	**A** 85 or above in HSC Biology or equivalent **N** BIOL1007 or BIOL1997 *Note: Department permission required for enrolment*	Semester 2
BIOL1997 **From Molecules to Ecosystems (SSP)**	6	**A** 90 or above in HSC Biology or equivalent **N** BIOL1007 or BIOL1907 *Note: Department permission required for enrolment*	Semester 2
CHNG1108 **Introduction to Chemical Engineering**	6	**A** HSC Mathematics and Chemistry **N** ENGG1800 OR CIVL1900 OR MECH1560 OR AERO1560 OR AMME1960 OR MTRX1701 OR ENGG1960	Semester 1
ENGG1800 **Introduction to Engineering Disciplines**	6	**N** CIVL1900 OR CHNG1108 OR MECH1560 OR AERO1560 OR AMME1960 OR MTRX1701 OR ENGG1960	Semester 1
PHYS1001 **Physics 1 (Regular)**	6	**A** HSC Physics or PHYS1003 or PHYS1004 or PHYS1902 or equivalent. Students who have not completed HSC Physics (or equivalent) are strongly advised to take the Physics Bridging Course (offered in February). Students are also encouraged to take (MATH1X21 or MATH1931 or MATH1X01 or MATH1906) and MATH1X02 concurrently. **N** PHYS1002 or PHYS1901 or EDUH1017 or PHYS1903	Semester 1
PHYS1003 **Physics 1 (Technological)**	6	**A** HSC Physics or PHYS1001 or PHYS1002 or PHYS1901 or equivalent. Students who have not completed HSC Physics (or equivalent) are strongly advised to take the Physics Bridging Course (offered in February). Students are also encouraged to take (MATH1X23 or MATH1933 or MATH1X03 or MATH1907) and MATH1X05 concurrently. **C** Recommended Co-requisites: (MATH1003 or MATH1903) and (MATH1005 or MATH1905). **N** PHYS1004 or PHYS1902 or PHYS1904 *It is recommended that PHYS1001 or PHYS1002 or PHYS1901 be completed before this unit*	Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
PHYS1901 **Physics 1A (Advanced)**	6	**A** (85 or above in HSC Physics or equivalent) OR (75 or above in one of PHYS1003 or PHYS1004) OR (PHYS1902 or PHYS1904). Students are also encouraged to take (MATH1X21 or MATH1931 or MATH1X01 or MATH1906) and MATH1X02 concurrently. **N** PHYS1001 or PHYS1002 or EDUH1017 or PHYS1903 *Note: Department permission required for enrolment*	Semester 1
CHEM2401 **Molecular Reactivity and Spectroscopy**	6	**A** 6cp MATH1XXX **P** (CHEM1XX1 or CHEM1903) and (CHEM1XX2 or CHEM1904) **N** CHEM2001 or CHEM2101 or CHEM2301 or CHEM2311 or CHEM2502 or CHEM2901 or CHEM2903 or CHEM2911 or CHEM2915 *This is a required chemistry unit of study for students intending to major in chemistry.*	Semester 1
CHEM2402 **Chemical Structure and Stability**	6	**A** 6cp MATH1XXX **P** (CHEM1XX1 or CHEM1903) and (CHEM1XX2 or CHEM1904) **N** CHEM2202 or CHEM2302 or CHEM2902 or CHEM2912 or CHEM2916 *This is a required chemistry unit of study for students intending to major in chemistry.*	Semester 2
CHEM2403 **Chemistry of Biological Molecules**	6	**A** 6cp MATH1XXX **P** (CHEM1XX1 or CHEM1903) and (CHEM1XX2 or CHEM1904) **N** CHEM2001 or CHEM2101 or CHEM2301 or CHEM2311 or CHEM2502 or CHEM2901 or CHEM2903 or CHEM2913 *To enrol in Senior Chemistry, students are required to have completed (CHEM2401 or CHEM2911 or CHEM2915) and (CHEM2402 or CHEM2912 or CHEM2916).*	Semester 2
CHEM2404 **Forensic and Environmental Chemistry**	6	**A** 6cp MATH1XXX **P** (CHEM1XX1 or CHEM1903) and (CHEM1XX2 or CHEM1904) **N** AGCH3033 *To enrol in Senior Chemistry students are required to have completed (CHEM2401 or CHEM2911 or CHEM2915) and (CHEM2402 or CHEM2912 or CHEM2916).*	Semester 1
Select a minimum of 12 credit points from the following units of study:			
AGEN3004 **Food Processing and Value Adding**	6	**A** 6cp from (BIOL1XXX, MBLG1XXX) and 6cp from CHEM1XXX **P** 6cp from (CHEM1XXX or AGEN1004 or AGEN1006) and 6cp from (BIOL1XXX or MBLG1XXX)	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** (CHNG2801 AND CHNG2802 AND CHNG2803 AND CHNG2804 AND CHNG2805 AND CHNG2806) OR (CHNG2801 AND CHNG2803 AND CHNG2804 AND AMME2960)	Semester 2
CHNG3808 **Engineering Macromolecules and Nanocomposites**	6	**A** Knowledge of reaction engineering, fluid flow, heat transfer and mass transfer. **P** CHNG2801 AND CHNG2806 **C** CHNG3802	Semester 1
CHNG3809 **Laboratory and Industrial Practice**	6	**P** CHNG1103, CHNG2801, CHNG2802, CHNG2803, CHNG2804, CHNG2805 AND CHNG2806 **C** CHNG3801, CHNG3802, CHNG3803	Semester 1
CHNG5003 **Green Engineering**	6	**A** CHNG3801 AND CHNG3802 AND CHNG3803 AND CHNG3805 AND CHNG3806 AND CHNG3807. All core third year chemical engineering.	Semester 2
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
CHNG5603 **Analysis, Modelling, Control: BioPhy Sys**	6	**A** It is assumed that students have a general knowledge of: (MATH1001 OR MATH1021) AND (MATH1003 OR MATH1023) *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.*	Semester 1
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
ENGG3800 **Industry and Community Projects**	6	*Note: Department permission required for enrolment*	Semester 1
Select a minimum of 12 credit points from the following units of study:			
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
CHNG5004 **Particles and Surfaces**	6		Semester 1
CHNG5006 **Advanced Wastewater Engineering**	6	**A** CHNG5005 OR CHNG3804.	Semester 2
CHNG5008 **Nanotechnology in Chemical Engineering**	6	**P** (CHNG3801 OR CHNG9301 OR CHNG5801) AND (CHNG3802 OR CHNG9302 OR CHNG5802) AND (CHNG3805 OR CHNG9305 OR CHNG5805) AND (CHNG3806 OR CHNG9306 OR CHNG5806) *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
CHNG5604 **Advanced Membrane Engineering**	6	**A** CHNG5601	Semester 2
CHNG5606 **Advanced Food Processing**	6	**A** CHNG2801 AND CHNG2802 AND CHNG3804 AND CHNG3805 AND AGEN3004 *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*
CHNG5607 **Advanced Biochemical Engineering**	6	**A** CHNG2802 AND CHNG2806 AND CHNG3803 AND CHNG3804 *Students who have not completed the units listed as assumed knowledge should consult the coordinator before enrolling in the course.*	Semester 1
Select a maximum of 12 credit points of units of study from the Bachelor of Engineering Honours General Elective table. It is strongly recommended that candidates select CHNG1108 as one of these electives in the first year of their candidature.			

For a standard enrolment plan for Chemical and Biomolecular Engineering visit CUSP (https://cusp.sydney.edu.au).

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.

Course Requirements

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

1. A minimum of 36 credit points from the Engineering Core Table, including all required units;
2. A minimum of 108 credit points from the Civil Stream Core Table, including all required units; and
3. A minimum of 48 credit points of additional units from the Civil Stream Specialist Table, including satisfying any additional requirements specified for the Specialist Table. This may include up to 12 credit points of general electives.

For a standard enrolment plan for Civil Engineering visit CUSP (https://cusp.sydney.edu.au).

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Civil Engineering Stream Table			
Civil Engineering Stream Core units			
Complete all 108 credit points of the following units of study:			
CIVL1802 **Statics**	6	**N** ENGG1802	Semester 2
CIVL1810 **Engineering Construction and Surveying**	6	**A** CIVL1900. Some statistical awareness is an advantage and co-enrolment in MATH1005 Statistics is advised. HSC Mathematics Extension 1 or completion of (MATH1001 or MATH1021) and MATH1002 are sufficient for non-statistical maths preparation **N** CIVL2810 *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 2
CIVL1900 **Introduction to Civil Engineering**	6	**N** ENGG1800 OR CHNG1108 OR MECH1560 OR AERO1560 OR AMME1960 OR MTRX1701 OR ENGG1960	Semester 1
CIVL2010 **Environmental Engineering**	6	**A** ENGG1803 OR ENGG1111 **N** CIVL3010	Semester 2
CIVL2110 **Materials**	6	**A** ENGG1802 or CIVL1802 **N** AMME1362	Semester 1
CIVL2201 **Structural Mechanics**	6	**A** From (CIVL1802 or ENGG1802), 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 in certain 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 OR CIVL1802 **N** AMME2301	Semester 1
CIVL2410 **Soil Mechanics**	6	**A** CIVL2201 AND GEOL1501 AND (CIVL1802 or ENGG1802). 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 CIVL1802 Statics (or ENGG1802 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. Familiarity with partial differential equations, and their analytical and numerical solution.	Semester 2
CIVL2611 **Introductory Fluid Mechanics**	6	**A** CIVL2201 AND (CIVL1802 or ENGG1802) AND (MATH1001 OR MATH1021). 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
CIVL2700 **Transport Systems**	6	**A** (MATH1001 OR MATH1021) AND (MATH1003 OR MATH1023) AND MATH1005 AND ENGG1801. Basic statistics through regression analysis, differential and integral calculus, computer programming.	Semester 1
CIVL2812 **Project Appraisal**	6	**A** MATH1005 **N** ENGG2850 OR CIVL3812	Semester 2
CIVL3205 **Concrete Structures 1**	6	**A** CIVL2110 AND CIVL2201 AND (CIVL2230 OR CIVL1900). 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
CIVL3206 **Steel Structures 1**	6	**A** CIVL2110 AND CIVL2201 AND (CIVL2230 or CIVL1900) *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
CIVL3612 **Fluid Mechanics**	6	**A** CIVL2611	Semester 1
CIVL3811 **Engineering Design and Construction**	6	**A** CIVL1810 OR CIVL2810 **N** CIVL4811	Semester 2
CIVL4903 **Civil Engineering Design**	6	**A** CIVL2410, CIVL3612, (CIVL4811 OR CIVL3811) **P** CIVL3205 and CIVL3206	Semester 1 Semester 2
CIVL4903 will be available in Semester 1 only from 2019.			
ENGG1801 **Engineering Computing**	6		Semester 1 Summer Main
GEOL1501 **Engineering Geology 1**	6	**N** GEOL1002 or GEOL1902 or GEOS1003 or GEOS1903	Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
MATH2061 **Linear Mathematics and Vector Calculus**	6	**P** (MATH1X21 or MATH1011 or MATH1931 or MATH1X01 or MATH1906) and (MATH1014 or MATH1X02) and (MATH1X23 or MATH1933 or MATH1X03 or MATH1907) **N** MATH2001 or MATH2901 or MATH2002 or MATH2902 or MATH2961 or MATH2067 or MATH2021 or MATH2921 or MATH2022 or MATH2922 *This unit of study is only available to Faculty of Engineering and Information Technologies students.*	Semester 1 Summer Main
Candidates enrolled in the combined Bachelor of Engineering (Honours) and Bachelor of Design in Architecture are exempt from CIVL2010 and CIVL2700 and must instead enrol in the following units:			
CIVL3235 **Structural Analysis**	6	**A** CIVL2110, (CIVL2230 or CIVL1900) AND MATH2061	Semester 2
CIVL4860 **Architectural to Structural Design**	6	**P** CIVL3235 AND (BDES3023 OR BDES3026) *This unit is restricted to students enrolled in the Bachelor of Engineering/ Bachelor of Design in Architecture combined degree.*	Semester 2
Civil Engineering Stream Specialist units			
Breadth units			
Complete a minimum of 18 credit points from the following units of study:			
CIVL3235 **Structural Analysis**	6	**A** CIVL2110, (CIVL2230 or CIVL1900) AND MATH2061	Semester 2
CIVL3310 **Humanitarian Engineering**	6		Semester 1
CIVL3411 **Geotechnical Engineering**	6	**A** CIVL2410	Semester 2
CIVL3614 **Hydrology**	6	**A** (ENGG1802 OR CIVL1802) 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
CIVL3703 **Transport Policy, Planning and Deployment**	6	**A** CIVL2700	Semester 1
CIVL3805 **Project Scope, Time and Cost Management**	6	**A** CIVL2810 or CIVL1810 **N** ENGG1850 or QBUS2350	Semester 1
Depth units			
Complete a minimum of 18 credit points from the following units of study:			
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
CIVL4813 **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. **N** CIVL3813 OR ENGG3854	Semester 2
CIVL4814 **Project Procurement and Tendering**	6	**A** CIVL3805	Semester 2
CIVL4815 **Project Formulation**	6	**P** CIVL3805 AND (CIVL3812 OR CIVL2812)	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 **Advanced Concrete Structures**	6	**P** CIVL3205 OR CIVL9205	Semester 2
CIVL5277 **Structural Rehabilitation and Timber Design**	6	**A** (CIVL2201 AND CIVL3205 AND CIVL3206) OR (CIVL9201 AND CIVL9205 AND CIVL9206)	Semester 2
CIVL5320 **Engineering for Sustainable Development**	6	**P** CIVL3310 OR CIVL9310	Semester 2
CIVL5330 **Global Engineering Field Work**	6	*Note: Department permission required for enrolment*	Intensive December Intensive July
CIVL5351 **Geoenvironmental Engineering**	6		Semester 2
CIVL5453 **Geotechnical Hazards**	6	**A** (CIVL2410 AND CIVL3411) OR (CIVL9410 AND CIVL9411). 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 **Fundamentals of Wind Engineering for Design**	6		Semester 1
CIVL5670 **Reservoir, Stream and Coastal Engineering**	6	**A** CIVL3612 and MATH2061.	Semester 1
CIVL5999 **Advanced Research and Analysis**	6	**A** CIVL2201 AND CIVL2611 AND CIVL2410	Semester 1

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
General electives			
Complete a minimum of zero and a maximum of 12 credit points of units of study from the Bachelor of Engineering Honours General Electives table			

For a standard enrolment plan for Civil Engineering visit CUSP (https://cusp.sydney.edu.au).

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Civil Engineering Architecture Stream Table			
To satisfy the degree requirement of the Bachelor of Engineering Honours (Civil) and Bachelor of Design in Architecture a candidate must study not less than 144 credit points of the core civil and engineering units of study and 96 credit points of design in architecture units of study as set out in the table below.			
Architecture Core units			
Complete all 90 credit points of the following units of study:			
BDES1011 **Architectural History/Theory 1**	6	**A** HSC Mathematics and HSC English Standard **N** DESA1102	Semester 1
BDES1023 **Architectural Technologies 1**	6	**N** DESA1102	Semester 2
BDES1026 **Architecture Studio 1A**	12	**C** BDES1011 **N** DESA1001 or BDES1010 or BDES1024	Semester 1
BDES1027 **Architecture Studio 1B**	12	**P** BDES1026 or BDES1010 or DESA1001 **C** BDES1023 **N** BDES1020 or DESA1002 or BDES1012	Semester 2
BDES2013 **Architectural Technologies 2**	6	**P** BDES1023 **N** DESA2111	Semester 1 Semester 2
BDES2026 **Architecture Studio 2A**	12	**P** BDES1027 or BDES1020 or DESA1002 **C** BDES2013 **N** BDES2010 or DESA2001 or BDES2012	Semester 1
BDES2027 **Architecture Studio 2B**	12	**P** BDES2026 and BDES1011 or BDES2010 or DESA2001 **C** (BDES2024 or CIVL2410) **N** BDES2020 or DESA2002 or BDES2021	Semester 2
BDES3026 **Architecture Studio 3A**	12	**P** (BDES2027 or BDES2020) and BDES2013 **C** (BDES3011 or MATH2061) **N** BDES3010 or DESA3001 or BDES3023	Semester 1
BDES3027 **Architecture Studio 3B**	12	**P** BDES3026 or BDES3010 or DESA3001 **N** BDES3020 or DESA3002 or BDES3012	Semester 2
Architecture Elective units			
Complete 6 credit points from the following units of study:			
BDES2024 **Art Processes**	6	**P** BDES1026 or BDES1024	Semester 2
BDES3011 **Architectural History/Theory 3**	6	**P** BDES2027 or BDES2021 or DESA2111 **N** DAAP3001	Semester 1
BDES3025 **Architectural Professional Practice**	6	**P** BDES3023 or BDES3026	Semester 2
Students wishing to continue with further studies in Architecture at Sydney University should choose BDES3025.			

For a standard enrolment plan for Civil Engineering visit CUSP (https://cusp.sydney.edu.au).

Bachelor of Engineering Honours (Electrical)

Course Overview

With rapid transformation occurring across industries and a greater emphasis on green technologies, electrical engineers are set to play a vital role in building our future society.

Electrical engineers design, develop, install and maintain systems in areas as diverse as computer systems, power systems, electronics and telecommunications. They also deal with computer architecture, digital communications, embedded systems, instrumentation, lasers, microelectronics, microwaves and antennas, optical communications, satellite mobile communications, signal processing and systems design.

As an electrical engineering graduate, you will have the opportunity to positively contribute to many of today's challenges including climate change, environmental preservation, sustainability, renewable energy generation and healthcare.

Electrical engineering programs provide the scientific, mathematical and engineering foundations required to design systems across diverse areas like satellite communications, high-performance computing, telecommunications, signal processing, energy generation and biomedical engineering.

For undergraduate students the majors that best align with Electrical Engineering stream are Computer, Internet of Thing, Power, or Telecommunications Engineering.

Course Requirements

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

1. A minimum of 36 credit points from the Engineering Core Table, including all required units;
2. A minimum of 108 credit points from the Electrical Stream Core Table, including all required units; and
3. A minimum of 48 credit points of additional units from the Electrical Stream Specialist Table, including satisfying any additional requirements specified for the Specialist Table.
4. A maximum of 12 credit points of general electives may be taken.

For a standard enrolment plan for Electrical Engineering visit CUSP (https://cusp.sydney.edu.au).

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Electrical Engineering Stream Table			
Electrical Engineering Stream Core units			
Complete all 108 credit points of the following units of study:			
ELEC1103 **Fundamentals of Elec and Electronic Eng**	6	**A** Basic knowledge of differentiation & integration, and HSC Physics	Semester 1
ELEC1601 **Introduction to Computer Systems**	6	**A** HSC Mathematics extension 1 or 2	Semester 2
INFO1110 **Introduction to Programming**	6		Intensive July Semester 1 Semester 2
PHYS1001 **Physics 1 (Regular)**	6	**A** HSC Physics or PHYS1003 or PHYS1004 or PHYS1902 or equivalent. Students who have not completed HSC Physics (or equivalent) are strongly advised to take the Physics Bridging Course (offered in February). Students are also encouraged to take (MATH1X21 or MATH1931 or MATH1X01 or MATH1906) and MATH1X02 concurrently. **N** PHYS1002 or PHYS1901 or EDUH1017 or PHYS1903	Semester 1
PHYS1003 **Physics 1 (Technological)**	6	**A** HSC Physics or PHYS1001 or PHYS1002 or PHYS1901 or equivalent. Students who have not completed HSC Physics (or equivalent) are strongly advised to take the Physics Bridging Course (offered in February). Students are also encouraged to take (MATH1X23 or MATH1933 or MATH1X03 or MATH1907) and MATH1X05 concurrently. **C** Recommended Co-requisites: (MATH1003 or MATH1903) and (MATH1005 or MATH1905). **N** PHYS1004 or PHYS1902 or PHYS1904 *It is recommended that PHYS1001 or PHYS1002 or PHYS1901 be completed before this unit*	Semester 2
COMP2123 **Data Structures and Algorithms**	6	**P** INFO1110 OR INFO1113 OR DATA1002 OR INFO1103 OR INFO1903 **N** INFO1105 OR INFO1905 OR COMP2823	Semester 1
ELEC2103 **Simulation and 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** COSC1001 or COSC1901	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 OR MATH1021) AND MATH1002 AND (MATH1003 OR MATH1023). 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** (MATH1X21 or MATH1011 or MATH1931 or MATH1X01 or MATH1906) and (MATH1014 or MATH1X02) and (MATH1X23 or MATH1933 or MATH1X03 or MATH1907) **N** MATH2001 or MATH2901 or MATH2002 or MATH2902 or MATH2961 or MATH2067 or MATH2021 or MATH2921 or MATH2022 or MATH2922 *This unit of study is only available to Faculty of Engineering and Information Technologies students.*	Semester 1 Summer Main
PHYS2213 **Physics 2EE**	6	**A** (MATH1X21 or MATH1931 or MATH1X01 or MATH1906) and (MATH1X02) and (MATH1X23 or MATH1933 or MATH1X03 or MATH1907) and (MATH1X05) **P** (PHYS1001 or PHYS1901) and (PHYS1003 or PHYS1902) **N** PHYS2011 or PHYS2911 or PHYS2012 or PHYS2912	Semester 2
Complete an additional 36 credit points of Electrical Engineering Stream Specialist units from the table below.			
Electrical Engineering Stream Specialist units			
All ELEC 3000-level, 4000-level or 5000-level units of study are Electrical Engineering Stream Specialist units. Students may complete ENGG3800 as a Stream Specialist unit, but this unit of study does not contribute to the Electrical Engineering Stream core unit requirements.			
Complete a minimum of 36 credit points of ELEC 3000-level, 4000-level or 5000-level units of study.			
Complete a maximum of 12 credit points of units of study from the Bachelor of Engineering Honours General Elective table.			

For a standard enrolment plan for Electrical Engineering visit CUSP (https://cusp.sydney.edu.au).

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 at Sydney.

Course Requirements

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

1. A minimum of 36 credit points from the Engineering Core Table, including all required units;
2. A minimum of 108 credit points from the Mechanical Stream Core Table pertaining to the specialist stream being undertaken, including all required units; and
3. A minimum of 48 credit points of additional units from the Mechanical Stream Specialist Table pertaining to the specialist stream being undertaken, including satisfying any additional requirements specified for the Specialist Table.
4. A maximum of 6 credit points of general electives may be taken.

For a standard enrolment plan for Mechanical Engineering visit CUSP (https://cusp.sydney.edu.au/).

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Mechanical Engineering Stream Table			
Mechanical Engineering Stream Core units			
Complete all 108 credit points of the following units of study:			
AMME1362 **Materials 1**	6	**N** CIVL2110 or AMME2302	Semester 2
ENGG1801 **Engineering Computing**	6		Semester 1 Summer Main
ENGG1802 **Engineering Mechanics**	6	*Note: Department permission required for enrolment*	Intensive January Semester 2 Summer Main
MECH1560 **Introduction to Mechanical Engineering**	6	**N** ENGG1800 or CIVL1900 or CHNG1108 or AERO1560 or AMME1960 or MTRX1701 or ENGG1960 *Limited Places due to TAFE component. Department Permission required for non-BE(Mech) students.*	Semester 1
AMME2000 **Engineering Analysis**	6	**P** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) AND (ENGG1801 OR INFO1103 OR INFO1903 OR INFO1110 OR DATA1002)	Semester 1
AMME2261 **Fluid Mechanics 1**	6	**A** Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **P** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) **N** AMME2200	Semester 1
AMME2262 **Thermal Engineering 1**	6	**A** Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **P** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) **N** AMME2200	Semester 2
AMME2301 **Mechanics of Solids**	6	**P** ENGG1802 AND (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) **N** CIVL2201	Semester 2
AMME2500 **Engineering Dynamics**	6	**A** Familiarity with the MATLAB programming environment **P** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) AND ENGG1802	Semester 1
AMME2700 **Instrumentation**	6	**A** Programming skills, 1st year maths skills, familiarity with fundamental Engineering concepts. **P** AERO1560 OR MECH1560 OR MTRX1701 OR ENGG1800	Semester 1
MECH2400 **Mechanical Design 1**	6	**A** ENGG1801 and ENGG1802, HSC Maths and Physics	Semester 2
AMME3500 **System Dynamics and Control**	6	**P** (AMME2000 OR MATH2067 OR (MATH2061 AND MATH2065) OR MATH2021) AND AMME2500	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 AND AMME2262)	Semester 1
MECH3361 **Mechanics of Solids 2**	6	**P** AMME2301 AND (AMME1362 OR AMME2302 OR CIVL2110)	Semester 2
MECH3362 **Materials 2**	6	**A** (1) A good understanding of basic knowledge and principles of material science and engineering from Materials I and mechanics of solids for simple structural elements (in tension, bending, torsion); (2) Reasonable mathematical skills in calculation of stresses and strains in simple structural elements. **P** AMME2301 AND (AMME2302 OR AMME1362 OR CIVL2110)	Semester 1
MECH3460 **Mechanical Design 2**	6	**A** Properties of engineering materials including fatigue failure theories. Statics and dynamics properties of machines. **P** MECH2400 and AMME2301	Semester 2
MECH3660 **Manufacturing Engineering**	6	**P** MECH2400 OR ENGG1960 OR AMME1960	Semester 1
Candidates for the Space Major are exempt from AMME2000 and MECH3460.			
Mechanical Engineering Stream Specialist units			
Complete 48 credit points of the units listed below:			

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
MECH1400 **Mechanical Construction**	6		Semester 2
MATH2021 **Vector Calculus and Differential Equations**	6	**P** (MATH1X21 or MATH1931 or MATH1X01 or MATH1906) and (MATH1XX2) and (MATH1X23 or MATH1933 or MATH1X03 or MATH1907) **N** MATH2921 or MATH2065 or MATH2965 or MATH2061 or MATH2961 or MATH2067	Semester 1
MATH2921 **Vector Calculus and Differential Eqs (Adv)**	6	**P** [(MATH1921 or MATH1931 or MATH1901 or MATH1906) or (a mark of 65 or above in MATH1021 or MATH1001)] and [MATH1902 or (a mark of 65 or above in MATH1002)] and [(MATH1923 or MATH1933 or MATH1903 or MATH1907) or (a mark of 65 or above in MATH1023 or MATH1003)] **N** MATH2021 or MATH2065 or MATH2965 or MATH2061 or MATH2961 or MATH2067	Semester 1
MECH2401 **Human-Centred Engineering Design**	6	**A** MECH1560 AND MECH1400	Semester 2
AMME3060 **Engineering Methods**	6	**P** AMME2000 OR MATH2067 OR (MATH2061 AND MATH2065) OR MATH2021	Semester 2
MECH4460 **Mechanical Design 3**	6	**A** ENGG1802, AMME2301, AMME2500, MECH3361 **P** MECH2400 and MECH3460	Semester 1
MECH4660 **Engineering Management**	6	**N** MECH3661 OR AERO3660 OR MECH2660	Semester 1
AMME5101 **Energy and the Environment**	6	**A** Students are expected to be familiar with the basic laws of thermodynamics, fluid mechanics and heat transfer **P** MECH3260 OR MECH9260 OR AERO3261 OR AERO9261 *Note: Department permission required for enrolment*	Semester 1
AMME5105 **Risk Management Analysis**	6		Semester 1
AMME5202 **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. *Note: Department permission required for enrolment*	Semester 1
AMME5271 **Computational Nanotechnology**	6	**A** Understanding of basic principles of Newtonian mechanics, physics and chemistry, fluid mechanics and solid mechanics. General knowledge of how to operate a computer and work with different software is also required. *Note: Department permission required for enrolment*	Semester 2
AMME5310 **Engineering Tribology**	6	**A** (AMME2302 OR AMME9302) AND (AMME2301 OR AMME9301) AND (MECH3261 OR MECH9261) *Note: Department permission required for enrolment*	Semester 1
AMME5510 **Vibration and Acoustics**	6	**P** (AMME2301 OR AMME9301) AND (AMME2200 OR AMME2261 OR AMME9261) AND (AMME2500 OR AMME9500)	Semester 2
AMME5520 **Advanced Control and Optimisation**	6	**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
AMME5912 **Crash Analysis and Design**	6	**A** Computer Aided Drafting, Basic FEA principles and Solid Mechanics *Note: Department permission required for enrolment*	Semester 1
MECH5255 **Air Conditioning and Refrigeration**	6	**A** Students are expected to be familiar with the basic laws of thermodynamics, fluid mechanics and heat transfer. **P** MECH3260 OR MECH9260 OR MECH5262 **N** MECH4255	Semester 2
MECH5265 **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
MECH5275 **Renewable Energy**	6	**A** The student will need a sound background in advanced level fluid mechanics, thermodynamics and heat transfer. In particular, students should be able to analyse fluid flow in turbomachinery; perform first and second law thermodynamic analysis of energy conversion systems, including chemically reacting systems; and perform advanced level calculations of conductive and convective and radiative heat transfer, including radiative spectral analysis. **P** (MECH3260 AND MECH3261) OR (AERO3260 AND AERO3261) OR (MECH5262 AND MECH5261) OR (MECH9260 AND MECH9261) OR (AERO9260 AND AERO9261). Students claiming to have prerequisite knowledge based on study at other institutions must contact the unit of study coordinator before enrolling in this unit and may be required to sit a pre-exam to demonstrate that they have the necessary knowledge and skills to undertake this advanced level unit. *Note: Department permission required for enrolment*	Semester 2
MECH5310 **Advanced Engineering Materials**	6	**P** (AMME2301 OR AMME9301) AND (AMME2302 OR AMME1362 OR AMME9302) AND (MECH3362 OR MECH9362) **N** MECH4310	Semester 1
A maximum of 6 credit points may be chosen from the Bachelor of Engineering General Elective Table.			
Candidates enrolled in the Space major complete the following 18 credit points of units of study:			
AERO2705 **Space Engineering 1**	6	**A** ENGG1801. First Year Maths and basic MATLAB programming skills. **P** (AERO1560 OR MECH1560 OR MTRX1701 OR ENGG1800) AND (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923). Entry to this unit requires that students are eligible for the Space Engineering Major. *Note: Department permission required for enrolment*	Semester 2
AERO3760 **Space Engineering 2**	6	**P** Students must have a 65% average in (AMME2500 AND AMME2261 AND AMME2301 AND AERO2705) OR (AMME2500 AND AMME2301 AND MTRX2700 AND AERO2705). Note: MUST have passed AERO2705	Semester 2
AERO4701 **Space Engineering 3**	6	**P** [65% average in (AERO3460 AND AERO3360 AND AERO3560 AND AERO3760) OR (MECH3660 AND MECH3261 AND MECH3361 AND AERO3760) OR (MECH3660 AND AMME3500 AND MTRX3700 AND AERO3760)] AND [Must have passed AERO3760]. Students must have achieved a 65% average mark in 3rd year for enrolment in this unit.	Semester 1

For a standard enrolment plan for Mechanical Engineering visit CUSP (https://cusp.sydney.edu.au).

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. A minimum of 36 credit points from the Engineering Core Table, including all required units;
2. A minimum of 108 credit points from the Mechatronic Stream Core Table pertaining to the specialist stream being undertaken, including all required units; and
3. A minimum of 48 credit points of additional units from the Mechatronic Stream Specialist Table pertaining to the specialist stream being undertaken, including satisfying any additional requirements specified for the Specialist Table.
4. A maximum of 6 credit points of general electives may be taken.

For a standard enrolment plan for Mechatronic Engineering visit CUSP (https://cusp.sydney.edu.au).

Unit of Study Table

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
Mechatronic Engineering Stream Table			
Mechatronic Engineering Stream Core units			
Complete all 108 credit points of the following units of study:			
ENGG1801 **Engineering Computing**	6		Semester 1 Summer Main
ENGG1802 **Engineering Mechanics**	6	*Note: Department permission required for enrolment*	Intensive January Semester 2 Summer Main
MTRX1701 **Introduction to Mechatronic Engineering**	6	**N** MECH1560 OR ENGG1800 OR AERO1560 OR CIVL1900 OR CHNG1108 OR AMME1960 OR ENGG1960	Semester 1
MTRX1702 **Mechatronics 1**	6	**A** MTRX1701 **N** ELEC1101 or ELEC2602 or COSC1902 or COSC1002	Semester 2
MTRX1705 **Introduction to Mechatronic Design**	6		Semester 2
AMME1362 **Materials 1**	6	**N** CIVL2110 or AMME2302	Semester 2
AMME2301 **Mechanics of Solids**	6	**P** ENGG1802 AND (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) **N** CIVL2201	Semester 2
AMME2500 **Engineering Dynamics**	6	**A** Familiarity with the MATLAB programming environment **P** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) AND ENGG1802	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
MECH2400 **Mechanical Design 1**	6	**A** ENGG1801 and ENGG1802, HSC Maths and Physics	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 AND MTRX1705 **N** ELEC2601 or ELEC3607	Semester 1
AMME3500 **System Dynamics and Control**	6	**P** (AMME2000 OR MATH2067 OR (MATH2061 AND MATH2065) OR MATH2021) AND AMME2500	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
MECH3460 **Mechanical Design 2**	6	**A** Properties of engineering materials including fatigue failure theories. Statics and dynamics properties of machines. **P** MECH2400 and AMME2301	Semester 2
MECH3660 **Manufacturing Engineering**	6	**P** MECH2400 OR ENGG1960 OR AMME1960	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
MTRX3760 **Mechatronic Systems Design**	6	**P** MTRX2700 *Note: Department permission required for enrolment*	Semester 2
Candidates for the Space Major are exempt from AMME1362 and MECH3460.			
Mechatronic Engineering Stream Specialist units			
Complete 48 credit points of the units listed below:			
Complete a minimum of 24 credit points from the following units of study:			

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
AMME4710 **Computer Vision and Image Processing**	6	**P** MTRX3700 OR MECH4720 OR MECH5720	Semester 2
AMME5520 **Advanced Control and Optimisation**	6	**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
AMME5790 **Introduction to Biomechatronics**	6	**A** A good practical knowledge in mechanical and electronic engineering; adequate maths and applied maths skills; background knowledge of physics, chemistry and biology; Some programming capability, MATLAB, C, C++; able to use common software tools used by engineers including CAD and EDA packages. **P** MECH3921 OR MTRX3700 OR AMME5921 **N** AMME4790 *AMME5790 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 specialised biomechatronic applications that will be encountered by Mechatronic Engineers who enter this broad field on graduation.*	Semester 2
MECH5720 **Sensors and Signals**	6	**A** Strong MATLAB skills **P** MTRX3700 **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 AMME5501 OR AMME9501) AND MTRX3700.	Semester 1
Select a maximum of 6 credit points from the Bachelor of Engineering General Elective Table.			
And the remainder from:			
AMME2000 **Engineering Analysis**	6	**P** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) AND (ENGG1801 OR INFO1103 OR INFO1903 OR INFO1110 OR DATA1002)	Semester 1
AMME2200 **Introductory Thermofluids**	6	**A** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933). Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **N** AMME2261 OR AMME2262	Semester 2
AMME3060 **Engineering Methods**	6	**P** AMME2000 OR MATH2067 OR (MATH2061 AND MATH2065) OR MATH2021	Semester 2
ELEC3404 **Electronic Circuit Design**	6	**A** A background in basic electronics and circuit theory is assumed.	Semester 1
MATH2021 **Vector Calculus and Differential Equations**	6	**P** (MATH1X21 or MATH1931 or MATH1X01 or MATH1906) and (MATH1XX2) and (MATH1X23 or MATH1933 or MATH1X03 or MATH1907) **N** MATH2921 or MATH2065 or MATH2965 or MATH2061 or MATH2961 or MATH2067	Semester 1
MATH2921 **Vector Calculus and Differential Eqs (Adv)**	6	**P** [(MATH1921 or MATH1931 or MATH1901 or MATH1906) or (a mark of 65 or above in MATH1021 or MATH1001)] and [MATH1902 or (a mark of 65 or above in MATH1002)] and [(MATH1923 or MATH1933 or MATH1903 or MATH1907) or (a mark of 65 or above in MATH1023 or MATH1003)] **N** MATH2021 or MATH2065 or MATH2965 or MATH2061 or MATH2961 or MATH2067	Semester 1
Candidates enrolled in the Space major complete the following 18 credit points of units of study:			
AERO2705 **Space Engineering 1**	6	**A** ENGG1801. First Year Maths and basic MATLAB programming skills. **P** (AERO1560 OR MECH1560 OR MTRX1701 OR ENGG1800) AND (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923). Entry to this unit requires that students are eligible for the Space Engineering Major. *Note: Department permission required for enrolment*	Semester 2
AERO3760 **Space Engineering 2**	6	**P** Students must have a 65% average in (AMME2500 AND AMME2261 AND AMME2301 AND AERO2705) OR (AMME2500 AND AMME2301 AND MTRX2700 AND AERO2705). Note: MUST have passed AERO2705	Semester 2
AERO4701 **Space Engineering 3**	6	**P** [65% average in (AERO3460 AND AERO3360 AND AERO3560 AND AERO3760) OR (MECH3660 AND MECH3261 AND MECH3361 AND AERO3760) OR (MECH3660 AND AMME3500 AND MTRX3700 AND AERO3760)] AND [Must have passed AERO3760]. Students must have achieved a 65% average mark in 3rd year for enrolment in this unit.	Semester 1

For a standard enrolment plan for Mechatronic Engineering visit CUSP (https://cusp.sydney.edu.au).

Bachelor of Engineering Honours (Software)

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. A minimum of 36 credit points from the Engineering Core Table, including all required units;
2. A minimum of 108 credit points from the Software Stream Core Table pertaining to the specialist stream being undertaken, including all required units; and
3. A minimum of 48 credit points of additional units from the Software Stream Specialist Table pertaining to the specialist stream being undertaken, including satisfying any additional requirements specified for the Specialist Table.
4. A maximum of 12 credit points of general electives may be taken.

For a standard enrolment plan for Software Engineering visit CUSP (https://cusp.sydney.edu.au).

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Software Engineering Stream Table			
Software Engineering Stream Core units			
Complete all 108 credit points of the following units of study:			
ELEC1601 **Introduction to Computer Systems**	6	**A** HSC Mathematics extension 1 or 2	Semester 2
INFO1110 **Introduction to Programming**	6		Intensive July Semester 1 Semester 2
INFO1113 **Object-Oriented Programming**	6	**P** INFO1110 **N** INFO1103 OR INFO1105 OR INFO1905	Semester 1 Semester 2
COMP2017 **Systems Programming**	6	**P** INFO1113 OR INFO1105 OR INFO1905 OR INFO1103 **C** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **N** COMP2129	Semester 1
COMP2123 **Data Structures and Algorithms**	6	**P** INFO1110 OR INFO1113 OR DATA1002 OR INFO1103 OR INFO1903 **N** INFO1105 OR INFO1905 OR COMP2823	Semester 1
ISYS2110 **Analysis and Design of Web Info Systems**	6	**P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 **N** INFO2110	Semester 1
ISYS2120 **Data and Information Management**	6	**A** Programming skills **P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 OR INFO1003 OR INFO1903 OR DECO1012 **N** INFO2120 OR INFO2820 OR COMP5138	Semester 2
MATH2069 **Discrete Mathematics and Graph Theory**	6	**P** 6 credit points of Junior Mathematics units **N** MATH2011 or MATH2009 or MATH2969	Semester 1
SOFT2201 **Software Construction and Design 1**	6	**P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 **N** INFO3220	Semester 2
SOFT2412 **Agile Software Development Practices**	6	**P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905	Semester 2
ELEC3609 **Internet Software Platforms**	6	**P** (INFO1103 OR INFO1110) AND (INFO2110 OR ISYS2110) AND (INFO2120 OR INFO2820 OR ISYS2120) **N** EBUS4001	Semester 2
INFO3616 **Principles of Security and Security Eng**	6	**A** INFO1110 AND INFO1112 AND INFO1113 AND MATH1064. Knowledge equivalent to the above units is assumed; this means good programming skills in Python or a C-related language, basic networking knowledge, skills from discrete mathematics. A technical orientation is expected. **N** ELEC5616	Semester 1
SOFT3202 **Software Construction and Design 2**	6	**P** SOFT2201 **N** INFO3220	Semester 1
SOFT3413 **Software Development Project**	6	**A** SOFT3202 **P** 18CP 2000-level or above units from SOFT, COMP or INFO *Note: Department permission required for enrolment*	Semester 2
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
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 throughout 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
Complete an additional 6 credit points of units of study from the Software Engineering Stream Specialist table below.			
Software Engineering Stream Specialist units			
Complete a total of 48 credit points of Stream Specialist units.			
Complete a minimum of 36 credit points (with no more than 18 credit points of level 1000 or 2000 units) from:			
Any COMP, DATA, ELEC, INFO, ISYS and SOFT units may be taken as Software Specialist units.			
The following units may also be taken as Software Specialist units.			
BUSS1030 **Accounting, Business and Society**	6	**N** ACCT1001 or ACCT1002 or ACCT1003 or ACCT1004 or ACCT1005	Semester 1 Semester 2

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
ENGG3800 **Industry and Community Projects**	6	*Note: Department permission required for enrolment*	Semester 1
MATH2061 **Linear Mathematics and Vector Calculus**	6	**P** (MATH1X21 or MATH1011 or MATH1931 or MATH1X01 or MATH1906) and (MATH1014 or MATH1X02) and (MATH1X23 or MATH1933 or MATH1X03 or MATH1907) **N** MATH2001 or MATH2901 or MATH2002 or MATH2902 or MATH2961 or MATH2067 or MATH2021 or MATH2921 or MATH2022 or MATH2922 *This unit of study is only available to Faculty of Engineering and Information Technologies students.*	Semester 1 Summer Main
MKTG1001 **Marketing Principles**	6		Semester 1 Semester 2
PHYS1001 **Physics 1 (Regular)**	6	**A** HSC Physics or PHYS1003 or PHYS1004 or PHYS1902 or equivalent. Students who have not completed HSC Physics (or equivalent) are strongly advised to take the Physics Bridging Course (offered in February). Students are also encouraged to take (MATH1X21 or MATH1931 or MATH1X01 or MATH1906) and MATH1X02 concurrently. **N** PHYS1002 or PHYS1901 or EDUH1017 or PHYS1903	Semester 1
PHYS1003 **Physics 1 (Technological)**	6	**A** HSC Physics or PHYS1001 or PHYS1002 or PHYS1901 or equivalent. Students who have not completed HSC Physics (or equivalent) are strongly advised to take the Physics Bridging Course (offered in February). Students are also encouraged to take (MATH1X23 or MATH1933 or MATH1X03 or MATH1907) and MATH1X05 concurrently. **C** Recommended Co-requisites: (MATH1003 or MATH1903) and (MATH1005 or MATH1905). **N** PHYS1004 or PHYS1902 or PHYS1904 *It is recommended that PHYS1001 or PHYS1002 or PHYS1901 be completed before this unit*	Semester 2
PHYS2213 **Physics 2EE**	6	**A** (MATH1X21 or MATH1931 or MATH1X01 or MATH1906) and (MATH1X02) and (MATH1X23 or MATH1933 or MATH1X03 or MATH1907) and (MATH1X05) **P** (PHYS1001 or PHYS1901) and (PHYS1003 or PHYS1902) **N** PHYS2011 or PHYS2911 or PHYS2012 or PHYS2912	Semester 2
Complete a maximum of 12 credit points of units of study from the Bachelor of Engineering Honours General Electives table.			

For a standard enrolment plan for Software Engineering visit CUSP (https://cusp.sydney.edu.au).

Chemical Engineering Major

Overview

Chemical engineering is a broad field that combines the key disciplines of chemistry, physics and biology. This major allows students to deepen their knowledge in areas such as biochemical engineering and biotechnology, energy and environment, green product and process design, minerals processing, process systems engineering and sustainability.

This major best aligns with the Biomedical stream. You can not enrol in the Chemical Engineering Major within the Chemical and Biomolecular Stream.

Unit of study table

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
Chemical Engineering Major			
Unit of study table			
Complete 24 credit points of the following:			
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 AND CHNG2802 AND CHNG2803 AND CHNG2804 AND CHNG2805 AND CHNG2806) OR (CHNG2801 AND CHNG2803 AND CHNG2804 AND AMME2960) **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 AND CHNG2802 AND CHNG2803 AND CHNG2804 AND CHNG2805 AND CHNG2806) OR (CHNG2801 AND CHNG2803 AND CHNG2804 AND AMME2960) **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 AND CHNG2802 AND CHNG2803 AND CHNG2804 AND CHNG2805 AND CHNG2806) OR (CHNG2801 AND CHNG2803 AND CHNG2804 AND AMME2960) **C** CHNG3801 and CHNG3802	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** (CHNG2801 AND CHNG2802 AND CHNG2803 AND CHNG2804 AND CHNG2805 AND CHNG2806) OR (CHNG2801 AND CHNG2803 AND CHNG2804 AND AMME2960)	Semester 2

Computer Engineering Major

Overview

The major in computer engineering builds on foundations in physics, mathematics, computer science and basic electrical engineering principles. 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.

This major best aligns with the Electrical stream.

Unit of study table

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
Computer Engineering Major			
Unit of study table			
Complete 24 credit points of units of study as follows:			
Complete all 18 credit points of these units of study:			
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 AND COMP2017	Semester 1
ELEC3608 **Computer Architecture**	6	**A** ELEC3607. Basic knowledge of assembly language and microprocessor systems is required. **P** ELEC2602	Semester 2
Select an additional 6 credit points from the following units of study:			
COMP3520 **Operating Systems Internals**	6	**P** (COMP2017 OR COMP2129) AND (COMP2123 OR COMP2823 OR INFO1105 OR INFO1905)	Semester 2
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** ELEC2302 AND (MATH2061 OR MATH2067 OR MATH2021 OR MATH2961 OR AMME2000) **N** AMME3500	Semester 2
ELEC3305 **Digital Signal Processing**	6	**A** 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 or MECH3661	Semester 2

Construction Management Major

Overview

Taking the Construction Management Major will give you much greater depth of knowledge in this field along with breadth of skills across all disciplines in Civil Engineering. Your course of study in the Construction Management Major will include techniques and models in the initiation, appraisal, procurement, planning, construction, control, organisation and management, and handover of engineering construction projects. You will develop professional project management skills in the context of engineering construction projects or civil infrastructure projects.

This major best aligns with the Civil stream.

Unit of study table

Unit of study	***Credit points***	***A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition***	***Session***
Construction Management Major			
Unit of study table			
Complete 24 credit points of the following:			
Select a minimum of 18 credit points from the following units of study:			
CIVL3805 **Project Scope, Time and Cost Management**	6	**A** CIVL2810 or CIVL1810 **N** ENGG1850 or QBUS2350	Semester 1
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
CIVL4813 **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. **N** CIVL3813 OR ENGG3854	Semester 2
CIVL4814 **Project Procurement and Tendering**	6	**A** CIVL3805	Semester 2
CIVL4815 **Project Formulation**	6	**P** CIVL3805 AND (CIVL3812 OR CIVL2812)	Semester 1
A maximum of 6 credit points from any other CIVL 3000-level, 4000-level or 5000-level unit from the Civil Engineering Stream Core or Specialist table may be taken.			

Electrical Engineering Major

Course Overview

With rapid transformation occurring across industries and a greater emphasis on green technologies, electrical engineering plays a vital role in building our future society. This major allows students to deepen their knowledge of the discipline of electrical engineering, including in areas such as satellite communications, high-performance computing, telecommunications, signal processing, energy generation and control systems.

This major best aligns with the Biomedical stream. You can not enrol in the Electrical Engineering Major within the Electrical Engineering Stream.

Unit of study table

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
Electrical Engineering Major			
Unit of study table			
Complete 24 credit points of the following, 18 credit points of which must be 3000-level or higher.			
ELEC2103 **Simulation and 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** COSC1001 or COSC1901	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 OR MATH1021) AND MATH1002 AND (MATH1003 OR MATH1023). 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
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
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. **P** ELEC3203	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** ELEC2302 AND (MATH2061 OR MATH2067 OR MATH2021 OR MATH2961 OR AMME2000) **N** AMME3500	Semester 2
ELEC3305 **Digital Signal Processing**	6	**A** 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
ELEC3405 **Communications Electronics and Photonics**	6	**A** ELEC2104. A background in basic electronics and circuit theory is assumed.	Semester 2
ELEC3505 **Communications**	6	**P** ELEC2302. 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

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
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 AND COMP2017	Semester 1
ELEC3608 **Computer Architecture**	6	**A** ELEC3607. Basic knowledge of assembly language and microprocessor systems is required. **P** ELEC2602	Semester 2
ELEC3609 **Internet Software Platforms**	6	**P** (INFO1103 OR INFO1110) AND (INFO2110 OR ISYS2110) AND (INFO2120 OR INFO2820 OR ISYS2120) **N** EBUS4001	Semester 2
ELEC3610 **E-Business Analysis and Design**	6	**N** EBUS3003	Semester 1
ELEC3702 **Management for Engineers**	6	**N** ENGG3005 or MECH3661	Semester 2
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
ELEC3803 **Bioelectronics**	6	**P** ELEC2104 OR ELEC2602.	Semester 2

Environmental Engineering Major

Overview

Environmental engineers are concerned with protecting the environment by assessing the impact a project has on the air, water, soil and noise levels in its vicinity. They define and document long term problems that may be caused by accidents, such as oil spills.

As an environmental engineering graduate, you may plan and design equipment and processes for the treatment and safe disposal of waste material and direct the conservation and wise use of natural resources, or be involved in research and development of alternative energy sources, water reclamation, waste treatment and recycling.

This major is best aligned with the Civil and Mechanical streams.

Unit of study table

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
Environmental Engineering Major			
Unit of study table			
Complete 24 credit points from the following:			
Select a minimum of 18 credit points from the following units of study:			
CIVL3614 **Hydrology**	6	**A** (ENGG1802 OR CIVL1802) 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
CIVL5351 **Geoenvironmental Engineering**	6		Semester 2
CIVL5668 **Fundamentals of Wind Engineering for Design**	6		Semester 1
CIVL5670 **Reservoir, Stream and Coastal Engineering**	6	**A** CIVL3612 and MATH2061.	Semester 1
CIVL5999 **Advanced Research and Analysis**	6	**A** CIVL2201 AND CIVL2611 AND CIVL2410	Semester 1
A maximum of 6 credit points from any other CIVL 3000-level, 4000-level or 5000-level unit from the Civil Engineering Stream Core or Specialist table may be taken.			
Alternatively, complete 24 credit points from the following units of study:			
AMME5101 **Energy and the Environment**	6	**A** Students are expected to be familiar with the basic laws of thermodynamics, fluid mechanics and heat transfer **P** MECH3260 OR MECH9260 OR AERO3261 OR AERO9261 *Note: Department permission required for enrolment*	Semester 1
AMME5202 **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. *Note: Department permission required for enrolment*	Semester 1
AMME5510 **Vibration and Acoustics**	6	**P** (AMME2301 OR AMME9301) AND (AMME2200 OR AMME2261 OR AMME9261) AND (AMME2500 OR AMME9500)	Semester 2
MECH5275 **Renewable Energy**	6	**A** The student will need a sound background in advanced level fluid mechanics, thermodynamics and heat transfer. In particular, students should be able to analyse fluid flow in turbomachinery; perform first and second law thermodynamic analysis of energy conversion systems, including chemically reacting systems; and perform advanced level calculations of conductive and convective and radiative heat transfer, including radiative spectral analysis. **P** (MECH3260 AND MECH3261) OR (AERO3260 AND AERO3261) OR (MECH5262 AND MECH5261) OR (MECH9260 AND MECH9261) OR (AERO9260 AND AERO9261). Students claiming to have prerequisite knowledge based on study at other institutions must contact the unit of study coordinator before enrolling in this unit and may be required to sit a pre-exam to demonstrate that they have the necessary knowledge and skills to undertake this advanced level unit. *Note: Department permission required for enrolment*	Semester 2

Geotechnical Engineering Major

Overview

Taking the Geotechnical Engineering Major will give you much greater depth of knowledge in this field along with breadth of skills across all disciplines in Civil Engineering. As a student in the Geotechnical Engineering Major you will undertake advanced units of study in geotechnical hazards, computer modelling, and environmental geotechnics. Graduate geotechnical engineers may be involved in examining the soil and rock layers that make up the earth in order to determine their physical and chemical properties so that they can design foundations and earthworks structures for buildings, roads, and many other types of projects.

This major best aligns with the Civil stream.

Unit of study table

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
Geotechnical Engineering Major			
Unit of study table			
Complete 24 credit points from the following:			
Complete a minimum of 18 credit points of these units of study:			
CIVL3411 **Geotechnical Engineering**	6	**A** CIVL2410	Semester 2
CIVL5351 **Geoenvironmental Engineering**	6		Semester 2
CIVL5453 **Geotechnical Hazards**	6	**A** (CIVL2410 AND CIVL3411) OR (CIVL9410 AND CIVL9411). 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
CIVL5999 **Advanced Research and Analysis**	6	**A** CIVL2201 AND CIVL2611 AND CIVL2410	Semester 1
A maximum of 6 credit points from any other CIVL 3000-level, 4000-level or 5000-level unit from the Civil Engineering Stream Core or Specialist table may be taken.			

Humanitarian Engineering Major

Overview

Humanitarian Engineering is the application of engineering to meet the needs of communities globally; while maintaining a focus on appropriateness and sustainability. This major is the first of its kind in Australia and open to all streams of undergraduate engineering. Humanitarian engineers are skilled engineers from all disciplines. They apply their skills and knowledge to challenges which arise in developing countries, during all stages of disasters, in indigenous communities and improving sustainability globally. In the major students will explore international aid and development, and learn from experienced practitioners and industry partners about how to work in developing communities, remote areas, and communities in disaster response and recovery.

Students will have the opportunity to conduct local or overseas fieldwork and apply their knowledge to analyse the challenges faced by Australia's close neighbours, such as rapid urbanisation, persistent poverty and climate change. This major forms the foundation for a career in Humanitarian Engineering in public, private or not-for-profit sectors. This course develops core skills in multi-disciplinary team work and cross-cultural competence, as well as preparing globally-minded engineers, which are all highly valued graduate attributes to any employer.

This major best aligns with the Civil and Biomedical streams.

Unit of study table

Information Technology Major

Overview

Information technology involves creation and management of business applications, websites, systems and the IT environment for organisations.

Drawing on both computer science and information systems, this major covers the study of computers and the programs that run on them as well as the creation of computer systems that satisfy individual and organisational needs. Students can focus on computer languages, programming (including the study of algorithms, data structures and networks), system development and implementation and network design as well as managerial aspects like strategic planning and operational management.

This major best aligns with the Biomedical stream. You can not enrol in the Information Technology Major within the Software stream.

Unit of study table

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
Information Technology Major			
Unit of study table			
Complete a minimum of 24 credit points of the following units of study, 18 credit points of which must be level 3000 or higher.			
INFO1113 **Object-Oriented Programming**	6	**P** INFO1110 **N** INFO1103 OR INFO1105 OR INFO1905	Semester 1 Semester 2
COMP2022 **Programming Languages, Logic and Models**	6	**A** MATH1004 OR MATH1904 OR MATH1064 OR MATH2069 OR MATH2969 **P** INFO1103 OR INFO1903 OR INFO1113 **N** COMP2922	Semester 2
COMP2922 **Programming Languages, Logic and Models (Adv)**	6	**A** MATH1004 OR MATH1904 OR MATH1064 OR MATH2069 OR MATH2969 **P** Distinction level result in INFO1103 OR INFO1903 OR INFO1113 **N** COMP2022 *Note: Department permission required for enrolment*	Semester 2
COMP2017 **Systems Programming**	6	**P** INFO1113 OR INFO1105 OR INFO1905 OR INFO1103 **C** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **N** COMP2129	Semester 1
COMP2123 **Data Structures and Algorithms**	6	**P** INFO1110 OR INFO1113 OR DATA1002 OR INFO1103 OR INFO1903 **N** INFO1105 OR INFO1905 OR COMP2823	Semester 1
COMP2823 **Data Structures and Algorithms (Adv)**	6	**A** Distinction-level result in at least one the listed 1000 level programming units **P** Distinction level result in at least one of INFO1110 OR INFO1113 OR DATA1002 OR INFO1103 OR INFO1903 **N** INFO1105 OR INFO1905 OR COMP2123 *Note: Department permission required for enrolment*	Semester 1
COMP3027 **Algorithm Design**	6	**A** MATH1004 OR MATH1904 OR MATH1064 **P** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **N** COMP2007 OR COMP2907 OR COMP3927	Semester 1
COMP3221 **Distributed Systems**	6	**P** (INFO1105 OR INFO1905) OR ((INFO1103 OR INFO1113) AND (COMP2123 OR COMP2823)) **N** COMP2121	Semester 1
COMP3308 **Introduction to Artificial Intelligence**	6	**A** Algorithms. Programming skills (e.g. Java, Python, C, C++, Matlab) **N** COMP3608	Semester 1
COMP3419 **Graphics and Multimedia**	6	**A** Programming skills **P** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905	Semester 2
COMP3520 **Operating Systems Internals**	6	**P** (COMP2017 OR COMP2129) AND (COMP2123 OR COMP2823 OR INFO1105 OR INFO1905)	Semester 2
COMP3608 **Introduction to Artificial Intelligence (Adv)**	6	**A** Algorithms. Programming skills (e.g. Java, Python, C, C++, Matlab) **P** Distinction-level results in some 2nd year COMP or MATH or SOFT units. **N** COMP3308 *COMP3308 and COMP3608 share the same lectures, but have different tutorials and assessment (the same type but more challenging).*	Semester 1
COMP3615 **Computer Science Project**	6	**P** (COMP2123 OR COMP2823) AND COMP2017 AND (COMP2022 OR COMP2922) **N** INFO3600 OR COMP3600	Semester 2
DATA2001 **Data Science: Big Data and Data Diversity**	6	**P** DATA1002 OR INFO1110 OR INFO1903 OR INFO1103	Semester 1
DATA2002 **Data Analytics: Learning from Data**	6	**A** (Basic Linear Algebra and some coding) or QBUS1040 **P** [DATA1001 or ENVX1001 or ENVX1002] or [MATH10X5 and MATH1115] or [MATH10X5 and STAT2011] or [MATH1905 and MATH1XXX (except MATH1XX5)] or [BUSS1020 or ECMT1010 or STAT1021] **N** STAT2012 or STAT2912	Semester 2

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
DATA3404 **Data Science Platforms**	6	**A** This unit of study assumes that students have previous knowledge of database structures and of SQL. The prerequisite material is covered in DATA2001 or ISYS2120. Familiarity with a programming language (e.g. Java or C) is also expected. **P** DATA2001 OR ISYS2120 OR INFO2120 OR INFO2820 **N** INFO3504 OR INFO3404	Semester 1
INFO2150 **Introduction to Health Data Science**	6	**A** Basic knowledge of Entity Relationship Modelling, database technology and SQL **P** (INFO1003 OR INFO1903 OR INFO1103 OR INFO1110 OR DATA1002) AND (DATA1001 OR MATH1005 OR MATH1905 OR MATH1015) **C** DATA2001 or ISYS2120 OR INFO2120 OR INFO2820 OR INFO1903	Semester 2
INFO2911 **IT Special Project 2A**	6	**P** [85% average in IT units of study in previous year] AND [Permission from the School of IT] *Note: Department permission required for enrolment*	Semester 1
INFO2912 **IT Special Project 2B**	6	**P** [85% average in IT units of study in previous year] AND [Permission from the School of IT] *Note: Department permission required for enrolment*	Semester 2
INFO3315 **Human-Computer Interaction**	6		Semester 2
INFO3616 **Principles of Security and Security Eng**	6	**A** INFO1110 AND INFO1112 AND INFO1113 AND MATH1064. Knowledge equivalent to the above units is assumed; this means good programming skills in Python or a C-related language, basic networking knowledge, skills from discrete mathematics. A technical orientation is expected. **N** ELEC5616	Semester 1
INFO3911 **IT Special Project 3A**	6	**P** [85% average in IT units of study in previous year] AND [Permission from the School of IT] *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	**P** [85% average in IT units of study in previous year] AND [Permission from the School of IT] *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
ISYS2110 **Analysis and Design of Web Info Systems**	6	**P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 **N** INFO2110	Semester 1
ISYS2120 **Data and Information Management**	6	**A** Programming skills **P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 OR INFO1003 OR INFO1903 OR DECO1012 **N** INFO2120 OR INFO2820 OR COMP5138	Semester 2
ISYS2160 **Information Systems in the Internet Age**	6	**A** INFO1003 OR INFO1103 OR INFO1903 OR INFO1113 **N** ISYS2140	Semester 2
ISYS3401 **Information Technology Evaluation**	6	**A** INFO2110 and ISYS2140 **P** (INFO2110 OR ISYS2110) AND (INFO2120 OR ISYS2120) AND (ISYS2140 OR ISYS2160)	Semester 1
ISYS3402 **Decision Analytics and Support Systems**	6	**A** Database Management AND Systems Analysis and Modelling **P** (ISYS2110 OR INFO2110) AND (ISYS2120 OR INFO2120)	Semester 2
ISYS3400 **Information Systems Project**	6	**P** (INFO2110 OR ISYS2110) AND (INFO2120 OR ISYS2120) AND (ISYS2140 OR ISYS2160) **N** INFO3600 or ISYS3207	Semester 2
SOFT2201 **Software Construction and Design 1**	6	**P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 **N** INFO3220	Semester 2
SOFT2412 **Agile Software Development Practices**	6	**P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905	Semester 2
SOFT3202 **Software Construction and Design 2**	6	**P** SOFT2201 **N** INFO3220	Semester 1
SOFT3410 **Concurrency for Software Development**	6	**P** (INFO1105 OR INFO1905) OR ((INFO1103 OR INFO1113) AND (COMP2123 OR COMP2823))	Semester 2
SOFT3413 **Software Development Project**	6	**A** SOFT3202 **P** 18CP 2000-level or above units from SOFT, COMP or INFO *Note: Department permission required for enrolment*	Semester 2
DATA3001 will be introduced in 2019.			

Internet of Things Major

Overview

The Internet of Things consists of sensors that collect data, communication networks for data transmission and data analytics applications for evaluating data and making decision. The major will cover these three key aspects of IoT by combining the study of telecommunications, electrical and computer engineering, with an emphasis on wireless communications, networks, sensor devices, data technologies and its applications in smart grids and critical infrastructure. The major offers a comprehensive program with state of the art IoT technologies and students can engage in the creative development of the innovative Internet of Things.

In this major, you will learn various programming languages, embedded systems, real time operating systems, communications networks, wide range of sensors, data analytics technology, security techniques and IoT system design methods and engineering implementation techniques that are essential for the development of IoT industry.

This major best aligns with the Electrical stream.

Unit of study table

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
Internet of Things Major			
Unit of study table			
Complete a minimum of 24 credit points of the following units of study, comprising:			
Complete all 12 credit points of:			
ELEC5514 **Networked Embedded Systems**	6	**A** ELEC3305, ELEC3506, ELEC3607 and ELEC5508 **P** ELEC5509	Semester 2
ELEC5517 **Software Defined Networks**	6	**P** ELEC3506 OR ELEC9506	Semester 2
Complete a minimum of 12 credit points from:			
ELEC5518 **IoT for Critical Infrastructures**	6		Semester 1
ELEC5616 **Computer and Network Security**	6	**A** A programming language, basic maths.	Semester 1
ELEC5208 **Intelligent Electricity Networks**	6	**A** Fundamentals of Electricity Networks, Control Systems and Telecommunications	Semester 1
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
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
COMP5216 **Mobile Computing**	6	**A** COMP5214 OR COMP9103. Software Development in JAVA, or similar introductory software development units.	Semester 2
COMP5426 **Parallel and Distributed Computing**	6		Semester 1

Materials Engineering Major

Overview

This major focuses on development of an understanding of the relationship between properties of materials and their relationship to engineering design. Concepts covered include: mechanical properties; fracture and fatigue mechanics; composite materials; ceramics and glasses; structure-property relationships; and selection of materials.

This major best aligns with the Mechanical stream.

Unit of study table

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
Materials Engineering Major			
Unit of study table			
Complete the following units of study, totalling 24 credit points:			
MECH3362 **Materials 2**	6	**A** (1) A good understanding of basic knowledge and principles of material science and engineering from Materials I and mechanics of solids for simple structural elements (in tension, bending, torsion); (2) Reasonable mathematical skills in calculation of stresses and strains in simple structural elements. **P** AMME2301 AND (AMME2302 OR AMME1362 OR CIVL2110)	Semester 1
MECH5304 **Materials Failure**	6	**A** Fundamental knowledge in materials science and engineering: 1) atomic and crystal structures 2) metallurgy 3) structure-property relationship 4) mechanics of engineering materials 5) solid mechanics **P** (AMME9301 OR AMME2301) AND (AMME9302 OR AMME2302 OR AMME1362) AND (MECH9361 OR MECH3361) AND (MECH9362 OR MECH5362 OR MECH3362)	Semester 2
MECH5305 **Smart Materials**	6	**A** Fundamental knowledge in materials science and engineering: 1) atomic and crystal structures 2) metallurgy 3) structure-property relationship 4) mechanics of engineering materials 5) solid mechanics **P** (AMME9301 OR AMME5301 OR AMME2301) AND (AMME9302 OR AMME5302 OR AMME2302 OR AMME1362)	Semester 2
MECH5310 **Advanced Engineering Materials**	6	**P** (AMME2301 OR AMME9301) AND (AMME2302 OR AMME1362 OR AMME9302) AND (MECH3362 OR MECH9362) **N** MECH4310	Semester 1

Mechanical Engineering Major

Overview

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.

This major provides students with the option to focus across a broad range of Mechanical Engineering technologies and activities - from the application of nanotechnology to the design of systems crucial to sustainable power generation, air conditioning, transport, steel production and mining.

This major best aligns with the Biomedical stream. You can not enrol in the Mechanical Engineering Major within the Mechanical stream.

Unit of study table

Unit of study	***Credit points***	***A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition***	***Session***
Mechanical Engineering Major			
Unit of study table			
Complete a minimum of 24 credit points of the following units of study, 18 credit points of which must be level 3000 or higher.			
AMME2200 **Introductory Thermofluids**	6	**A** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933). Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **N** AMME2261 OR AMME2262	Semester 2
AMME2261 **Fluid Mechanics 1**	6	**A** Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **P** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) **N** AMME2200	Semester 1
AMME2262 **Thermal Engineering 1**	6	**A** Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **P** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) **N** AMME2200	Semester 2
AMME3500 **System Dynamics and Control**	6	**P** (AMME2000 OR MATH2067 OR (MATH2061 AND MATH2065) OR MATH2021) AND AMME2500	Semester 1
MECH2400 **Mechanical Design 1**	6	**A** ENGG1801 and ENGG1802, HSC Maths and Physics	Semester 2
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 AND AMME2262)	Semester 1
MECH3361 **Mechanics of Solids 2**	6	**P** AMME2301 AND (AMME1362 OR AMME2302 OR CIVL2110)	Semester 2
MECH3362 **Materials 2**	6	**A** (1) A good understanding of basic knowledge and principles of material science and engineering from Materials I and mechanics of solids for simple structural elements (in tension, bending, torsion); (2) Reasonable mathematical skills in calculation of stresses and strains in simple structural elements. **P** AMME2301 AND (AMME2302 OR AMME1362 OR CIVL2110)	Semester 1

Mechatronic Engineering Major

Overview

Mechatronic engineering involves the study of computer-controlled systems that form the basis of the 'intelligent' products that are ubiquitous in today's society.

This major allows students to understand the interconnection between disciplines such as mechanical, electrical and systems engineering, as well as computer science, and provides a foundation for cutting-edge technologies in fields including robotics, manufacturing, aerospace and bioengineering.

This major best aligns with the Biomedical stream. You can not enrol in the Mechatronic Engineering Major within the Mechatronic stream.

Unit of study table

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
Mechatronic Engineering Major			
Unit of study table			
Complete 24 credit points of the following units of study of which 18 credit points must be level 3000 or higher.			
AMME2301 **Mechanics of Solids**	6	**P** ENGG1802 AND (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) **N** CIVL2201	Semester 2
AMME3500 **System Dynamics and Control**	6	**P** (AMME2000 OR MATH2067 OR (MATH2061 AND MATH2065) OR MATH2021) AND AMME2500	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
MECH2400 **Mechanical Design 1**	6	**A** ENGG1801 and ENGG1802, HSC Maths and Physics	Semester 2
MTRX1702 **Mechatronics 1**	6	**A** MTRX1701 **N** ELEC1101 or ELEC2602 or COSC1902 or COSC1002	Semester 2
MTRX1705 **Introduction to Mechatronic Design**	6		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 AND MTRX1705 **N** ELEC2601 or ELEC3607	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
MTRX3760 **Mechatronic Systems Design**	6	**P** MTRX2700 *Note: Department permission required for enrolment*	Semester 2

Power Engineering Major

Overview

The Power Engineering major 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. Your study will be completed in the areas of 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 a 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.

This major best aligns with the Electrical stream.

Unit of study table

Unit of study	***Credit points***	***A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition***	***Session***
Power Engineering Major			
Unit of study table			
Complete a minimum of 24 credit points of units of study, comprising:			
Complete all 18 credit points of:			
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
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** ELEC2302 AND (MATH2061 OR MATH2067 OR MATH2021 OR MATH2961 OR AMME2000) **N** AMME3500	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. **P** (ELEC3203 OR ELEC9203 OR ELEC5732) AND (ELEC3206 OR ELEC9206 OR ELEC5734)	Semester 1
Complete a minimum of 6 credit points from:			
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 OR ELEC5732) AND (ELEC3206 OR ELEC9206 OR ELEC5734)	Semester 2
ELEC5211 **Power System Dynamics and Control**	6	**A** The pre-required knowledge for learning this UoS is a deep understanding on circuit analysis and its applications in power system steady state analysis. **P** ELEC3203 OR ELEC9203 OR ELEC5732	Semester 1
ELEC5212 **Power System Planning and Markets**	6	**A** The pre-required knowledge for learning this UoS is power system steady state analysis **P** ELEC3203 or ELEC9203 OR ELEC5732	Semester 2

Space Engineering Major

Overview

Combining key areas including orbital mechanics, space vehicles, ground station infrastructure, space avionics and space robotics, the space engineering major at Sydney is the only program of its kind offered in Australia.

You must meet the specific entry requirements to enrol in this major. It is available primarily within the Aeronautical, Mechanical or Mechatronic streams of the Bachelor of Engineering and associated combined degrees.

Unit of study table

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
Space Engineering Major			
This major is available only to approved students based on admission pathway, or through internal approval.			
Unit of study table			
Complete 24 credit points of the following:			
Complete all 18 credit points of these units of study:			
AERO2705 **Space Engineering 1**	6	**A** ENGG1801. First Year Maths and basic MATLAB programming skills. **P** (AERO1560 OR MECH1560 OR MTRX1701 OR ENGG1800) AND (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923). Entry to this unit requires that students are eligible for the Space Engineering Major. *Note: Department permission required for enrolment*	Semester 2
AERO3760 **Space Engineering 2**	6	**P** Students must have a 65% average in (AMME2500 AND AMME2261 AND AMME2301 AND AERO2705) OR (AMME2500 AND AMME2301 AND MTRX2700 AND AERO2705). Note: MUST have passed AERO2705	Semester 2
AERO4701 **Space Engineering 3**	6	**P** [65% average in (AERO3460 AND AERO3360 AND AERO3560 AND AERO3760) OR (MECH3660 AND MECH3261 AND MECH3361 AND AERO3760) OR (MECH3660 AND AMME3500 AND MTRX3700 AND AERO3760)] AND [Must have passed AERO3760]. Students must have achieved a 65% average mark in 3rd year for enrolment in this unit.	Semester 1
Select an additional 6 credit points from the following units of study:			
AERO4260 **Aerodynamics 2**	6	**P** AMME2200 OR AMME2261	Semester 1
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 2
AERO5700 **Space Engineering (Advanced)**	6	**A** AERO3760 **P** (AERO3760 AND AERO4701) OR AERO9760 *Note: Department permission required for enrolment*	Semester 2
AMME5202 **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. *Note: Department permission required for enrolment*	Semester 1
AMME5510 **Vibration and Acoustics**	6	**P** (AMME2301 OR AMME9301) AND (AMME2200 OR AMME2261 OR AMME9261) AND (AMME2500 OR AMME9500)	Semester 2

Structures Engineering Major

Overview

Taking the Structures Major will give you much greater depth of knowledge in this field along with breadth of skills across all disciplines in Civil Engineering. In the Structures Major you will complete advanced units of study in areas such as advanced structural analysis and structural behaviour with particular focus on steel, concrete and composite steel-concrete structures. Structural engineers take into account natural forces such as wind, waves and earthquakes and their effects when designing and planning for building. Certain stresses caused by the modern environment, including the traffic of both cars and people, also need to be considered. Innovative solutions to these problems are researched, developed and tested by structural engineers.

As a structural engineering graduate, you can specialise in one area of work, such as bridges and tunnels, buildings, or large constructions such as oil installations. Engineers who have both studied and taught at the University of Sydney were involved in the construction of major structures including the Sydney Harbour Bridge, the Sydney Aquatic Centre at Homebush Bay, and the Anzac Bridge in Sydney and many are finding placements in current infrastructure projects such as North West Rail Link, Light Rail and WestConnex.

This major best aligns with the Civil stream.

Unit of study table

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
Structural Engineering Major			
Unit of study table			
Complete 24 credit points of units of study as follows:			
Select a minimum of 18 credit points from the following units of study:			
CIVL3235 **Structural Analysis**	6	**A** CIVL2110, (CIVL2230 or CIVL1900) AND MATH2061	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 **Advanced Concrete Structures**	6	**P** CIVL3205 OR CIVL9205	Semester 2
CIVL5277 **Structural Rehabilitation and Timber Design**	6	**A** (CIVL2201 AND CIVL3205 AND CIVL3206) OR (CIVL9201 AND CIVL9205 AND CIVL9206)	Semester 2
CIVL5458 **Numerical Methods in Civil Engineering**	6		Semester 1
CIVL5999 **Advanced Research and Analysis**	6	**A** CIVL2201 AND CIVL2611 AND CIVL2410	Semester 1
A maximum of 6 credit points from any other CIVL 3000-level, 4000-level or 5000-level unit from the Civil Engineering Stream Core or Specialist table may be taken.			

Telecommunications Engineering Major

Overview

In the Telecommunications Engineering major 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.

This major best aligns with the Electrical stream.

Unit of study table

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
Telecommunications Engineering Major			
Unit of study table			
Complete 24 credit points from the following:			
ELEC3305 **Digital Signal Processing**	6	**A** 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
ELEC3506 **Data Communications and the Internet**	6	**N** NETS2150	Semester 2
ELEC4505 **Digital Communication Systems**	6	**P** ELEC3505	Semester 1

Transport Engineering Major

As well as being a fully trained Civil engineer, the Transport major extends your skills to incorporate planning, design, operation and management of infrastructure to achieve safe, economical, and environmentally sustainable movement of people and goods. The major in transport engineering covers traditional mathematical and engineering methods, and also considers multidisciplinary issues such as environmental and social impact, economics, and public policy.

Knowledge of transport issues is of great benefit to graduates in any broad engineering professional situation. Graduates with a transport major are expected to work in the planning, design, construction, management or operation of road, rail, air or sea infrastructure and systems anywhere in the world.

This major best aligns with the Civil stream.

Unit of study table

Unit of study	***Credit points***	***A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition***	***Session***
Transport Engineering Major			
Unit of study table			
Complete 24 credit points of units of study as follows:			
Complete all 18 credit points of the following:			
CIVL3703 **Transport Policy, Planning and Deployment**	6	**A** CIVL2700	Semester 1
CIVL5701 City Logistics (available from 2019)			
CIVL5702 Transport Planning Models (available from 2019)			
A maximum of 6 credit points from any other CIVL 3000-level, 4000-level or 5000-level unit from the Civil Engineering Stream Core or Specialist table may be taken.			

Bachelor of Advanced Computing

Course Overview

The Bachelor of Advanced Computing is designed with your computing career in mind. You will develop practical and theoretical skills across the computing, information technology and business transformation industries. In Australia's most innovative IT course, you can combine your passion for computing with a choice of more than 100 cross-disciplinary majors as you cultivate specialist industry knowledge and computing expertise.

As an advanced computing student, you will learn from leaders in the field. First year covers the core skills required to become an IT professional before you specialise in a major that aligns with your preferred career pathway: computer science, information systems, software development or computational data science.

The computer science major will foster your ability to create and use the latest computer technology, while the information systems major applies this computing technology to devising and managing innovative business solutions. The software development major focuses on the design of new software systems and the computational data science major will develop your ability to draw meaningful knowledge from data to drive decision making. You can combine your computing skills with a second major from over 100 study areas including music, commerce, science and the arts, and develop the well-rounded perspective highly valued by employers. You have the choice to graduate after three years with the Bachelor of Computing or continue to complete advanced professional and research skills in your fourth year.

Course Requirements

To meet the requirements of the Bachelor of Advanced Computing, a candidate must successfully complete 192 credit points, comprising:

1. 96 credit points of degree core units of study
2. A major (48 credit points) chosen from the 4 options listed in the tables below
3. At least 12 credit points of 4000-level or higher Bachelor of Advanced Computing electives
4. (Optionally) up to 12 credit points of units of study in the Open Learning Environment as listed in Table O in the Shared Pool for Undergraduate Degrees
5. (Optionally) minor (36 credit points) or second major (48 credit points) from Table S
6. Where appropriate, additional elective units from the Bachelor of Advanced Computing or Table S in the Shared Pool for Undergraduate Degrees

For a standard enrolment plan for Bachelor of Advanced Computing visit CUSP https://cusp.sydney.edu.au.

Bachelor of Advanced Computing

Bachelor of Computing

Bachelor of Advanced Computing

Bachelor of Advanced Computing and Bachelor of Science

Bachelor of Advanced Computing 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 2014 (the 'Coursework Rule'), the Coursework Policy 2014, the Resolutions of the Faculty, the University of Sydney (Student Appeals against Academic Decisions) Rule 2006 (as amended), the Academic Honesty in Coursework Policy 2015 and the Academic Honesty Procedures 2016. Up to date versions of all such documents are available from the Policy Register: http://sydney.edu.au/policies.

Course Resolutions

1. **Course codes**

Code	Course and stream title
	Bachelor of Computing
	Bachelor of Advanced Computing
	Bachelor of Advanced Computing / Bachelor of Science
	Bachelor of Advanced Computing / Bachelor of Commerce

2. **Attendance Pattern**

The attendance pattern for these courses is full time or part time according to candidate choice. Part-time students must still satisfy appropriate enrolment progression and are subject to the same degree time limits as full-time students. Visa requirements commonly restrict international students to full time study only. 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 Computing is not available in streams.
(2) The Bachelor of Advanced Computing is available in the Dalyell stream.
(3) Completion of a stream is not a requirement of the Bachelor of Advanced Computing. The requirements for the Dalyell stream are set out in Table S of the Shared Pool for Undergraduate Degrees. Candidates wishing to transfer into or out of the Dalyell stream should contact the Student Centre.
(4) The Bachelor of Science, as part of the Bachelor of Advanced Computing / Bachelor of Science combined degree, is available in the following streams:
(a) Health
(b) Medical Science
(c) Dalyell

Completion of a stream is not a requirement of the Bachelor of Science. The requirements for the completion of each stream are as specified in Table A for the Bachelor of Science or, in the case of the Dalyell Stream, in Table S of the Shared Pool for Undergraduate Degrees. Candidates wishing to transfer between the Bachelor of Science streams should contact the Student Centre.Candidates who qualify for the Dalyell stream may complete that stream while also completing another stream.

(5) The Bachelor of Commerce, as part of the Bachelor of Advanced Computing / Bachelor of Commerce combined degree, is available in the following streams:
(a) Dalyell

Completion of a stream is not a requirement of the Bachelor of Commerce. The requirements for the completion of the Dalyell Stream are set out in Table S the Shared Pool for Undergraduate Degrees. Candidates wishing to transfer into or out of the Dalyell Stream should contact the Student Centre.

4. **Cross-Faculty Management**

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

5. **Admission to Candidature**

(1) Admission to the Bachelor of Advanced Computing, the Bachelor of Advanced Computing and Bachelor of Science and the Bachelor of Advanced Computing and Bachelor of Commerce 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 applicants. Applicants are ranked by merit and offers for available places are issued according to the ranking. Details of admission requirements are found in the Coursework Rule and the Coursework Policy.
(2) Commencing candidates may not be admitted to candidature in the Bachelor of Computing. With the permission of the Faculty, candidates in the Bachelor of Advanced Computing may transfer into the Bachelor of Computing as specified in Clause 13 below.
(3) Admission to the Dalyell stream requires achievement of a minimum tertiary admission rank (ATAR) set by the Board of Interdisciplinary Studies or equivalent standard.

6. Requirements for Award

(1) The units of study that may be taken for the Bachelor of Computing, the Bachelor of Advanced Computing, the Bachelor of Advanced Computing/Bachelor of Commerce and the Bachelor of Advanced Computing/Bachelor of Science are:
(a) Table A for the Bachelor of Computing/Bachelor of Advanced Computing;
(b) Table A for the Bachelor of Commerce;
(c) Table A for the Bachelor of Science;
(d) Table S from the Shared Pool for Undergraduate Degrees;
(e) Table O from the Shared Pool for Undergraduate Degrees.

In these resolutions, except where otherwise specified Table S and Table O mean Table S and Table O as specified here.

(2) To qualify for the award of the Bachelor of Computing, a candidate must complete 144 credit points, comprising:
(a) 78 credit points of core units as specified in Table A for the Bachelor of Computing/Bachelor of Advanced Computing;
(b) An Information Technology Major (48 credit points) from Table A for the Bachelor of Computing/Bachelor of Advanced Computing and as defined in section 7 below;
(c) Optionally, up to 12 credit points of units of study in the Open Learning Environment as listed in Table O;
(d) Optionally a minor (36 credit points) from Table S;
(e) Where appropriate, additional elective units as required from Table A for the Bachelor of Computing/Bachelor of Advanced Computing.

(3) To qualify for the award of the Bachelor of Advanced Computing, a candidate must complete 192 credit points, comprising:
(a) 96 credit points of core units as specified in Table A for the Bachelor of Computing/Bachelor of Advanced Computing;
(b) An Information Technology Major (48 credit points) from Table A for the Bachelor of Computing/Bachelor of Advanced Computing and as defined in section 7 below;
(c) At least 12 credit points of 4000-level or higher IT electives from Table A for the Bachelor of Computing/Bachelor of Advanced Computing;
(d) Optionally up to 12 credit points of units of study in the Open Learning Environment as listed in Table O;
(e) Optionally, minor (36 credit points) or second major (48 credit points) from Table S;
(f) Where appropriate, additional elective units as required from Table A for the Bachelor of Computing/Bachelor of Advanced Computing or Table S.

(4) To qualify for the award of the Bachelor of Advanced Computing / Bachelor of Science a candidate must complete 240 credit points comprising:
(a) 96 credit points of core units as specified in Table A for the Bachelor of Computing/Bachelor of Advanced Computing;
(b) An Information Technology Major (48 credit points) from Table A for the Bachelor of Computing/Bachelor of Advanced Computing and as defined in section 7 below;
(c) At least 12 credit points of 4000-level or higher IT electives from Table A for the Bachelor of Computing/Bachelor of Advanced Computing;
(d) Degree core: 12 credit points of mathematics degree core units of study as set out in Table A for the Bachelor of Science (students may count the units from their major(s) or minor(s) to fulfill this requirement) and 12 credit points of 1000-level science elective units of study (excluding units listed as Mathematics degree core) as set out in Table A (students may count the units from their major(s) or minor(s) to fulfil this requirement); and
(e) A Science Major (48 credit points) or a 3-year program with an embedded major from Table A for the Bachelor of Science, and which is different from the major completed to satisfy requirements specified clause 6 (4)(b) above (note: candidates taking Computational Data Science to fulfil requirements specified in clauses 6 (4) (b) may not take Data Science to fulfil requirements for the second major specified in this clause);
(f) If enrolled in a stream, requirements for the stream as specified in Table A for the Bachelor of Science or Table S.
(g) 12 credit points of units of study in the Open Learning Environment as listed in Table O;
(h) Where appropriate, additional elective units as required from Table A for the Bachelor of Computing/Bachelor of Advanced Computing, Table A for the Bachelor of Science and Table S.

(5) To qualify for the award of the Bachelor of Advanced Computing / Bachelor of Commerce a candidate must complete 240 credit points comprising:
(a) 96 credit points of core units as specified in Table A for the Bachelor of Computing/Bachelor of Advanced Computing;
(b) An Information Technology Major (48 credit points) from Table A for the Bachelor of Computing/Bachelor of Advanced Computing and as defined in section 7 below;
(c) At least 12 credit points of 4000-level or higher IT electives from Table A for the Bachelor of Computing/Bachelor of Advanced Computing;
(d) 24 credit points of core units of study as set out in Table A for the Bachelor of Commerce;
(e) A Commerce Major (48 credit points) from Table A for the Bachelor of Commerce;
(f) 12 credit points of units of study in the Open Learning Environment as specified in Table O;
(g) Where appropriate, additional elective units as required from Table A for the Bachelor of Computing/Bachelor of Advanced Computing, Table A for the Bachelor of Commerce, and Table S.

7. Majors, Minors and Programs

(1) *Bachelor of Computing and Bachelor of Advanced Computing*
(a) Completion of a major (the Information Technology Major) from Table A for the Bachelor of Computing/Bachelor of Advanced Computing is a requirement for the Bachelor of Computing and Bachelor of Advanced Computing. The majors available as Information Technology Majors are:
(i) Computer Science
(ii) Software Development
(iii) Information Systems
(iv) Computational Data Science
(b) Completion of a minor (the common pool minor) as listed and specified in Table S is optional in the Bachelor of Computing. Completion of a minor or major (the common pool minor or major) as listed and specified in Table S is optional in the Bachelor of Advanced Computing. The available minors and majors and requirements are as specified in TableS. Students taking an Information Technology Major in Computational Data Science may not take a minor or major in Data Science from Table S.

(2) *Bachelor of Advanced Computing / Bachelor of Science*
(a) Completion of a major (the Information Technology Major) from Table A for the Bachelor of Computing/Bachelor of Advanced Computing is a requirement for the Bachelor of Advanced Computing/Bachelor of Science. The majors available as Information Technology Majors are as specified in clause 7 (1)(a) for the Bachelor of Advanced Computing.
(b) Completion of a major (the Science Major) or a program which contains a major (the Science Program) from Table A for the Bachelor of Science is a requirement for the Bachelor of Advanced Computing/ Bachelor of Science. The Science Major must not be the same as the Information Technology Major completed to satisfy requirements specified in clause 7 (2)(a) above. Students taking an Information Technology Major in Computational Data Science may not take a Table A major for the Bachelor of Science or Table S

Major in Data Science. The majors and programs available and requirements for completing the majors and programs are as specified in Table A for the Bachelor of Science.

(3) *Bachelor of Advanced Computing / Bachelor of Commerce*

(a) Completion of a major (the Information Technology Major) from Table A for the Bachelor of Computing/Bachelor of Advanced Computing is a requirement for the Bachelor of Advanced Computing/ Bachelor of Commerce. The majors available are as specified in clause 7 (1) (a) for the Bachelor of Advanced Computing.

(b) Completion of a major (the Commerce Major) from Table A for the Bachelor of Commerce is a requirement. The majors available and requirements for completing the major are as specified in Table A for the Bachelor of Commerce.

8. Progression Rules

(1) *Progression within a major, program or minor:* Except with the permission of the relevant program, major or minor coordinator, candidates must have passed, or be concurrently enrolled in, all units of study at a given level before enrolling in any units at a higher level.

(2) *Progression within the Bachelor of Advanced Computing combined degrees:* Candidates must adhere to any progression rules for the Bachelor of Science or Bachelor of Commerce as relevant.

(3) *Progression within the Medical Science Stream:* Students in this stream will be required to meet the progression requirements for the stream.

(4) *Progression with the Dalyell Stream:* .

(a) With the permission of the Dalyell coordinator, candidates in the Dalyell stream may attempt advanced units at higher levels than the usual sequence through a program, major or minor.

(b) Candidates must achieve an Annual Average Mark at a level determined by the Board of Interdisciplinary Studies in each year of study to continue in the Dalyell stream. Candidates who do not maintain an Annual Average Mark at the level determined by the Board of Interdisciplinary Studies may continue in any other major, minor, program or stream into which they were admitted, but will not remain in the Dalyell stream.

9. Requirements for the Honours degree

(1) *Bachelor of Computing:* Honours is not available in the Bachelor of Computing.

(2) *Bachelor of Advanced Computing (as either a single degree or as part of a combined degree):* Honours is awarded in the Bachelor of Advanced Computing to meritorious candidates who meet the level of performance specified in clause 10.

(3) *Honours in an area of study in the Bachelor of Science and Bachelor of Commerce, as part of a combined degree with the Bachelor of Advanced Computing*

(a) Honours in an area of study in the Bachelor of Science or Bachelor of Commerce, as part of the combined degree, is available to meritorious candidates by enrolling in the Bachelor of Advanced Studies and completing an embedded honours component after completion of requirements for the combined degree.

(b) For candidates completing the Bachelor of Science or Bachelor of Commerce as part of a combined degree with the Bachelor of Advanced Computing and also completing an embedded honours component in the Bachelor of Advanced Studies, the requirement in the Bachelor of Advanced Studies for completion of a second major shall be met by the Information Technology major specified in 6 (4) (b) or 6 (5) (b).

10. Award of the Degrees

(1) The Bachelor of Advanced Computing degree is awarded with honours. The 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	Range
Honours Class I	75 <= EIHWAM
Honours Class II (Division 1)	70 <= EIHWAM <75
Honours Class II (Division 2)	65 <= EIHWAM <70

Candidates who do not meet the requirements for honours in the Bachelor of Advanced Computing but who have otherwise satisfied the course requirements, will be awarded the pass degree.

(2) The Bachelor of Science and the Bachelor of Commerce are awarded at pass level. Honours in Science or Commerce is taken by enrolling in the Bachelor of Advanced Studies and completing an embedded honours component.

(3) Candidates who attempt the Bachelor of Science or Bachelor of Commerce as part of a combined degree with the Bachelor of Advanced Computing with an embedded honours component in the Bachelor of Advanced Studies who do not meet the requirements for honours but who meet the requirement for the pass degree, may be awarded the relevant degree or combined degree at pass level for which they fulfil requirements.

11. Cross-institutional study

Cross-institutional study is not available in the Bachelor of Computing or Bachelor of Advanced Computing. Cross-institutional study in the Bachelor of Commerce or Bachelor of Science is as specified in the relevant degree and faculty resolutions.

12. International exchange

The faculties of Engineering and Information Technology, Science and Commerce encourage candidates in these degrees to participate in international exchange programs subject to the terms set out in the Resolutions of the Faculty of Engineering and Information Technology.

13. Course Transfer

(1) A candidate enrolled in the Bachelor of Advanced Computing who has satisfied the requirements of the Bachelor of Computing may transfer to the Bachelor of Computing and graduate.

(2) A candidate in a combined degree with the Bachelor of Advanced Computing may abandon that combined degree and elect to complete either the Bachelor of Advanced Computing or the other component of the combined degree (the Bachelor of Science or the Bachelor of Commerce) in accordance with the resolutions governing that degree.

(3) A candidate who, having satisfied requirements for a combined degree with the Bachelor of Advanced Computing, who has enrolled in the Bachelor of Advanced Studies to complete an embedded honours component as specified in 9 (3) (a) may abandon the Bachelor of Advanced Studies and graduate with the Bachelor of Advanced Computing or the associated combined degree in accordance with the resolutions governing that degree or those degrees.

14. Credit for previous study

Credit transfer is subject to the provisions of the Coursework Policy and the Resolutions of the Faculty of Engineering and Information Technologies and also, for students enrolled in combined degrees, the resolutions of the relevant faculty.

15. Transitional Provisions

These resolutions apply to students who commenced their candidature after 1 January, 2018.

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Bachelor of Advanced Computing and Bachelor of Computing			
Award requirements			
Bachelor of Advanced Computing			
To qualify for the award of the Bachelor of Advanced Computing, a candidate must complete 192 credit points, comprising:			
(a) 96 credit points of degree core units of study as set out in the table below;			
(b) A major (48 credit points) from the list of majors from the table below;			
(c) At least 12 credit points of 4000-level or higher electives from the table below;			
(d) (Optionally) up to 12 credit points of units of study in the Open Learning Environment as listed in Table O in the Shared Pool for Undergraduate Degrees;			
(e) (Optionally) a minor of 36 credit points or a second major of 48 credit points as listed and specified in Table S in the Shared Pool for Undergraduate Degrees;			
(f) Where appropriate, additional elective units from the table below or Table S in the Shared Pool for Undergraduate Degrees.			
Bachelor of Computing			
To qualify for the award of the Bachelor of Computing, a candidate must complete 144 credit points, comprising:			
(a) 78 credit points of degree core units as set out in the table below;			
(b) A major (48 credit points) from the list of majors from the table below;			
(c) (Optionally) up to 12 credit points of units of study in the Open Learning Environment as listed in Table O in the Shared Pool for Undergraduate Degrees;			
(d) (Optionally) a minor of 36 credit points as listed and specified in Table S in the Shared Pool for Undergraduate Degrees;			
(e) Where appropriate, additional elective units from the table below.			
Streams The available streams in the Bachelor of Advanced Computing are: Dalyell			
Achievement of the Dalyell stream requires:			
(i) Completion of 12 credit points of Dalyell units as set out in Table S;			
(ii) Admission on the basis of ATAR or first year WAM as determined by the Board of Interdisciplinary Studies;			
(iii) Maintenance of the required WAM as determined by the Board of Interdisciplinary Studies.			
Majors Table A majors available in this course are: Computer Science Computational Data Science Information Systems Software Development Requirements from the majors are listed in the Majors tabs in this Handbook.			
Minors Table A minors available in this course are: Computer Science Computational Data Science Information Systems Software Development Requirements from the minors are listed alongside the major requirements in the Majors tabs in this Handbook.			
Degree Core			
The degree core units of study required for this course are listed below. Candidates who exit at the third year do not complete the 4000-level degree core units and graduate with a Bachelor of Computing.			
1000-level units of study			
DATA1001 **Foundations of Data Science**	6	**N** MATH1005 or MATH1905 or MATH1015 or MATH1115 or ENVX1001 or ENVX1002 or ECMT1010 or BUSS1020 or STAT1021	Semester 1 Semester 2
ELEC1601 **Introduction to Computer Systems**	6	**A** HSC Mathematics extension 1 or 2	Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
INFO1110 **Introduction to Programming**	6		Intensive July Semester 1 Semester 2
INFO1111 **Computing 1A Professionalism**	6	**N** ENGG1805 OR ENGG1111 OR ENGD1000	Semester 1
INFO1112 **Computing 1B OS and Network Platforms**	6	**C** ELEC1601 AND (INFO1110 OR INFO1103 OR INFO1113). For most students, INFO1110 should have already been passed in semester 1.	Semester 2
INFO1113 **Object-Oriented Programming**	6	**P** INFO1110 **N** INFO1103 OR INFO1105 OR INFO1905	Semester 1 Semester 2
MATH1021 **Calculus Of One Variable**	3	**A** HSC Mathematics Extension 1. Students who have not completed HSC Extension 1 Mathematics (or equivalent) are strongly advised to take the Extension 1 Mathematics Bridging Course (offered in February). **N** MATH1011 or MATH1901 or MATH1906 or MATH1111 or ENVX1001 or MATH1001 or MATH1921 or MATH1931	Semester 1
MATH1002 **Linear Algebra**	3	**A** HSC Mathematics or MATH1111. Students who have not completed HSC Mathematics (or equivalent) are strongly advised to take the Mathematics Bridging Course (offered in February). **N** MATH1012 or MATH1014 or MATH1902	Semester 1 Summer Main
MATH1064 **Discrete Mathematics for Computation**	6	**N** MATH1004 or MATH1904	Semester 2
2000-level units of study			
COMP2123 **Data Structures and Algorithms**	6	**P** INFO1110 OR INFO1113 OR DATA1002 OR INFO1103 OR INFO1903 **N** INFO1105 OR INFO1905 OR COMP2823	Semester 1
COMP2823 **Data Structures and Algorithms (Adv)**	6	**A** Distinction-level result in at least one the listed 1000 level programming units **P** Distinction level result in at least one of INFO1110 OR INFO1113 OR DATA1002 OR INFO1103 OR INFO1903 **N** INFO1105 OR INFO1905 OR COMP2123 *Note: Department permission required for enrolment*	Semester 1
ISYS2120 **Data and Information Management**	6	**A** Programming skills **P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 OR INFO1003 OR INFO1903 OR DECO1012 **N** INFO2120 OR INFO2820 OR COMP5138	Semester 2
SOFT2412 **Agile Software Development Practices**	6	**P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905	Semester 2
INFO2222 **Computing 2 Usability and Security**	6	**P** 12CP 1000-level INFO	Semester 1
3000-level units of study			
INFO3333 **Computing 3 Management**	6	**P** 12CP 2000-level COMP, INFO or ISYS **C** INFO2222 **N** INFO3402	Semester 1
4000-level units of study The following units will be available from 2019: INFO4001 Thesis A INFO4002 Thesis B INFO4444 Computing 4 Innovation			
Electives			
2000-level units of study			
COMP2017 **Systems Programming**	6	**P** INFO1113 OR INFO1105 OR INFO1905 OR INFO1103 **C** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **N** COMP2129	Semester 1
COMP2022 **Programming Languages, Logic and Models**	6	**A** MATH1004 OR MATH1904 OR MATH1064 OR MATH2069 OR MATH2969 **P** INFO1103 OR INFO1903 OR INFO1113 **N** COMP2922	Semester 2
COMP2922 **Programming Languages, Logic and Models (Adv)**	6	**A** MATH1004 OR MATH1904 OR MATH1064 OR MATH2069 OR MATH2969 **P** Distinction level result in INFO1103 OR INFO1903 OR INFO1113 **N** COMP2022 *Note: Department permission required for enrolment*	Semester 2
DATA2001 **Data Science: Big Data and Data Diversity**	6	**P** DATA1002 OR INFO1110 OR INFO1903 OR INFO1103	Semester 1
DATA2002 **Data Analytics: Learning from Data**	6	**A** (Basic Linear Algebra and some coding) or QBUS1040 **P** [DATA1001 or ENVX1001 or ENVX1002] or [MATH10X5 and MATH1115] or [MATH10X5 and STAT2011] or [MATH1905 and MATH1XXX (except MATH1XX5)] or [BUSS1020 or ECMT1010 or STAT1021] **N** STAT2012 or STAT2912	Semester 2
INFO2150 **Introduction to Health Data Science**	6	**A** Basic knowledge of Entity Relationship Modelling, database technology and SQL **P** (INFO1003 OR INFO1903 OR INFO1103 OR INFO1110 OR DATA1002) AND (DATA1001 OR MATH1005 OR MATH1905 OR MATH1015) **C** DATA2001 or ISYS2120 OR INFO2120 OR INFO2820 OR INFO1903	Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
ISYS2110 **Analysis and Design of Web Info Systems**	6	**P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 **N** INFO2110	Semester 1
ISYS2160 **Information Systems in the Internet Age**	6	**A** INFO1003 OR INFO1103 OR INFO1903 OR INFO1113 **N** ISYS2140	Semester 2
SOFT2201 **Software Construction and Design 1**	6	**P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 **N** INFO3220	Semester 2
3000-level units of study			
COMP3027 **Algorithm Design**	6	**A** MATH1004 OR MATH1904 OR MATH1064 **P** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **N** COMP2007 OR COMP2907 OR COMP3927	Semester 1
COMP3927 **Algorithm Design (Adv)**	6	**A** MATH1004 OR MATH1904 OR MATH1064 **P** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **N** COMP2007 OR COMP2907 OR COMP3027 *Note: Department permission required for enrolment*	Semester 1
COMP3221 **Distributed Systems**	6	**P** (INFO1105 OR INFO1905) OR ((INFO1103 OR INFO1113) AND (COMP2123 OR COMP2823)) **N** COMP2121	Semester 1
COMP3308 **Introduction to Artificial Intelligence**	6	**A** Algorithms. Programming skills (e.g. Java, Python, C, C++, Matlab) **N** COMP3608	Semester 1
COMP3419 **Graphics and Multimedia**	6	**A** Programming skills **P** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905	Semester 2
COMP3520 **Operating Systems Internals**	6	**P** (COMP2017 OR COMP2129) AND (COMP2123 OR COMP2823 OR INFO1105 OR INFO1905)	Semester 2
COMP3600 **Computer Science Project (Adv)**	6	**P** (COMP2123 OR COMP2823) AND COMP2017 AND (COMP2022 OR COMP2922) with Distinction level results in at least one of the above listed units **N** INFO3600 OR COMP3615 *Note: Department permission required for enrolment*	Semester 2
COMP3608 **Introduction to Artificial Intelligence (Adv)**	6	**A** Algorithms. Programming skills (e.g. Java, Python, C, C++, Matlab) **P** Distinction-level results in some 2nd year COMP or MATH or SOFT units. **N** COMP3308 *COMP3308 and COMP3608 share the same lectures, but have different tutorials and assessment (the same type but more challenging).*	Semester 1
COMP3615 **Computer Science Project**	6	**P** (COMP2123 OR COMP2823) AND COMP2017 AND (COMP2022 OR COMP2922) **N** INFO3600 OR COMP3600	Semester 2
DATA3404 **Data Science Platforms**	6	**A** This unit of study assumes that students have previous knowledge of database structures and of SQL. The prerequisite material is covered in DATA2001 or ISYS2120. Familiarity with a programming language (e.g. Java or C) is also expected. **P** DATA2001 OR ISYS2120 OR INFO2120 OR INFO2820 **N** INFO3504 OR INFO3404	Semester 1
INFO3315 **Human-Computer Interaction**	6		Semester 2
INFO3406 **Introduction to Data Analytics**	6	**A** Basic statistics and database management. **P** (MATH1005 OR MATH1905) AND (INFO2120 OR INFO2820).	Semester 2
INFO3616 **Principles of Security and Security Eng**	6	**A** INFO1110 AND INFO1112 AND INFO1113 AND MATH1064. Knowledge equivalent to the above units is assumed; this means good programming skills in Python or a C-related language, basic networking knowledge, skills from discrete mathematics. A technical orientation is expected. **N** ELEC5616	Semester 1
ISYS3400 **Information Systems Project**	6	**P** (INFO2110 OR ISYS2110) AND (INFO2120 OR ISYS2120) AND (ISYS2140 OR ISYS2160) **N** INFO3600 or ISYS3207	Semester 2
ISYS3401 **Information Technology Evaluation**	6	**A** INFO2110 and ISYS2140 **P** (INFO2110 OR ISYS2110) AND (INFO2120 OR ISYS2120) AND (ISYS2140 OR ISYS2160)	Semester 1
ISYS3402 **Decision Analytics and Support Systems**	6	**A** Database Management AND Systems Analysis and Modelling **P** (ISYS2110 OR INFO2110) AND (ISYS2120 OR INFO2120)	Semester 2
SOFT3202 **Software Construction and Design 2**	6	**P** SOFT2201 **N** INFO3220	Semester 1
SOFT3410 **Concurrency for Software Development**	6	**P** (INFO1105 OR INFO1905) OR ((INFO1103 OR INFO1113) AND (COMP2123 OR COMP2823))	Semester 2
SOFT3413 **Software Development Project**	6	**A** SOFT3202 **P** 18CP 2000-level or above units from SOFT, COMP or INFO *Note: Department permission required for enrolment*	Semester 2
DATA3001 Data Science Capstone Project will be available from 2019.			
DATA3406 Human-in-the-Loop Data Analytics will replace INFO3406 Introduction to Data Analytics from 2019.			
4000-level units of study			
INFO4003 Thesis B (extension) will be available from 2019.			
5000-level 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

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
COMP5046 **Natural Language Processing**	6	**A** Knowledge of an OO programming language *Note: Department permission required for enrolment*	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 OR COMP9103. 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.	Semester 1
COMP5318 **Machine Learning and Data Mining**	6	**A** INFO2110 OR ISYS2110 OR COMP9120 OR COMP5138	Semester 1
COMP5328 **Advanced Machine Learning**	6	**A** COMP5318	Semester 2
COMP5329 **Deep Learning**	6	**A** COMP5318	Semester 1
COMP5338 **Advanced Data Models**	6	**A** This unit of study assumes foundational knowledge of relational database systems as taught in COMP5138/COMP9120 (Database Management Systems) or INFO2120/INFO2820/ISYS2120 (Database Systems 1).	Semester 2
COMP5347 **Web Application Development**	6	**A** COMP9220 or COMP5028. The course assumes basic knowledge on OO design and proficiency in a programming language	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 COMP9103 Software Development in JAVA	Semester 1
COMP5415 **Multimedia Design and Authoring**	6		Semester 2
COMP5416 **Advanced Network Technologies**	6	**A** ELEC3506 OR ELEC9506 OR ELEC5740 OR COMP5116	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		Semester 1
COMP5427 **Usability Engineering**	6		Semester 2
DATA5207 **Data Analysis in the Social Sciences**	6	**A** COMP5310	Semester 1
ELEC5306 **Advanced Signal Processing: Video Compression**	6	**A** Basic understanding of digital signal processing (filtering, DFT) and programing skills (e.g. Matlab/Java/Python/C++)	Semester 1
ELEC5307 **Advanced Signal Processing with Deep Learning**	6	**A** Mathematics (e.g., probability and linear algebra) and programing skills (e.g. Matlab/Java/Python/C++)	Semester 2
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 **P** ELEC5509	Semester 2
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 throughout 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.	Semester 2
INFO5010 **IT Advanced Topic A**	6	*Note: Department permission required for enrolment*	Semester 1 Semester 2
INFO5011 **IT Advanced Topic B**	6	*Note: Department permission required for enrolment*	Semester 1 Semester 2
INFO5991 **Services Science Management and Engineering**	6	**A** INFO5990. Students are expected to have a degree in computer science, engineering, information technology, information systems or business.	Semester 1 Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
INFO5992 **Understanding IT Innovations**	6	**A** INFO5990 **N** PMGT5875	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
INFO5993 **IT Research Methods**	6		Semester 1 Semester 2
ISYS5050 **Knowledge Management Systems**	6	**A** An undergraduate degree in Computer Science or Information Systems. Good grasp of database technologies and the role of information systems in organisations.	Semester 1

For a standard enrolment plan for Bachelor of Advanced Computing visit CUSP https://cusp.sydney.edu.au.

Unit of Study Descriptions

Bachelor of Advanced Computing and Bachelor of Computing

Award requirements

Bachelor of Advanced Computing

To qualify for the award of the Bachelor of Advanced Computing, a candidate must complete 192 credit points, comprising:(a) 96 credit points of degree core units of study as set out in the table below;(b) A major (48 credit points) from the list of majors from the table below;(c) At least 12 credit points of 4000-level or higher electives from the table below;(d) (Optionally) up to 12 credit points of units of study in the Open Learning Environment as listed in Table O in the Shared Pool for Undergraduate Degrees;(e) (Optionally) a minor of 36 credit points or a second major of 48 credit points as listed and specified in Table S in the Shared Pool for Undergraduate Degrees;(f) Where appropriate, additional elective units from the table below or Table S in the Shared Pool for Undergraduate Degrees.

Bachelor of Computing

To qualify for the award of the Bachelor of Computing, a candidate must complete 144 credit points, comprising:(a) 78 credit points of degree core units as set out in the table below;(b) A major (48 credit points) from the list of majors from the table below;(c) (Optionally) up to 12 credit points of units of study in the Open Learning Environment as listed in Table O in the Shared Pool for Undergraduate Degrees;(d) (Optionally) a minor of 36 credit points as listed and specified in Table S in the Shared Pool for Undergraduate Degrees;(e) Where appropriate, additional elective units from the table below.

Streams

The available streams in the Bachelor of Advanced Computing are:DalyellAchievement of the Dalyell stream requires:(i) Completion of 12 credit points of Dalyell units as set out in Table S;(ii) Admission on the basis of ATAR or first year WAM as determined by the Board of Interdisciplinary Studies;(iii) Maintenance of the required WAM as determined by the Board of Interdisciplinary Studies.

Majors

Table A majors available in this course are:Computer ScienceComputational Data ScienceInformation SystemsSoftware DevelopmentRequirements from the majors are listed in the Majors tabs in this Handbook.

Minors

Table A minors available in this course are:Computer ScienceComputational Data ScienceInformation SystemsSoftware DevelopmentRequirements from the minors are listed alongside the major requirements in the Majors tabs in this Handbook.

Degree Core

The degree core units of study required for this course are listed below. Candidates who exit at the third year do not complete the 4000-level degree core units and graduate with a Bachelor of Computing.

1000-level units of study

DATA1001
Foundations of Data Science

Credit points: 6 **Teacher/Coordinator:** Dr Di Warren **Session:** Semester 1, Semester 2 **Classes:** lecture 3 hrs/week; computer tutorial 2 hr/week **Prohibitions:** MATH1005 or MATH1905 or MATH1015 or MATH1115 or ENVX1001 or ENVX1002 or ECMT1010 or BUSS1020 or STAT1021 **Assessment:** assignments, quizzes, presentation, exam **Mode of delivery:** Normal (lecture/lab/tutorial) day

DATA1001 is a foundational unit in the Data Science major. The unit focuses on developing critical and statistical thinking skills for all students. Does mobile phone usage increase the incidence of brain tumours? What is the public's attitude to shark baiting following a fatal attack? Statistics is the science of decision making, essential in every industry and undergirds all research which relies on data. Students will use problems and data from the physical, health, life and social sciences to develop adaptive problem solving skills in a team setting. Taught interactively with embedded technology, DATA1001 develops critical thinking and skills to problem-solve with data. It is the prerequisite for DATA2002.

Textbooks
Statistics, Fourth Edition, Freedman Pisani Purves

ELEC1601
Introduction to Computer Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories, Tutorials **Assumed knowledge:** HSC Mathematics extension 1 or 2 **Assessment:** Through semester assessment (60%) and Final Exam (40%) **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, machine language, assembly language and high level programming constructs.

INFO1110
Introduction to Programming

Credit points: 6 **Session:** Intensive July, Semester 1, Semester 2 **Classes:** lectures, laboratories, seminars **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit is an essential starting point for software developers, IT consultants, and computer scientists to build their understanding of principle computer operation. Students will obtain knowledge and skills with procedural programming. Crucial concepts include defining data types, control flow, iteration, functions, recursion, the model of addressable memory. Students will be able to reinterpret a general problem into a computer problem, and use their understanding of the computer model to develop source code. This unit trains students with software development process, including skills of testing and debugging. It is a prerequisite for more advanced programming languages, systems programming, computer security and high performance computing.

INFO1111
Computing 1A Professionalism

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratories, Project Work - own time **Prohibitions:** ENGG1805 OR ENGG1111 OR ENGD1000 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces students to the fundamental principles that underlie professional practice in computing. It lays the foundation for later studies, and presents to the students challenges common to a multidisciplinary IT environment. The subject also provides students with the opportunity to develop important attributes such as communication skills, an understanding of professional ethics, and of working as a part of a team. Tool use is an important aspect of this unit: students are required to learn to use tools for planning and completing work, managing artefacts including reports, and communicating within the team. A selection of guest speakers will address students on different career paths.

Dalyell students may enrol in ENGD1000 Building a Sustainable World in place of INFO1111

INFO1112
Computing 1B OS and Network Platforms

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories **Corequisites:** ELEC1601 AND (INFO1110 OR INFO1103 OR INFO1113). For most students, INFO1110 should have already been passed in semester 1. **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit introduces principles and concepts of modern computer systems, including mobile computers and the Internet, to provide students with fundamental knowledge of the environments in which modern, networked applications operate. Students will have basic knowledge to understand how computers work and are aware of principles and concepts they are likely to encounter in their career. The unit covers: Principles of operating systems and the way applications interact with the OS, including the particularities of modern operating systems for mobile devices Principles of computer networking, including mobile networking Writing applications that use facilities of the OS and networking, including understanding the challenges that are common in distributed systems

INFO1113
Object-Oriented Programming

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** lectures, laboratories, seminars **Prerequisites:** INFO1110 **Prohibitions:** INFO1103 OR INFO1105 OR INFO1905 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Object-oriented (OO) programming is a technique that arranges code into classes, each encapsulating in one place related data and the operations on that data. Inheritance is used to reuse code from a more general class, in specialised situations. Most modern programming languages provide OO features. Understanding and using these are an essential skill to software developers in industry. This unit provides the student with the concepts and individual programming skills in OO programming, starting from their previous mastery of procedural programming.

MATH1021
Calculus Of One Variable

Credit points: 3 **Session:** Semester 1 **Classes:** 2x1-hr lectures; 1x1-hr tutorial per week **Prohibitions:** MATH1011 or MATH1901 or MATH1906 or MATH1111 or ENVX1001 or MATH1001 or MATH1921 or MATH1931 **Assumed knowledge:** HSC Mathematics Extension 1. Students who have not completed HSC Extension 1 Mathematics (or equivalent) are strongly advised to take the Extension 1 Mathematics Bridging Course (offered in February). **Assessment:** exam, quizzes, assignments **Mode of delivery:** Normal (lecture/lab/tutorial) day

Calculus is a discipline of mathematics that finds profound applications in science, engineering, and economics. This unit investigates differential calculus and integral calculus of one variable and the diverse applications of this theory. Emphasis is given both to the theoretical and foundational aspects of the subject, as well as developing the valuable skill of applying the mathematical theory to solve practical problems. Topics covered in this unit of study include complex numbers, functions of a single variable, limits and continuity, differentiation, optimisation, Taylor polynomials, Taylor's Theorem, Taylor series, Riemann sums, and Riemann integrals.

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:** MATH1012 or MATH1014 or MATH1902 **Assumed knowledge:** HSC Mathematics or MATH1111. Students who have not completed HSC Mathematics (or equivalent) are strongly advised to take the Mathematics Bridging Course (offered in February). **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

MATH1064
Discrete Mathematics for Computation

Credit points: 6 **Session:** Semester 2 **Classes:** lecture 3 hrs/week; tutorial 1 hr/week; prac class 1hr/week **Prohibitions:** MATH1004 or MATH1904 **Assessment:** assignment, quizzes, exam **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces students to the language and key methods of the area of Discrete Mathematics. The focus is on mathematical concepts in discrete mathematics and their applications, with an emphasis on computation. For instance, to specify a computational problem precisely one needs to give an abstract formulation using mathematical objects such as sets, functions, relations, orders, and sequences. In order to prove that a proposed solution is correct, one needs to apply the principles of mathematical logic, and to use proof techniques such as induction. To reason about the efficiency of an algorithm, one often needs to estimate the growth of functions or count the size of complex mathematical objects. This unit provides the necessary mathematical background for such applications of discrete mathematics. Students will be introduced to mathematical logic and proof techniques; sets, functions, relations, orders, and sequences; counting and discrete probability; asymptotic growth; and basic graph theory.

Textbooks

As set out in the Junior Mathematics Handbook.

2000-level units of study

COMP2123
Data Structures and Algorithms

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prerequisites:** INFO1110 OR INFO1113 OR DATA1002 OR INFO1103 OR INFO1903 **Prohibitions:** INFO1105 OR INFO1905 OR COMP2823 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will teach some powerful ideas that are central to solving algorithmic problems in ways that are more efficient than naive approaches. In particular, students will learn how data collections can support efficient access, for example, how a dictionary or map can allow key-based lookup that does not slow down linearly as the collection grows in size. The data structures covered in this unit include lists, stacks, queues, priority queues, search trees, hash tables, and graphs. Students will also learn efficient techniques for classic tasks such as sorting a collection. The concept of asymptotic notation will be introduced, and used to describe the costs of various data access operations and algorithms.

COMP2823
Data Structures and Algorithms (Adv)

Credit points: 6 **Session:** Semester 1 **Classes:** lectures, tutorials **Prerequisites:** Distinction level result in at least one of INFO1110 OR INFO1113 OR DATA1002 OR INFO1103 OR INFO1903 **Prohibitions:** INFO1105 OR INFO1905 OR COMP2123 **Assumed knowledge:** Distinction-level result in at least one the listed 1000 level programming units **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit will teach some powerful ideas that are central to solving algorithmic problems in ways that are more efficient than naive approaches. In particular, students will learn how data collections can support efficient access, for example, how a dictionary or map can allow key-based lookup that does not slow down linearly as the collection grows in size. The data structures covered in this unit include lists, stacks, queues, priority queues, search trees, hash tables, and graphs. Students will also learn efficient techniques for classic tasks such as sorting a collection. The concept of asymptotic notation will be introduced, and used to describe the costs of various data access operations and algorithms.

ISYS2120
Data and Information Management

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories, Project Work - own time **Prerequisites:** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 OR INFO1003 OR INFO1903 OR DECO1012 **Prohibitions:** INFO2120 OR INFO2820 OR COMP5138 **Assumed knowledge:** Programming skills **Assessment:** through semester assessment (50%), final exam (50%) **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 the SQL database query languages, which is industry standard. Other topics covered will include the important concept of transaction management, application development with a backend database, and an overview of data warehousing and OLAP.

SOFT2412
Agile Software Development Practices

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories, Project Work - own time **Prerequisites:** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit builds students skills to follow defined processes in software development, in particular, working in small teams in an agile approach. Content covers the underlying concepts and principles of software processes, their analysis, measurement and improvement. Students will practice with a variety of professional-strength tool support for the practices that ensure quality outcomes. The unit requires students to enter already skilled in individual programming; instead this unit focuses on the complexities in a team setting.

INFO2222
Computing 2 Usability and Security

Credit points: 6 **Session:** Semester 1 **Classes:** Meetings, Laboratories, Project Work - own time **Prerequisites:** 12CP 1000-level INFO **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides an integrated treatment of two critical topics for a computing professional: human computer interaction (HCI) and security. The techniques and core ideas of HCI will be studied with a particular focus on examples and case studies related to security. This unit builds the students' awareness of the deep challenges in creating computing systems that can meet people's needs for both HCI and security. It will develop basic skills to evaluate systems for their effectiveness in meeting people's needs within the contexts of their use, building knowledge of common mistakes in systems, and approaches to avoid those mistakes.

3000-level units of study

INFO3333
Computing 3 Management

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratories, Project Work - own time **Prerequisites:** 12CP 2000-level COMP, INFO or ISYS **Corequisites:** INFO2222 **Prohibitions:** INFO3402 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit teaches students vital skills for an effective professional career: preparing them to eventually be a leader, who ensures that others achieve high-quality outcomes. Building on experiences from earlier units (that covered working in a team, agile development practices, paying attention to needs and characteristics of users, and the value of data) this unit teaches students key concepts needed as a manager, or when working with managers. The focus includes managing projects, managing services, and ensuring governance.

4000-level units of study

The following units will be available from 2019:INFO4001 Thesis AINFO4002 Thesis BINFO4444 Computing 4 Innovation

Electives

2000-level units of study

COMP2017
Systems Programming

Credit points: 6 **Session:** Semester 1 **Classes:** lectures, laboratories **Prerequisites:** INFO1113 OR INFO1105 OR INFO1905 OR INFO1103 **Corequisites:** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **Prohibitions:** COMP2129 **Assessment:** through semester assessment (50%), final exam (50%) **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.

COMP2022
Programming Languages, Logic and Models

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Prerequisites:** INFO1103 OR INFO1903 OR INFO1113 **Prohibitions:** COMP2922 **Assumed knowledge:** MATH1004 OR MATH1904 OR MATH1064 OR MATH2069 OR MATH2969 **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides an introduction to the foundations of computational models, and their connection to programming languages/tools. The unit covers various abstract models for computation including Lambda Calculus, and Logic calculi (e. g. concept of formal proofs in propositional, predicate, and temporal logic). For each abstract model, we introduce programming languages/tools that are built on the introduced abstract computational models. We will discuss functional languages including Scheme/Haskell, and Prolog/Datalog.

COMP2922
Programming Languages, Logic and Models (Adv)

Credit points: 6 **Session:** Semester 2 **Classes:** lectures, tutorials **Prerequisites:** Distinction level result in INFO1103 OR INFO1903 OR INFO1113 **Prohibitions:** COMP2022 **Assumed knowledge:** MATH1004 OR MATH1904 OR MATH1064 OR MATH2069 OR MATH2969 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit provides an introduction to the foundations of computational models, and their connection to programming languages/tools. The unit covers various abstract models for computation including Lambda Calculus, and Logic calculi (e.g. concept of formal proofs in propositional, predicate, and temporal logic). For each abstract model, we introduce programming languages/tools that are built on the introduced abstract computational models. We will discuss functional languages including Scheme/Haskell, and Prolog/Datalog.

DATA2001
Data Science: Big Data and Data Diversity

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratories, Project Work - own time **Prerequisites:** DATA1002 OR INFO1110 OR INFO1903 OR INFO1103 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course focuses on methods and techniques to efficiently explore and analyse large data collections. Where are hot spots of pedestrian accidents across a city? What are the most popular travel locations according to user postings on a travel website? The ability to combine and analyse data from various sources and from databases is essential for informed decision making in both research and industry.

Students will learn how to ingest, combine and summarise data from a variety of data models which are typically encountered in data science projects, such as relational, semi-structured, time series, geospatial, image, text. As well as reinforcing their programming skills through experience with relevant Python libraries, this course will also introduce students to the concept of declarative data processing with SQL, and to analyse data in relational databases. Students will be given data sets from, eg. , social media, transport, health and social sciences, and be taught basic explorative data analysis and mining techniques in the context of small use cases. The course will further give students an understanding of the challenges involved with analysing large data volumes, such as the idea to partition and distribute data and computation among multiple computers for processing of 'Big Data'.

DATA2002
Data Analytics: Learning from Data

Credit points: 6 **Teacher/Coordinator:** Jean Yang **Session:** Semester 2 **Classes:** lecture 3 hrs/week; computer tutorial 2 hr/week **Prerequisites:** [DATA1001 or ENVX1001 or ENVX1002] or [MATH10X5 and MATH1115] or [MATH10X5 and STAT2011] or [MATH1905 and MATH1XXX (except MATH1XX5)] or [BUSS1020 or ECMT1010 or STAT1021] **Prohibitions:** STAT2012 or STAT2912 **Assumed knowledge:** (Basic Linear Algebra and some coding) or QBUS1040 **Assessment:** written assignment, presentation, exams **Mode of delivery:** Normal (lecture/lab/tutorial) day

Technological advances in science, business, engineering has given rise to a proliferation of data from all aspects of our life. Understanding the information presented in these data is critical as it enables informed decision making into many areas including market intelligence and science. DATA2002 is an intermediate course in statistics and data sciences, focusing on learning data analytic skills for a wide range of problems and data. How should the Australian government measure and report employment and unemployment? Can we tell the difference between decaffeinated and regular coffee ? In this course, you will learn how to ingest, combine and summarise data from a variety of data models which are typically encountered in data science projects as well as reinforcing their programming skills through experience with statistical programming language. You will also be exposed to the concept of statistical machine learning and develop the skill to analyze various types of data in order to answer a scientific question. From this unit, you will develop knowledge and skills that will enable you to embrace data analytic challenges stemming from everyday problems.

INFO2150
Introduction to Health Data Science

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Prerequisites:** (INFO1003 OR INFO1903 OR INFO1103 OR INFO1110 OR DATA1002) AND (DATA1001 OR MATH1005 OR MATH1905 OR MATH1015) **Corequisites:** DATA2001 or ISYS2120 OR INFO2120 OR INFO2820 OR INFO1903 **Assumed knowledge:** Basic knowledge of Entity Relationship Modelling, database technology and SQL **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Health organisations cannot function effectively without computer information systems. Clinical data are stored and distributed in different databases, different formats and different locations. It requires a lot of effort to create an integrated and clean-up version of data from multiple sources, This unit provides basic introduction to the process and knowledge to enable the analysis of health data. The unit will be of interest to students seeking the understanding of the various coding standards in health industry, data retrieval from databases, data linkage issue, cleaning and pre-processing steps, necessary statistical techniques and presentation of results.

It will be valuable to those who want to work as health-related occupations, such as health informatics analysts, healthcare administrators, medical and health services manager or research officers in hospitals, government health agencies and research organisations. Having said that, a good understanding of health data analysis is a useful asset to all students.

ISYS2110
Analysis and Design of Web Info Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, tutorials **Prerequisites:** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 **Prohibitions:** INFO2110 **Assessment:** through semester assessment (40%), final exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course discusses the processes, methods, techniques and tools that organisations use to determine how they should conduct their business, with a particular focus on how web-based technologies can most effectively contribute to the way business is organized. The course covers a systematic methodology for analysing a business problem or opportunity, determining what role, if any, web-based technologies can play in addressing the business need, articulating business requirements for the technology solution, specifying alternative approaches to acquiring the technology capabilities needed to address the business requirements, and specifying the requirements for the information systems solution in particular, in-house development, development from third-party providers, or purchased commercial-off-the-shelf (COTS) packages.

ISYS2160
Information Systems in the Internet Age

Credit points: 6 **Session:** Semester 2 **Classes:** lectures, tutorials **Prohibitions:** ISYS2140 **Assumed knowledge:** INFO1003 OR INFO1103 OR INFO1903 OR INFO1113 **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 the Internet era. Key topics covered include: system thinking and system theory, basic concepts of information systems, internet and e-commerce, e-payment and m-commerce, online marketing and social media, information systems for competitive advantage, functional and enterprise systems, business intelligence, information systems development and acquisition, information security, ethics, and privacy

SOFT2201
Software Construction and Design 1

Credit points: 6 **Session:** Semester 2 **Classes:** lectures, laboratories **Prerequisites:** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 **Prohibitions:** INFO3220 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces the foundations of software design and construction. It covers the topics of modelling software (UML, CRC, use cases), software design principles, object-oriented programming theory (inheritance, polymorphism, dynamic subtyping and generics), and simple design patterns. The unit aims to foster a strong technical understanding of the underlying software design and construction theory (delivered in the lecture) but also has a strong emphasis of the practice, where students apply the theory on practical examples.

3000-level units of study

COMP3027
Algorithm Design

Credit points: 6 **Session:** Semester 1 **Classes:** lectures, tutorials **Prerequisites:** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **Prohibitions:** COMP2007 OR COMP2907 OR COMP3927 **Assumed knowledge:** MATH1004 OR MATH1904 OR MATH1064 **Assessment:** through semester assessment (40%), final exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides an introduction to the design techniques that are used to find efficient algorithmic solutions for given problems. The techniques covered included greedy, divide-and-conquer, dynamic programming, and adjusting flows in networks. Students will extend their skills in algorithm analysis. The unit also provides an introduction to the concepts of computational complexity and reductions between problems.

COMP3927
Algorithm Design (Adv)

Credit points: 6 **Session:** Semester 1 **Classes:** lectures, tutorials **Prerequisites:** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **Prohibitions:** COMP2007 OR COMP2907 OR COMP3027 **Assumed knowledge:** MATH1004 OR MATH1904 OR MATH1064 **Assessment:** through semester assessment (40%), final exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit provides an introduction to the design techniques that are used to find efficient algorithmic solutions for given problems. The techniques covered included greedy, divide-and-conquer, dynamic programming, and adjusting flows in networks. Students will extend their skills in algorithm analysis. The unit also provides an introduction to the concepts of computational complexity and reductions between problems.

COMP3221
Distributed Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratories, Project Work - own time **Prerequisites:** (INFO1105 OR INFO1905) OR ((INFO1103 OR INFO1113) AND (COMP2123 OR COMP2823)) **Prohibitions:** COMP2121 **Assessment:** through semester assessment (60%), final exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will provide broad introduction to the principles of distributed computing and distributed systems and their design; provide students the fundamental knowledge required to analyse, design distributed algorithms and implement various types of applications, like blockchains; explain the common algorithmic design principles and approaches used in the design of message passing at different scales (e.g., logical time, peer-to-peer overlay, gossip-based communication).

COMP3308
Introduction to Artificial Intelligence

Credit points: 6 **Session:** Semester 1 **Classes:** Tutorials, Lectures **Prohibitions:** COMP3608 **Assumed knowledge:** Algorithms. Programming skills (e.g. Java, Python, C, C++, Matlab) **Assessment:** Through semester assessment (45%) and Final Exam (55%) **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, neural networks and probabilistic reasoning. 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 2 **Classes:** Lectures, Tutorials **Prerequisites:** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **Assumed knowledge:** Programming skills **Assessment:** Through semester assessment (40%) and Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides a broad introduction to the field of graphics and multimedia computing to meet the diverse requirements of application areas such as entertainment, industrial design, virtual reality, intelligent media management, social media 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.

COMP3520
Operating Systems Internals

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Prerequisites:** (COMP2017 OR COMP2129) AND (COMP2123 OR COMP2823 OR INFO1105 OR INFO1905) **Assessment:** Through semester assessment (40%) and Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will provide a comprehensive discussion 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.).

COMP3600
Computer Science Project (Adv)

Credit points: 6 **Session:** Semester 2 **Classes:** project work, sites visits, meetings **Prerequisites:** (COMP2123 OR COMP2823) AND COMP2017 AND (COMP2022 OR COMP2922) with Distinction level results in at least one of the above listed units **Prohibitions:** INFO3600 OR COMP3615 **Assessment:** through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

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.

COMP3608
Introduction to Artificial Intelligence (Adv)

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prerequisites:** Distinction-level results in some 2nd year COMP or MATH or SOFT units. **Prohibitions:** COMP3308 **Assumed knowledge:** Algorithms. Programming skills (e.g. Java, Python, C, C++, Matlab) **Assessment:** Through semester assessment (45%) and Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: COMP3308 and COMP3608 share the same lectures, but have different tutorials and assessment (the same type but more challenging).

An advanced alternative to COMP3308; covers material at an advanced and challenging level.

COMP3615
Computer Science Project

Credit points: 6 **Session:** Semester 2 **Classes:** Project Work, Site Visit, Meetings **Prerequisites:** (COMP2123 OR COMP2823) AND COMP2017 AND (COMP2022 OR COMP2922) **Prohibitions:** INFO3600 OR COMP3600 **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.

DATA3404
Data Science Platforms

Credit points: 6 **Session:** Semester 1 **Classes:** lectures, tutorials **Prerequisites:** DATA2001 OR ISYS2120 OR INFO2120 OR INFO2820 **Prohibitions:** INFO3504 OR INFO3404 **Assumed knowledge:** This unit of study assumes that students have previous knowledge of database structures and of SQL. The prerequisite material is covered in DATA2001 or ISYS2120. 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 data science platforms and of systems that manage large data collections. These skills are needed for successful performance tuning and to understand the scalability challenges faced by when processing Big Data. This unit builds upon the second' year DATA2001 - 'Data Science - Big Data and Data Diversity' and correspondingly assumes a sound understanding of SQL and data analysis tasks.

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 data management platform. Topics include: physical data organization and disk-based index structures, query processing and optimisation, and database tuning.

The second part focuses on the large-scale management of big data in a distributed architecture. Topics include: distributed and replicated databases, information retrieval, data stream processing, and web-scale data processing.

The unit will be of interest to students seeking an introduction to data management tuning, disk-based data structures and algorithms, and information retrieval. It will be valuable to those pursuing such careers as Software Engineers, Data Engineers, Database Administrators, and Big Data Platform specialists.

INFO3315
Human-Computer Interaction

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is a first subject in HCI, Human Computer Interaction. It is designed for students who want to be involved in one of the many roles required to create future technology. There are three main parts: the human foundations from psyschology and physiology; HCI methods for design and evaluation of interfaces; leading edge directions for technologies.

This subject is highly multi-disciplinary. At the core, it is a mix of Computer Science Software Engineering combined with the design discipline, UX - User Experience. It draws on psychology, both for relevant theories and user study methods. The practical work is human-centred with project work that motivates the formal curriculum. This year the projects will be in area of health and wellness.

INFO3406
Introduction to Data Analytics

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories **Prerequisites:** (MATH1005 OR MATH1905) AND (INFO2120 OR INFO2820). **Assumed knowledge:** Basic statistics and database management. **Assessment:** Through semester assessment (40%) and Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Big Data refers to datasets that are massive, heterogenous, and dynamic that are beyond current approaches for the capture, storage, management, and analysis of the data. The focus of this unit is on understanding and applying relevant concepts, techniques, algorithms, and tools for the analysis, management and visualization of big data - with the goal of keeping abreast of the continual increase in the volume and complexity of data sets and enabling discovery of information and knowledge to guide effective decision making.

INFO3616
Principles of Security and Security Eng

Credit points: 6 **Session:** Semester 1 **Classes:** lectures, tutorials, research **Prohibitions:** ELEC5616 **Assumed knowledge:** INFO1110 AND INFO1112 AND INFO1113 AND MATH1064. Knowledge equivalent to the above units is assumed; this means good programming skills in Python or a C-related language, basic networking knowledge, skills from discrete mathematics. A technical orientation is expected. **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides an introduction to the many facets of security in the digital and networked world, the challenges that IT systems face, and the design principles that have been developed to build secure systems and counter attacks. The unit puts the focus squarely on providing a thorough understanding of security principles and engineering for security. At the same time, we stress a hands-on approach to teach the state-of-the-art incarnations of security principles and technology, and we practice programming for security. We pay particular attention to the fact that security is much more than just technology as we discuss the fields of usability in security, operational security, and cyber-physical systems. At the end of this unit, graduates are prepared for practical demands in their later careers and know how to tackle new, yet unforeseen challenges.

This unit also serves as the initial step for a specialisation in computer and communications security.

ISYS3400
Information Systems Project

Credit points: 6 **Session:** Semester 2 **Classes:** Project Work - in class, Project Work - own time, Site Visits, Meetings **Prerequisites:** (INFO2110 OR ISYS2110) AND (INFO2120 OR ISYS2120) AND (ISYS2140 OR ISYS2160) **Prohibitions:** INFO3600 or ISYS3207 **Assessment:** Through semester assessment (80%) and 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
Information Technology Evaluation

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prerequisites:** (INFO2110 OR ISYS2110) AND (INFO2120 OR ISYS2120) AND (ISYS2140 OR ISYS2160) **Assumed knowledge:** INFO2110 and ISYS2140 **Assessment:** Through semester assessment (35%) and Final Exam (65%) **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.

ISYS3402
Decision Analytics and Support Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories, Project Work - own time **Prerequisites:** (ISYS2110 OR INFO2110) AND (ISYS2120 OR INFO2120) **Assumed knowledge:** Database Management AND Systems Analysis and Modelling **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

With the rapid increases in the volume and variety of data available, the problem of providing effective support to facilitate good decision making has become more challenging. This unit of study will provide a comprehensive understanding the diverse types of decision and the decision making processes. It will introduce decision modelling and the design and implementation of application systems to support decision making in organisational contexts. It will include a range of business intelligence and analytics solutions based on online analytical processing (OLAP) models and technologies. The unit will also cover a number of modelling approaches (optimization, predictive, descriptive) and their integration in the context of enabling improved, data-driven decision making.

SOFT3202
Software Construction and Design 2

Credit points: 6 **Session:** Semester 1 **Classes:** lectures, laboratories **Prerequisites:** SOFT2201 **Prohibitions:** INFO3220 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit is a sequel of Software Construction and Design I (SOFT2301). It introduces advanced concepts which build on the topics of SOFT2301. SOFT3302 covers topics including software validation and verification, the theory of testing, and advanced design patterns. The unit has a strong focus on the theoretical underpinning of software design. I the labs the theory is applied with contemporary tools with concrete examples.

SOFT3410
Concurrency for Software Development

Credit points: 6 **Session:** Semester 2 **Classes:** lectures, laboratories **Prerequisites:** (INFO1105 OR INFO1905) OR ((INFO1103 OR INFO1113) AND (COMP2123 OR COMP2823)) **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The manufacturing industry has experienced a radical shift in the way they design computers, with the integration of multiple processors on the same chip. This hardware shift now requires software developers to acquire the skills that will allow them to write efficient concurrent software. Software developers used to wait for manufacturers to increase the clock frequency of their processors to see increases in the performance of their programs, the challenge is now to exploit, in the same program, more and more processing resources rather than faster processing resources. In this unit, you will learn how to tackle the problems underlying this challenge, including developing and testing concurrent programs, synchronizing resources between concurrent threads, overcoming fairness issues and guaranteeing progress, and ensuring scalability in the level of concurrency.

SOFT3413
Software Development Project

Credit points: 6 **Session:** Semester 2 **Classes:** project work, site visits, meetings **Prerequisites:** 18CP 2000-level or above units from SOFT, COMP or INFO **Assumed knowledge:** SOFT3202 **Assessment:** through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit will provide students an opportunity to apply the knowledge and practice 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.

DATA3001 Data Science Capstone Project will be available from 2019.DATA3406 Human-in-the-Loop Data Analytics will replace INFO3406 Introduction to Data Analytics from 2019.

4000-level units of study

INFO4003 Thesis B (extension) will be available from 2019.

5000-level units of study

COMP5045
Computational Geometry

Credit points: 6 **Session:** Semester 1 **Classes:** Project Work **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 (72%) and Final Exam (28%) **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
Natural Language Processing

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratory **Assumed knowledge:** Knowledge of an OO programming language **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

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 answering; machine translation; and classifying and clustering of documents. This unit will explore the key challenges of natural language to computational modelling, and the state of the art approaches to the key NLP sub-tasks, including tokenisation, morphological analysis, word sense representation, part-of-speech tagging, named entity recognition and other information extraction, text categorisation, phrase structure parsing and dependency 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 **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%) and Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This is an advanced course on Pervasive Computing, with a focus on the "Internet of Things" (IoT). It introduces the key aspects of the IoT 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.

COMP5048
Visual Analytics

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Assumed knowledge:** It is assumed that students will have basic knowledge of data structures, algorithms and programming skills. **Assessment:** Through semester assessment (60%) and 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, visualisation 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:** Lectures, Tutorials **Assumed knowledge:** COMP5214 OR COMP9103. Software Development in JAVA, or similar introductory software development units. **Assessment:** Through semester assessment (45%) and 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:** Lectures, Tutorials **Assumed knowledge:** Algorithmic skills (as expected from any IT graduate). Basic probability knowledge. **Assessment:** Through semester assessment (60%) and Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The growing connected-ness 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 and probability tackle the problems of communicating (routing, diffusing, aggregating) in dynamic and social networks.

COMP5318
Machine Learning and Data Mining

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Assumed knowledge:** INFO2110 OR ISYS2110 OR COMP9120 OR COMP5138 **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Machine learning is the process of automatically building mathematical models that explain and generalise datasets. It integrates elements of statistics and algorithm development into the same discipline. 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 machine learning and data mining.

Topics to be covered include problems of discovering patterns in the data, classification, regression, feature extraction and data visualisation. Also covered are analysis, comparison and usage of various types of machine learning techniques and statistical techniques.

COMP5328
Advanced Machine Learning

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, tutorials **Assumed knowledge:** COMP5318 **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Machine learning models explain and generalise data. This course introduces some fundamental machine learning concepts, learning problems and algorithms to provide understanding and simple answers to many questions arising from data explanation and generalisation. For example, why do different machine learning models work? How to further improve them? How to adapt them to different purposes?

The fundamental concepts, learning problems and algorithms are carefully selected. Many of them are closely related to practical questions of the day, such as transfer learning, learning with label noise and multi-view learning.

COMP5329
Deep Learning

Credit points: 6 **Session:** Semester 1 **Classes:** Tutorials, Lectures **Assumed knowledge:** COMP5318 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course provides an introduction to deep machine learning, which is rapidly emerging as one of the most successful and widely applicable set of techniques across a range of applications. Students taking this course will be exposed to cutting-edge research in machine learning, starting from theories, models, and algorithms, to implementation and recent progress of deep learning. Specific topics include: classical architectures of deep neural network, optimization techniques for training deep neural networks, theoretical understanding of deep learning, and diverse applications of deep learning in computer vision.

COMP5338
Advanced Data Models

Credit points: 6 **Session:** Semester 2 **Classes:** Tutorials, Lectures **Assumed knowledge:** This unit of study assumes foundational knowledge of relational database systems as taught in COMP5138/COMP9120 (Database Management Systems) or INFO2120/INFO2820/ISYS2120 (Database Systems 1). **Assessment:** Through semester assessment (40%) and 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:** Lectures, Laboratory, Project Work **Assumed knowledge:** COMP9220 or COMP5028. The course assumes basic knowledge on OO design and proficiency in a programming language **Assessment:** Through semester assessment (40%) and Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Nowadays most client facing enterprise applications are running on web or at least with a web interface. The design and implementation of a web application require totally different set of skills to those are required for traditional desktop applications. All web applications are of client/ server architecture. Requests sent to a web application are expected to go through the public Internet, which slows the responsiveness and increases the possible security threat. A typical web application is also expected to handle large number of requests coming from every corner of the Internet and sent by all sorts of client systems. This further complicates the design of such system.

This course aims at providing both conceptual understanding and hand-on experiences for the technologies used in building web applications. We will examine how data/messages are communicated between client and server; how to improve the responsiveness using rich client technology; as well as how to build a secure web application.

At the end of this course, students are expected to have a clear understanding of the structure and technologies of web applications. Students are also expected to have practical knowledge of some major web application environments and to be able to develop and deploy simple web applications. Cloud based platform are increasingly popular as the development and deployment platform. This course will incorporate the cloud aspect of web application development as well.

COMP5348
Enterprise Scale Software Architecture

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratory **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%) and 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:** Lectures, Practical Labs, Project Work **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 COMP9103 Software Development in JAVA **Assessment:** Through semester assessment (45%) and Final Exam (55%) **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.

COMP5415
Multimedia Design and Authoring

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Assessment:** Through semester assessment (40%) and Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides principles and practicalities of creating interactive and effective multimedia products. It gives an overview of the complete spectrum of different media platforms and current authoring techniques used in multimedia production. Coverage includes the following key topics: enabling multimedia technologies; multimedia design issues; interactive 2D and 3D computer animation; multimedia object modelling and rendering; multimedia scripting programming; post-production and delivery of multimedia applications.

COMP5416
Advanced Network Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratory **Assumed knowledge:** ELEC3506 OR ELEC9506 OR ELEC5740 OR COMP5116 **Assessment:** Through semester assessment (40%) and 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:** Lectures, Tutorials **Assessment:** Through semester assessment (40%) and 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 utilising 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, visualisation, registration, modelling, retrieval and management. A broad range of practical integrated clinical applications will be also elaborated.

COMP5425
Multimedia Retrieval

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Assumed knowledge:** COMP9007 or COMP5211. Basic Programming skills and data structure knowledge. **Assessment:** Through semester assessment (40%) and Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The explosive growth of multimedia data, including text, audio, images and video has imposed unprecedented challenges for search engines to meet various information needs of users. This unit provides students with the necessary and updated knowledge of this field in the context of big data, from the information retrieval basics of a search engine, to many advanced techniques towards next generation search engines, such as content based image and video retrieval, large scale visual information retrieval, and social media.

COMP5426
Parallel and Distributed Computing

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Assessment:** Through semester assessment (45%) and Final Exam (55%) **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 optimising 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:** Lectures, Laboratory **Assessment:** Through semester assessment (60%) and 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

DATA5207
Data Analysis in the Social Sciences

Credit points: 6 **Session:** Semester 1 **Classes:** lectures, laboratories **Assumed knowledge:** COMP5310 **Assessment:** through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Data science is a new, rapidly expanding field. There is an unprecedented demand from technology companies, financial services, government and not-for-profits for graduates who can effectively analyse data. This subject will help students gain a critical understanding of the strengths and weaknesses of quantitative research, and acquire practical skills using different methods and tools to answer relevant social science questions.

This subject will offer a nuanced combination of real-world applications to data science methodology, bringing an awareness of how to solve actual social problems to the Master of Data Science. We cover topics including elections, criminology, economics and the media. You will clean, process, model and make meaningful visualisations using data from these fields, and test hypotheses to draw inferences about the social world.

Techniques covered range from descriptive statistics and linear and logistic regression, the analysis of data from randomised experiments, model selection for prediction and classification tasks, to the analysis of unstructured text as data, multilevel and geospatial modelling, all using the open source program R. In doing this, not only will we build on the skills you have already mastered through this degree, but explore different ways to use them once you graduate.

ELEC5306
Advanced Signal Processing: Video Compression

Credit points: 6 **Session:** Semester 1 **Classes:** lectures, laboratories **Assumed knowledge:** Basic understanding of digital signal processing (filtering, DFT) and programing skills (e.g. Matlab/Java/Python/C++) **Assessment:** Through semester assessment (40%), Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study introduces digital image and video compression algorithms and standards. This course mainly focuses on fundamental and advanced methods for digital video compression. It covers the following areas: digital video fundamentals, digital image and video compression standards, and video codec optimization.

ELEC5307
Advanced Signal Processing with Deep Learning

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, laboratories **Assumed knowledge:** Mathematics (e.g., probability and linear algebra) and programing skills (e.g. Matlab/Java/Python/C++) **Assessment:** Through semester assessment (40%), Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study introduces deep learning for a broad range of multi-dimensional signal processing applications. It covers deep learning technologies for image super-resolution and restoration, image categorization, object localization, image segmentation, face recognition, person detection and re-identification, human pose estimation, action recognition, object tracking as well as image and video captioning.

ELEC5508
Wireless Engineering

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories **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 (40%) and Final Exam (60%) **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. Wireless channel: Multipath fading, frequency selective fading, Doppler spread, statistical models, diversity, GSM, OFDM. Capacity and Interference: Cell types, coverage, frequency reuse, interference management, SIMO, MISO, multiuser diversity, CDMA, OFDMA, beamforming, superposition coding. MIMO: SVD, waterfilling, beamforming, V-BLAST, SIC, MMSE, Power Allocation. LTE/LTE-Advanced: Uplink-downlink channels, control signals, data transmission, spatial multiplexing, CoMP, spectrum reuse, heterogeneous networks, inter-cell interference coordination, carrier aggregation. Queueing theory: basic models, queueing systems, waiting time, delay, queue length, priority queues, wireless network virtualization (WNV) queues.

ELEC5509
Mobile Networks

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **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 (100%) **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:** Lectures, Laboratories **Prerequisites:** ELEC5509 **Assumed knowledge:** ELEC3305, ELEC3506, ELEC3607 and ELEC5508 **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aim to teach the fundamentals concepts associated with: Networked Embedded Systems, wireless sensor networks; Wireless channel propagation and radio power consumption; Wireless networks, ZigBee, Bluetooth, etc. ; Sensor principle, data fusion, source detection and identification; Multiple source detection, multiple access communications; Network topology, routing, network information theory; Distributed source channel coding for sensor networks; Power-aware and energy-aware communication protocols; Distributed embedded systems problems such as time synchronization and node localisation; 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.

Ability to identify the main issues and trade-offs in networked embedded systems; Understanding of the state-of-the-art solutions in the area; Based on the above understanding, ability to analyse requirements and devise first-order solutions for particular networked embedded systems problems; Familiarisation with a simulator platform and real hardware platforms for network embedded systems through the students involvement in projects.

ELEC5616
Computer and Network Security

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Laboratories, Project Work - own time **Assumed knowledge:** A programming language, basic maths. **Assessment:** Through semester assessment (50%) and 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:** Lectures, Tutorials **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 throughout the week and make sure that time is truly productive. **Assessment:** Through semester assessment (40%) and 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, Project Work - own time, Presentation, Tutorials **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:** Lectures, Tutorials, Laboratories, Project Work - in class, Project Work - own time **Assumed knowledge:** A programming language, basic maths. **Assessment:** Through semester assessment (80%) and Final Exam (20%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

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.

INFO5010
IT Advanced Topic A

Credit points: 6 **Session:** Semester 1, Semester 2 **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 **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.

INFO5991
Services Science Management and Engineering

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lectures, Seminars **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

The service economy plays a dominant and growing role in economic growth and employment in most parts of the world. Increasingly, the improved productivity and competitive performance of firms and nations in services relies on innovative and effective design, engineering, and management of IT-centric services.

This unit offers IT graduates and professionals an understanding of the role of IT-centric services in a social, economic and business context, as well as knowledge of the principles of their design, engineering and management in a service-oriented IT framework. Delivery of the unit is driven by a critical approach to the literature, live case studies presented by industry professionals and writing a Consultants' Report. Its learning outcomes are based on industry needs. Three modules address the range of topics in Services Science, Management and Engineering (SSME).

1. Service fundamentals context and strategy: the service economy and the nature of service systems; the role IT-centric services in a social, economic and business context; IT-centric services optimisation and innovation.

2. Designing and Engineering IT-centric services: service design; service oriented enterprise and IT architecture.

3. Sourcing, governing, and managing IT-centric services: outsourcing IT-centric services (including services in the cloud); IT-centric services governance and management (COBIT and ITIL; service level agreements.

Critical analysis of articles and the persuasive use of evidence in writing are cornerstones of the unit. Students learn how to apply these skills in business consulting processes to a business case drawn from a recent consulting project at a large multinational organisation. The processes include:clarifying the client's situation and problems, researching evidence related to it, analysing the evidence, developing options for solving the problems, presenting recommendations persuasively to the client both orally and in a written Consultants' Report. These steps are scaffolded for the student, with formative assessment, and increasing levels of difficulty.

Students need to be able to read, critically analyse, and report on an article or case study every three weeks. If you are not confident of your skills in these areas, you can enroll in the free courses provided by the University's Learning Centre in Academic Reading and Writing and Oral Communication Skills. Some of these courses are specifically designed for students with a non-English speaking background. Familiarity with using Library reference tools and the ability to locate scholarly resources in the Library's electronic databases is also necessary. See the Library's Research and information skills page for help with this http://www.library.usyd.edu.au/skills/

INFO5992
Understanding IT Innovations

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lectures, Tutorials **Prohibitions:** PMGT5875 **Assumed knowledge:** INFO5990 **Assessment:** Through semester assessment (40%) and Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

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:** Lectures, Tutorials (applied workshop), E-Learning **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%) and 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.

INFO5993
IT Research Methods

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Seminars **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. Students will learn research ethics. 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.

ISYS5050
Knowledge Management Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Assumed knowledge:** An undergraduate degree in Computer Science or Information Systems. Good grasp of database technologies and the role of information systems in organisations. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The need to track and facilitate the sharing of the core knowledge resources in contemporary organisations is widely recognised. This course will provide a comprehensive introduction to the area of Knowledge Management (KM) from both technological and organisational perspectives. We will review and discuss a range of published papers, case studies, and other publications that deal with a range of important KM-related topics. One of the key knowledge management technologies, Business Intelligence Systems, will be covered in detail. It will also include hands-on work using the BI (Online Analytical Processing- OLAP) tool, COGNOS.

Some of the main themes to be covered will include: KM- Conceptual Foundations; Taxonomies of organizational knowledge and KM mechanisms; Case/Field Studies of KM Initiatives; Data Warehousing and OLAP/Business Analytics; Data, text, and web mining; Social media,crowdsourcing, and KM; Big data and actionable knowledge.

For a standard enrolment plan for Bachelor of Information Technology visit CUSP https://cusp.sydney.edu.au.

Majors in the Bachelor of Advanced Computing

Compulsory Major

All students in the Bachelor of Advanced Computing undertake one of the following four majors.

Computer Science

A major in computer science covers the key concepts of computation. You will learn the principles and techniques needed to solve tasks efficiently with computation, and how to express those solutions in software. You will also discover how computation can be modelled and how to reason about the limits of what computation can achieve. A major in computer science will provide you with the knowledge and skills needed to innovate in information technology, and create fundamentally new IT solutions to future challenges.

Computational Data Science

The Computational Data Science major will develop your mathematical, analytical and technical skills to create solutions to guide data-driven decision making. Data scientists build intelligent systems to manage, interpret, understand and derive key knowledge from big data sets.

Leveraging the University of Sydney's research strengths, you will explore the latest in computational statistics, large-scale data processing, data mining, machine learning and data visualisation, while also developing the skills to effectively communicate data insights to key stakeholders.

Information Systems

Information Systems is the study of people and organisations in order to determine and deliver solutions that meet their technological needs. Hence Information Systems deals with the following type of issues: strategic planning, system development, system implementation, operational management, end-user needs and education. Information Systems study is related to Computer Science but the crucial distinction is that Information Systems is about making computer systems work to optimise the productivity and efficiency of organisations, whereas much of Computer Science is about developing software technologies to solve problems, which can improve quality of life and enhance delivery of service. The school's research in Information Systems encompasses natural language processing, IT economics, social networking analysis, ontology design, data mining and analysis, and knowledge management and open source software.

Software Development

A major in software development provides the understanding and skill that allow a team to reliably produce high-quality working software that meets client needs. From a foundation of individual programming skill, you will learn the theory and practices involved in determining requirements, designing software solutions, and delivering the outcomes.

Optional Major

Students in the Bachelor of Advanced Computing may also undertake a second major or a minor. This may be either a second major from those listed above, or any major or minor from Table S.

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Computational Data Science			
Computational Data Science major			
Achievement of a major in Computational Data Science requires 48 credit points from this table including: 12 credit points of 1000-level core units; 18 credit points of 2000-level core units; 6 credit points of 3000-level core units; 12 credit points of 3000-level selective units.			
Computational Data Science minor			
Achievement of a minor in Computational Data Science requires 36 credit points from this table including: 12 credit points of 1000-level core units; 18 credit points of 2000-level core units; 6 credit points of 3000-level selective units.			
Units of Study			
The relevant units of study are listed below			
1000-level units of study			
Core units			
DATA1001 **Foundations of Data Science**	6	**N** MATH1005 or MATH1905 or MATH1015 or MATH1115 or ENVX1001 or ENVX1002 or ECMT1010 or BUSS1020 or STAT1021	Semester 1 Semester 2
INFO1110 **Introduction to Programming**	6		Intensive July Semester 1 Semester 2
2000-level units of study			
Core units			
COMP2123 **Data Structures and Algorithms**	6	**P** INFO1110 OR INFO1113 OR DATA1002 OR INFO1103 OR INFO1903 **N** INFO1105 OR INFO1905 OR COMP2823	Semester 1
COMP2823 **Data Structures and Algorithms (Adv)**	6	**A** Distinction-level result in at least one the listed 1000 level programming units **P** Distinction level result in at least one of INFO1110 OR INFO1113 OR DATA1002 OR INFO1103 OR INFO1903 **N** INFO1105 OR INFO1905 OR COMP2123 *Note: Department permission required for enrolment*	Semester 1
DATA2001 **Data Science: Big Data and Data Diversity**	6	**P** DATA1002 OR INFO1110 OR INFO1903 OR INFO1103	Semester 1
DATA2002 **Data Analytics: Learning from Data**	6	**A** (Basic Linear Algebra and some coding) or QBUS1040 **P** [DATA1001 or ENVX1001 or ENVX1002] or [MATH10X5 and MATH1115] or [MATH10X5 and STAT2011] or [MATH1905 and MATH1XXX (except MATH1XX5)] or [BUSS1020 or ECMT1010 or STAT1021] **N** STAT2012 or STAT2912	Semester 2
3000-level units of study			
Core units			
DATA3001 Data Science Capstone Project will be available from 2019.			
Selective units			
COMP3027 **Algorithm Design**	6	**A** MATH1004 OR MATH1904 OR MATH1064 **P** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **N** COMP2007 OR COMP2907 OR COMP3927	Semester 1
COMP3927 **Algorithm Design (Adv)**	6	**A** MATH1004 OR MATH1904 OR MATH1064 **P** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **N** COMP2007 OR COMP2907 OR COMP3027 *Note: Department permission required for enrolment*	Semester 1
COMP3308 **Introduction to Artificial Intelligence**	6	**A** Algorithms. Programming skills (e.g. Java, Python, C, C++, Matlab) **N** COMP3608	Semester 1

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
COMP3608 **Introduction to Artificial Intelligence (Adv)**	6	**A** Algorithms. Programming skills (e.g. Java, Python, C, C++, Matlab) **P** Distinction-level results in some 2nd year COMP or MATH or SOFT units. **N** COMP3308 *COMP3308 and COMP3608 share the same lectures, but have different tutorials and assessment (the same type but more challenging).*	Semester 1
DATA3404 **Data Science Platforms**	6	**A** This unit of study assumes that students have previous knowledge of database structures and of SQL. The prerequisite material is covered in DATA2001 or ISYS2120. Familiarity with a programming language (e.g. Java or C) is also expected. **P** DATA2001 OR ISYS2120 OR INFO2120 OR INFO2820 **N** INFO3504 OR INFO3404	Semester 1
DATA 3406 Human-in-the-Loop Data Analytics will be available from 2019.			

For a standard enrolment plan for the Bachelor of Advanced Computing with a major in Computational Data Science visit CUSP https://cusp.sydney.edu.au.

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Computer Science			
Computer Science major			
Achievement of a major in Computer Science requires 48 credit points from this table including: (i) 12 credit points of 1000-level core units; (ii) 18 credit points of 2000-level core units; (iii) 12 credit points of 3000-level core units; (iv) 6 credit points of 3000-level (major only) selective units.			
Computer Science minor			
Achievement of a minor in Computer Science requires 36 credit points from this table including: (i) 12 credit points of 1000-level core units; (ii) 18 credit points of 2000-level core units; (iii) 6 credit points of 3000-level (minor only) selective units			
Units of study			
The relevant units of study are listed below.			
1000-level units of study			
Core			
INFO1110 **Introduction to Programming**	6		Intensive July Semester 1 Semester 2
INFO1113 **Object-Oriented Programming**	6	**P** INFO1110 **N** INFO1103 OR INFO1105 OR INFO1905	Semester 1 Semester 2
2000-level units of study			
Core			
COMP2017 **Systems Programming**	6	**P** INFO1113 OR INFO1105 OR INFO1905 OR INFO1103 **C** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **N** COMP2129	Semester 1
COMP2022 **Programming Languages, Logic and Models**	6	**A** MATH1004 OR MATH1904 OR MATH1064 OR MATH2069 OR MATH2969 **P** INFO1103 OR INFO1903 OR INFO1113 **N** COMP2922	Semester 2
COMP2922 **Programming Languages, Logic and Models (Adv)**	6	**A** MATH1004 OR MATH1904 OR MATH1064 OR MATH2069 OR MATH2969 **P** Distinction level result in INFO1103 OR INFO1903 OR INFO1113 **N** COMP2022 *Note: Department permission required for enrolment*	Semester 2
COMP2123 **Data Structures and Algorithms**	6	**P** INFO1110 OR INFO1113 OR DATA1002 OR INFO1103 OR INFO1903 **N** INFO1105 OR INFO1905 OR COMP2823	Semester 1
COMP2823 **Data Structures and Algorithms (Adv)**	6	**A** Distinction-level result in at least one the listed 1000 level programming units **P** Distinction level result in at least one of INFO1110 OR INFO1113 OR DATA1002 OR INFO1103 OR INFO1903 **N** INFO1105 OR INFO1905 OR COMP2123 *Note: Department permission required for enrolment*	Semester 1
3000-level units of study			
Core			
COMP3027 **Algorithm Design**	6	**A** MATH1004 OR MATH1904 OR MATH1064 **P** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **N** COMP2007 OR COMP2907 OR COMP3927	Semester 1
COMP3927 **Algorithm Design (Adv)**	6	**A** MATH1004 OR MATH1904 OR MATH1064 **P** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **N** COMP2007 OR COMP2907 OR COMP3027 *Note: Department permission required for enrolment*	Semester 1
COMP3615 **Computer Science Project**	6	**P** (COMP2123 OR COMP2823) AND COMP2017 AND (COMP2022 OR COMP2922) **N** INFO3600 OR COMP3600	Semester 2
COMP3600 **Computer Science Project (Adv)**	6	**P** (COMP2123 OR COMP2823) AND COMP2017 AND (COMP2022 OR COMP2922) with Distinction level results in at least one of the above listed units **N** INFO3600 OR COMP3615 *Note: Department permission required for enrolment*	Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Selective units (major only)			
COMP3221 **Distributed Systems**	6	**P** (INFO1105 OR INFO1905) OR ((INFO1103 OR INFO1113) AND (COMP2123 OR COMP2823)) **N** COMP2121	Semester 1
COMP3308 **Introduction to Artificial Intelligence**	6	**A** Algorithms. Programming skills (e.g. Java, Python, C, C++, Matlab) **N** COMP3608	Semester 1
COMP3608 **Introduction to Artificial Intelligence (Adv)**	6	**A** Algorithms. Programming skills (e.g. Java, Python, C, C++, Matlab) **P** Distinction-level results in some 2nd year COMP or MATH or SOFT units. **N** COMP3308 *COMP3308 and COMP3608 share the same lectures, but have different tutorials and assessment (the same type but more challenging).*	Semester 1
COMP3419 **Graphics and Multimedia**	6	**A** Programming skills **P** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905	Semester 2
COMP3520 **Operating Systems Internals**	6	**P** (COMP2017 OR COMP2129) AND (COMP2123 OR COMP2823 OR INFO1105 OR INFO1905)	Semester 2
Selective units (minor only)			
COMP3027 **Algorithm Design**	6	**A** MATH1004 OR MATH1904 OR MATH1064 **P** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **N** COMP2007 OR COMP2907 OR COMP3927	Semester 1
COMP3927 **Algorithm Design (Adv)**	6	**A** MATH1004 OR MATH1904 OR MATH1064 **P** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **N** COMP2007 OR COMP2907 OR COMP3027 *Note: Department permission required for enrolment*	Semester 1
COMP3221 **Distributed Systems**	6	**P** (INFO1105 OR INFO1905) OR ((INFO1103 OR INFO1113) AND (COMP2123 OR COMP2823)) **N** COMP2121	Semester 1
COMP3308 **Introduction to Artificial Intelligence**	6	**A** Algorithms. Programming skills (e.g. Java, Python, C, C++, Matlab) **N** COMP3608	Semester 1
COMP3608 **Introduction to Artificial Intelligence (Adv)**	6	**A** Algorithms. Programming skills (e.g. Java, Python, C, C++, Matlab) **P** Distinction-level results in some 2nd year COMP or MATH or SOFT units. **N** COMP3308 *COMP3308 and COMP3608 share the same lectures, but have different tutorials and assessment (the same type but more challenging).*	Semester 1
COMP3419 **Graphics and Multimedia**	6	**A** Programming skills **P** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905	Semester 2
COMP3520 **Operating Systems Internals**	6	**P** (COMP2017 OR COMP2129) AND (COMP2123 OR COMP2823 OR INFO1105 OR INFO1905)	Semester 2

For a standard enrolment plan for the Bachelor of Advanced Computing with a major in Computer Science visit CUSP https://cusp.sydney.edu.au.

Unit of Study Table

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
Information Systems			
Information Systems major			
A major in Information Systems requires 48 credit points from this table including: (i) 12 credit points of 1000-level core units; (ii) 18 credit points of 2000-level core units; (iii) 18 credit points of 3000-level core (major only) units.			
Information Systems minor			
A minor in Information Systems requires 36 credit points from this table including: (i) 12 credit points of 1000-level core units; (ii) 18 credit points of 2000-level core units; (iii) 6 credit points of 3000-level selective (minor only) units.			
Units of study			
The relevant units of study are listed below.			
1000-level units of study			
Core			
INFO1110 **Introduction to Programming**	6		Intensive July Semester 1 Semester 2
INFO1113 **Object-Oriented Programming**	6	**P** INFO1110 **N** INFO1103 OR INFO1105 OR INFO1905	Semester 1 Semester 2
2000-level units of study			
Core			
ISYS2110 **Analysis and Design of Web Info Systems**	6	**P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 **N** INFO2110	Semester 1
ISYS2120 **Data and Information Management**	6	**A** Programming skills **P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 OR INFO1003 OR INFO1903 OR DECO1012 **N** INFO2120 OR INFO2820 OR COMP5138	Semester 2
ISYS2160 **Information Systems in the Internet Age**	6	**A** INFO1003 OR INFO1103 OR INFO1903 OR INFO1113 **N** ISYS2140	Semester 2
3000-level units of study			
Core units (major only)			
ISYS3401 **Information Technology Evaluation**	6	**A** INFO2110 and ISYS2140 **P** (INFO2110 OR ISYS2110) AND (INFO2120 OR ISYS2120) AND (ISYS2140 OR ISYS2160)	Semester 1
ISYS3402 **Decision Analytics and Support Systems**	6	**A** Database Management AND Systems Analysis and Modelling **P** (ISYS2110 OR INFO2110) AND (ISYS2120 OR INFO2120)	Semester 2
ISYS3400 **Information Systems Project**	6	**P** (INFO2110 OR ISYS2110) AND (INFO2120 OR ISYS2120) AND (ISYS2140 OR ISYS2160) **N** INFO3600 or ISYS3207	Semester 2
Selective units (minor only)			
ISYS3401 **Information Technology Evaluation**	6	**A** INFO2110 and ISYS2140 **P** (INFO2110 OR ISYS2110) AND (INFO2120 OR ISYS2120) AND (ISYS2140 OR ISYS2160)	Semester 1
ISYS3402 **Decision Analytics and Support Systems**	6	**A** Database Management AND Systems Analysis and Modelling **P** (ISYS2110 OR INFO2110) AND (ISYS2120 OR INFO2120)	Semester 2

For a standard enrolment plan for the Bachelor of Advanced Computing with a major in Information Systems visit CUSP https://cusp.sydney.edu.au.

Unit of Study Table

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Software Development			
Software Development major			
Achievement of a major in Software Development requires 48 credit points from this table including: (i) 12 credit points of 1000-level core units; (ii) 18 credit points of 2000-level core units; (iii) 18 credit points of 3000-level core (major only) units.			
Software Development minor			
A minor in Software Development requires 36 credit points from this table including: (i) 12 credit points of 1000-level core units; (ii) 18 credit points of 2000-level core units; (iii) 6 credit points of 3000-level selective (minor only) units.			
Units of study			
The relevant units of study are listed below.			
1000-level units of study			
Core			
INFO1110 **Introduction to Programming**	6		Intensive July Semester 1 Semester 2
INFO1113 **Object-Oriented Programming**	6	**P** INFO1110 **N** INFO1103 OR INFO1105 OR INFO1905	Semester 1 Semester 2
2000-level units of study			
Core			
COMP2123 **Data Structures and Algorithms**	6	**P** INFO1110 OR INFO1113 OR DATA1002 OR INFO1103 OR INFO1903 **N** INFO1105 OR INFO1905 OR COMP2823	Semester 1
COMP2823 **Data Structures and Algorithms (Adv)**	6	**A** Distinction-level result in at least one the listed 1000 level programming units **P** Distinction level result in at least one of INFO1110 OR INFO1113 OR DATA1002 OR INFO1103 OR INFO1903 **N** INFO1105 OR INFO1905 OR COMP2123 *Note: Department permission required for enrolment*	Semester 1
SOFT2201 **Software Construction and Design 1**	6	**P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 **N** INFO3220	Semester 2
SOFT2412 **Agile Software Development Practices**	6	**P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905	Semester 2
3000-level units of study			
Core units (major only)			
SOFT3202 **Software Construction and Design 2**	6	**P** SOFT2201 **N** INFO3220	Semester 1
SOFT3410 **Concurrency for Software Development**	6	**P** (INFO1105 OR INFO1905) OR ((INFO1103 OR INFO1113) AND (COMP2123 OR COMP2823))	Semester 2
SOFT3413 **Software Development Project**	6	**A** SOFT3202 **P** 18CP 2000-level or above units from SOFT, COMP or INFO *Note: Department permission required for enrolment*	Semester 2
Selective units (minor only)			
SOFT3202 **Software Construction and Design 2**	6	**P** SOFT2201 **N** INFO3220	Semester 1
SOFT3410 **Concurrency for Software Development**	6	**P** (INFO1105 OR INFO1905) OR ((INFO1103 OR INFO1113) AND (COMP2123 OR COMP2823))	Semester 2

For a standard enrolment plan for the Bachelor of Advanced Computing with a major in Software Development visit CUSP https://cusp.sydney.edu.au.

Pre-2018 Enrolments

Bachelor of Information Technology, the Bachelor of Computer Science and Technology, and the Bachelor of Computer Science and Technology (Advanced)

From 2018 the Bachelor of Information Technology, the Bachelor of Computer Science and Technology, and the Bachelor of Computer Science and Technology (Advanced) are no longer available for commencing students.

Students already enrolled in these degrees should refer to the handbook archive for the rules of their degree. Refer to the School of IT for transitional enrolment plans.

Bachelor of Project Management

Course Overview

The Bachelor of Project Management uses multidisciplinary theories and methods to investigate a particular project management 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, stakeholder management, project finance, complex project coordination, analytics, statistics, risk management and organisational behaviour. 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 focuses on the application of learning to the Computer and IT industry.

The Bachelor of Project Management is offered as a combined degree with:

- Bachelor of Engineering (Honours)

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 CUSP (https://cusp.sydney.edu.au).

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			
MATH1021 **Calculus Of One Variable**	3	**A** HSC Mathematics Extension 1. Students who have not completed HSC Extension 1 Mathematics (or equivalent) are strongly advised to take the Extension 1 Mathematics Bridging Course (offered in February). **N** MATH1011 or MATH1901 or MATH1906 or MATH1111 or ENVX1001 or MATH1001 or MATH1921 or MATH1931	Semester 1
MATH1002 **Linear Algebra**	3	**A** HSC Mathematics or MATH1111. Students who have not completed HSC Mathematics (or equivalent) are strongly advised to take the Mathematics Bridging Course (offered in February). **N** MATH1012 or MATH1014 or MATH1902	Semester 1 Summer Main
MATH1023 **Multivariable Calculus and Modelling**	3	**A** HSC Mathematics Extension 1. Students who have not completed HSC Extension 1 Mathematics (or equivalent) are strongly advised to take the Extension 1 Mathematics Bridging Course (offered in February). **N** MATH1013 or MATH1903 or MATH1907 or MATH1003 or MATH1923 or MATH1933	Semester 2
MATH1005 **Statistical Thinking with Data**	3	**A** HSC Mathematics. Students who have not completed HSC Mathematics (or equivalent) are strongly advised to take the Mathematics Bridging Course (offered in February). **N** MATH1015 or MATH1905 or STAT1021 or STAT1022 or ECMT1010 or ENVX1001 or ENVX1002 or BUSS1020	Semester 2 Summer Main Winter Main
ENGG1850 **Introduction to Project Management**	6	**N** CIVL3805 or QBUS2350	Semester 1
ENGG1801 **Engineering Computing**	6		Semester 1 Summer Main
BUSS1040 **Economics for Business Decision Making**	6	**N** ECON1001 OR ECON1040	Semester 1 Semester 2
PMGT1852 **Communications and Stakeholder Management**	6	**A** ENGG1850	Semester 2
First year: Civil Engineering Science stream			
CIVL1802 **Statics**	6	**N** ENGG1802	Semester 2
CIVL1900 **Introduction to Civil Engineering**	6	**N** ENGG1800 OR CHNG1108 OR MECH1560 OR AERO1560 OR AMME1960 OR MTRX1701 OR ENGG1960	Semester 1
First Year: Built Environment stream			
DAAE1001 **Living Cities**	6	**A** DECO1006 and DECO1012 and BDES1011 and AWSS1001	Semester 2
DAAE2001 **Australian Architecture**	6	**N** DESA2305	Semester 2
First Year: Software stream			
INFO1110 **Introduction to Programming**	6		Intensive July Semester 1 Semester 2
INFO1113 **Object-Oriented Programming**	6	**P** INFO1110 **N** INFO1103 OR INFO1105 OR INFO1905	Semester 1 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 (MATH1011 OR MATH1001 OR MATH1021 OR MATH1901 OR MATH1921) AND (MATH1002 OR MATH1902) AND (MATH1013 OR MATH1003 OR MATH1023 OR MATH1903 OR MATH1923) AND (MATH1015 OR MATH1005 OR MATH1905)	Intensive January Semester 1
ENGG2852 **Project Based Organisational Behaviour**	6	**P** ENGG1850 AND (PSYC1002 OR PMGT1852)	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 (CIVL1802 or ENGG1802), 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 in certain 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 OR CIVL1802 **N** AMME2301	Semester 1
CIVL1810 **Engineering Construction and Surveying**	6	**A** CIVL1900. Some statistical awareness is an advantage and co-enrolment in MATH1005 Statistics is advised. HSC Mathematics Extension 1 or completion of (MATH1001 or MATH1021) and MATH1002 are sufficient for non-statistical maths preparation **N** CIVL2810 *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 2
Second Year: Built Environment stream			
BADP2002 **City Form and Development**	6	**P** DAAE1001 or (DAAE2002 and ENGG1850)	Semester 1
DESA3011 **Introduction to Building Construction**	6	*Note: Department permission required for enrolment*	Semester 2
Second Year: Software stream			
ISYS2110 **Analysis and Design of Web Info Systems**	6	**P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 **N** INFO2110	Semester 1
ISYS2120 **Data and Information Management**	6	**A** Programming skills **P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 OR INFO1003 OR INFO1903 OR DECO1012 **N** INFO2120 OR INFO2820 OR COMP5138	Semester 2
Third year: All streams			
ENGG3853 **Project Risk Management Tools and Techniques**	6	**P** ENGG2851. **N** CIVL4810	Semester 1
ENGG3854 **Negotiating and Contracting**	6	**P** ENGG1850 AND ENGG2850 AND ENGG2852. **N** CIVL3813 or CIVL4813	Semester 2 Summer Main
PMGT3850 **Project Management Capstone Project A**	6	**P** 30 credits of 2nd or 3rd 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 and 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, and PMGT3850	Semester 2
PMGT3855 **Project Variance Analysis**	6	**P** ENGG2851	Semester 2
PMGT3858 **Complex Project Coordination**	6	**P** ENGG1850 AND ENGG2852.	Semester 1
Students undertaking a combined BE(Hons)/BPM which includes an Honours Thesis are not required to complete PMGT3850 or PMGT3851 Project Management Capstone units.			
Third Year: Civil Engineering Science stream			
CIVL2700 **Transport Systems**	6	**A** (MATH1001 OR MATH1021) AND (MATH1003 OR MATH1023) AND MATH1005 AND ENGG1801. Basic statistics through regression analysis, differential and integral calculus, computer programming.	Semester 1
Select one of the following units:			
CIVL2410 **Soil Mechanics**	6	**A** CIVL2201 AND GEOL1501 AND (CIVL1802 or ENGG1802). 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 CIVL1802 Statics (or ENGG1802 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. Familiarity with partial differential equations, and their analytical and numerical solution.	Semester 2
CIVL2611 **Introductory Fluid Mechanics**	6	**A** CIVL2201 AND (CIVL1802 or ENGG1802) AND (MATH1001 OR MATH1021). 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
CIVL3811 **Engineering Design and Construction**	6	**A** CIVL1810 OR CIVL2810 **N** CIVL4811	Semester 2
Third Year: Built Environment stream			
DAAE3001 **Sustainable Architectural Practice**	6	**P** BDES1023 or (DAAE1001 and DESA3011) or (DAAE2002 and DESP1001) *Note: Department permission required for enrolment*	Semester 1
BADP3002 **Property and the Built Environment**	6	**P** BAEN3001 or (DAAE1001 and DESA3011) or (DAAE2002 and DESP1001) **C** BAEN3002 or ENGG3854	Semester 2

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
Third Year: Software stream			
ELEC3609 **Internet Software Platforms**	6	**P** (INFO1103 OR INFO1110) AND (INFO2110 OR ISYS2110) AND (INFO2120 OR INFO2820 OR ISYS2120) **N** EBUS4001	Semester 2
ELEC3610 **E-Business Analysis and Design**	6	**N** EBUS3003	Semester 1

Notes

1. 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 which offers the unit.

2. 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.

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 School before enrolling.

Recommended Electives

In addition to the core units in the above table candidates for the single degree must complete electives to gain a total of 144 credit points as required for the degree. The following are recommended elective units of study.

Project Management Electives

Candidates enrolled in a combined degree must complete a minimum of 18 credit points of Project Management Electives

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
PMGT2800 **Project Placement A**	6	**A** ENGG1850 AND MATH1005 AND BUSS1040 AND PMGT1852. This unit of study is only available to students who have a credit average or above and who have obtained approval from the program director. *Note: Department permission required for enrolment*	Semester 1
PMGT2801 **Project Placement B**	6	**A** ENGG1850 AND MATH1005 AND BUSS1040 AND PMGT1852 *Note: Department permission required for enrolment*	Semester 1
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

Other Recommended Electives

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
CIVL2110 **Materials**	6	**A** ENGG1802 or CIVL1802 **N** AMME1362	Semester 1
CIVL2611 **Introductory Fluid Mechanics**	6	**A** CIVL2201 AND (CIVL1802 or ENGG1802) AND (MATH1001 OR MATH1021). 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
COMP2017 **Systems Programming**	6	**P** INFO1113 OR INFO1105 OR INFO1905 OR INFO1103 **C** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **N** COMP2129	Semester 1
COMP2022 **Programming Languages, Logic and Models**	6	**A** MATH1004 OR MATH1904 OR MATH1064 OR MATH2069 OR MATH2969 **P** INFO1103 OR INFO1903 OR INFO1113 **N** COMP2922	Semester 2
COMP2123 **Data Structures and Algorithms**	6	**P** INFO1110 OR INFO1113 OR DATA1002 OR INFO1103 OR INFO1903 **N** INFO1105 OR INFO1905 OR COMP2823	Semester 1
DAAE2002 **Architecture, Place and Society** *This unit of study is not available in 2018*	6	**N** DESA2211	Semester 1
DAAE2008 **Innovative Building Structures**	6	**P** BDES1023 **N** DESA2206	Semester 2
DAAE2011 **Intro to Visual Communication Design**	6	**N** DAAE2009 or DECO1015 or DECO2101	Semester 1 Summer Main Winter Main
DATA1001 **Foundations of Data Science**	6	**N** MATH1005 or MATH1905 or MATH1015 or MATH1115 or ENVX1001 or ENVX1002 or ECMT1010 or BUSS1020 or STAT1021	Semester 1 Semester 2
DATA1002 **Informatics: Data and Computation**	6	**N** INFO1903	Semester 2
DATA2001 **Data Science: Big Data and Data Diversity**	6	**P** DATA1002 OR INFO1110 OR INFO1903 OR INFO1103	Semester 1
DATA2002 **Data Analytics: Learning from Data**	6	**A** (Basic Linear Algebra and some coding) or QBUS1040 **P** [DATA1001 or ENVX1001 or ENVX1002] or [MATH10X5 and MATH1115] or [MATH10X5 and STAT2011] or [MATH1905 and MATH1XXX (except MATH1XX5)] or [BUSS1020 or ECMT1010 or STAT1021] **N** STAT2012 or STAT2912	Semester 2
DECO2103 **Architectural Modelling and Prototyping**	6	**A** Basic understanding of design principles and design processes and how to apply them in practical design projects **P** DESA1555 and completion of at least 36 credit points *Note: Department permission required for enrolment*	Semester 1
ISYS2110 **Analysis and Design of Web Info Systems**	6	**P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 **N** INFO2110	Semester 1

Unit of study	Credit points	A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition	Session
ISYS2120 **Data and Information Management**	6	**A** Programming skills **P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 OR INFO1003 OR INFO1903 OR DECO1012 **N** INFO2120 OR INFO2820 OR COMP5138	Semester 2
ISYS2160 **Information Systems in the Internet Age**	6	**A** INFO1003 OR INFO1103 OR INFO1903 OR INFO1113 **N** ISYS2140	Semester 2
MATH2021 **Vector Calculus and Differential Equations**	6	**P** (MATH1X21 or MATH1931 or MATH1X01 or MATH1906) and (MATH1XX2) and (MATH1X23 or MATH1933 or MATH1X03 or MATH1907) **N** MATH2921 or MATH2065 or MATH2965 or MATH2061 or MATH2961 or MATH2067	Semester 1
MATH2061 **Linear Mathematics and Vector Calculus**	6	**P** (MATH1X21 or MATH1011 or MATH1931 or MATH1X01 or MATH1906) and (MATH1014 or MATH1X02) and (MATH1X23 or MATH1933 or MATH1X03 or MATH1907) **N** MATH2001 or MATH2901 or MATH2002 or MATH2902 or MATH2961 or MATH2067 or MATH2021 or MATH2921 or MATH2022 or MATH2922 *This unit of study is only available to Faculty of Engineering and Information Technologies students.*	Semester 1 Summer Main
MATH2068 **Number Theory and Cryptography**	6	**A** MATH1014 or MATH1002 or MATH1902 **P** 6 credit points of Junior Mathematics units **N** MATH2988 or MATH3009 or MATH3024	Semester 2
MATH2069 **Discrete Mathematics and Graph Theory**	6	**P** 6 credit points of Junior Mathematics units **N** MATH2011 or MATH2009 or MATH2969	Semester 1
MATH2070 **Optimisation and Financial Mathematics**	6	**A** MATH1X23 or MATH1933 or MATH1X03 or MATH1907 **P** (MATH1X21 or MATH1011 or MATH1931 or MATH1X01 or MATH1906) and (MATH1014 or MATH1X02) **N** MATH2010 or MATH2033 or MATH2933 or MATH2970 or ECMT3510 *Students may enrol in both MATH2070 and MATH3075 in the same semester*	Semester 2
PSYC1002 **Psychology 1002**	6	*This unit is also offered in the Sydney Summer School. For more information consult the web site: http://sydney.edu.au/summer/*	Semester 2 Summer Main
QBUS3330 **Methods of Decision Analysis**	6	**P** BUSS1020 or DATA1001 or ECMT1010 or ENVX1001 or ENVX1002 or STAT1021 or ((MATH1005 or MATH1015) and MATH1115) or 6 credit points of MATH units which must include MATH1905. **N** QBUS2320; ECMT2630; ENGG1850; CIVL3805	Semester 2
QBUS2810 **Statistical Modelling for Business**	6	**A** This unit relies on mathematical knowledge at the level of the Maths in Business program, including calculus and matrix algebra. Students who do not meet this requirement are strongly encouraged to acquire the needed mathematical skills prior to enrolling in this unit. **P** 2018 Commencing students: QBUS1040; 2018 continuing students: BUSS1020 or DATA1001 or ECMT1010 or ENVX1001 or ENVX1002 or STAT1021 or ((MATH1005 or MATH1015) and MATH1115) or 6 credit points of MATH units which must include MATH1905. **N** ECMT2110	Semester 1 Semester 2
QBUS2820 **Predictive Analytics**	6	**A** This unit assumes mathematical knowledge at the level of the Maths in Business program (including calculus and matrix algebra) and basic computer programming skills at the level of QBUS2810. **P** QBUS2810 or ECMT2110 or DATA2002	Semester 2
SOFT2201 **Software Construction and Design 1**	6	**P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 **N** INFO3220	Semester 2
SOFT2412 **Agile Software Development Practices**	6	**P** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905	Semester 2
WORK1004 **Foundations of Management**	6	**N** WORK2201	Semester 2
WORK2210 **Strategic Management**	6	**P** 40 credit points worth of units of study	Semester 1
WORK2218 **Managing Organisational Behaviour**	6	**P** 24 Junior credit points	Semester 2
WORK3205 **Organisational Communication**	6	**N** WORK2221	Intensive July Semester 2
WORK3202 **Leadership**	6	**N** WORK2222	Semester 1
Alternative elective units may be taken with approval of the Head of School.			
Project Management Honours A candidate for Honours in Project Management must 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 2000-level and 3000-level or higher 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 Director)*	Semester 1 Semester 2
PMGT4851 **Project Management Honours Project B**	12	**P** Students are required to achieve a minimum 65% average mark in the 2000-level and 3000-level or higher 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
Candidates for Honours in Project Management must select 24 credit points from the following list of electives.			
PMGT5875 **Project Innovation Management**	6		Semester 1
PMGT5876 **Strategic Delivery of Change**	6	**N** WORK6026	Semester 1 Semester 2

Unit of study	*Credit points*	*A: Assumed knowledge P: Prerequisites C: Corequisites N: Prohibition*	*Session*
PMGT5879 **Strategic Portfolio and Program Management**	6		Semester 1 Semester 2
PMGT5886 **System Dynamics Modelling for PM**	6	*Note: Department permission required for enrolment*	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 2000-level and 3000-level or higher units of the above program to be eligible for entry to Honours.

2. Students undertaking the Honours program may enrol in alternative postgraduate Project Management units with permission of the Program Director.

For a standard enrolment plans for the various Project Management streams visit CUSP (https://cusp.sydney.edu.au).

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

MATH1021
Calculus Of One Variable

Credit points: 3 **Session:** Semester 1 **Classes:** 2x1-hr lectures; 1x1-hr tutorial per week **Prohibitions:** MATH1011 or MATH1901 or MATH1906 or MATH1111 or ENVX1001 or MATH1001 or MATH1921 or MATH1931 **Assumed knowledge:** HSC Mathematics Extension 1. Students who have not completed HSC Extension 1 Mathematics (or equivalent) are strongly advised to take the Extension 1 Mathematics Bridging Course (offered in February). **Assessment:** exam, quizzes, assignments **Mode of delivery:** Normal (lecture/lab/tutorial) day

Calculus is a discipline of mathematics that finds profound applications in science, engineering, and economics. This unit investigates differential calculus and integral calculus of one variable and the diverse applications of this theory. Emphasis is given both to the theoretical and foundational aspects of the subject, as well as developing the valuable skill of applying the mathematical theory to solve practical problems. Topics covered in this unit of study include complex numbers, functions of a single variable, limits and continuity, differentiation, optimisation, Taylor polynomials, Taylor's Theorem, Taylor series, Riemann sums, and Riemann integrals.

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:** MATH1012 or MATH1014 or MATH1902 **Assumed knowledge:** HSC Mathematics or MATH1111. Students who have not completed HSC Mathematics (or equivalent) are strongly advised to take the Mathematics Bridging Course (offered in February). **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

MATH1023
Multivariable Calculus and Modelling

Credit points: 3 **Session:** Semester 2 **Classes:** 2x1-hr lectures; 1x1-hr tutorial per week **Prohibitions:** MATH1013 or MATH1903 or MATH1907 or MATH1003 or MATH1923 or MATH1933 **Assumed knowledge:** HSC Mathematics Extension 1. Students who have not completed HSC Extension 1 Mathematics (or equivalent) are strongly advised to take the Extension 1 Mathematics Bridging Course (offered in February). **Assessment:** exam, quizzes, assignments **Mode of delivery:** Normal (lecture/lab/tutorial) day

Calculus is a discipline of mathematics that finds profound applications in science, engineering, and economics. This unit investigates multivariable differential calculus and modelling. Emphasis is given both to the theoretical and foundational aspects of the subject, as well as developing the valuable skill of applying the mathematical theory to solve practical problems. Topics covered in this unit of study include mathematical modelling, first order differential equations, second order differential equations, systems of linear equations, visualisation in 2 and 3 dimensions, partial derivatives, directional derivatives, the gradient vector, and optimisation for functions of more than one variable.

Textbooks
As set out in the Junior Mathematics Handbook

MATH1005
Statistical Thinking with Data

Credit points: 3 **Session:** Semester 2, Summer Main, Winter Main **Classes:** Lectures 2 hrs/week; Practical 1 hr/week **Prohibitions:** MATH1015 or MATH1905 or STAT1021 or STAT1022 or ECMT1010 or ENVX1001 or ENVX1002 or BUSS1020 **Assumed knowledge:** HSC Mathematics. Students who have not completed HSC Mathematics (or equivalent) are strongly advised to take the Mathematics Bridging Course (offered in February). **Assessment:** One 1.5 hour examination, assignments and quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

In a data-rich world, global citizens need to problem solve with data, and evidence based decision-making is essential is every field of research and work.

This unit equips you with the foundational statistical thinking to become a critical consumer of data. You will learn to think analytically about data and to evaluate the validity and accuracy of any conclusions drawn. Focusing on statistical literacy, the unit covers foundational statistical concepts, including the design of experiments, exploratory data analysis, sampling and tests of significance.

Textbooks
Freedman, Pisani and Purves, Statistics, Norton, 2007

ENGG1850
Introduction to Project Management

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Laboratories **Prohibitions:** CIVL3805 or QBUS2350 **Assessment:** Through semester assessment (50%) and 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 Main **Classes:** Lectures, Tutorials **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces students to solving engineering problems using computers. Students learn how to organise data to present and understand it better using a spreadsheet (Excel), and also how to instruct the computer exactly what to do to solve complex problems using programming (Matlab). Real engineering examples, applications and case-studies are given, and students are required to think creatively and solve problems using computer tools.

Matlab will cover three-quarters of the unit. The remaining one-quarter will be devoted to the use of Excel in engineering scenarios. Furthermore, cross integration between Matlab and Excel will also be highlighted.

No programming experience is required or assumed. Students are assumed to have a basic understanding of mathematics and logic, and very elementary computing skills.

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:** ECON1001 OR ECON1040 **Assessment:** written assignment (15%), on-line quizzes (10%), mid-semester exam (20%), and final exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

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.

PMGT1852
Communications and Stakeholder Management

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Assumed knowledge:** ENGG1850 **Assessment:** through semester assessment (50%) and final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Effective stakeholder management and communication play a vital role in the success of projects. Project managers and leaders often express that stakeholder management, leadership and communication are often the most sought-after competencies. This unit of study focuses on the process of stakeholder identification; defining their roles and responsibilities; understanding their organisation mission, vision and overall strategic objectives; alignment and prioritisation of specific project needs and requirements; with emphasis on stakeholder engagement/analytic methodologies such as analysing stakeholder influence, reliance, collaboration and communication networks. The unit of study will also cover aspects of psychology, emotional intelligence, communication techniques and leadership qualities required for effective performance in project management roles.

First year: Civil Engineering Science stream

CIVL1802
Statics

Credit points: 6 **Session:** Semester 2 **Classes:** lectures, tutorials **Prohibitions:** ENGG1802 **Assessment:** through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Unit will focus on Engineering Statics, covering topics such as resolution of forces and moments, free body diagrams, support reactions, equilibrium in rigid bodies, trusses frames and machines, method of sections, method of joints, centroids, distributed forces, vibrations and friction. There will be extensive use of both 2D and 3D examples and solution methods by either resolution in the principle axes or by using vectors. Its main aim is to prepare students for 2nd year civil units such as Structural Mechanics.

CIVL1900
Introduction to Civil Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prohibitions:** ENGG1800 OR CHNG1108 OR MECH1560 OR AERO1560 OR AMME1960 OR MTRX1701 OR ENGG1960 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The objective of this unit of study is to introduce students to the field of civil engineering and its areas of specialisation: structural engineering, environmental engineering, geotechnical engineering, construction management, transportation engineering, and humanitarian engineering. The unit will cover basic physics concepts relevant to civil engineering. The unit will equip students with knowledge of foundational civil engineering tools and techniques such as the identification and calculation of loads on structures, structural systems, and load paths in structures. The unit covers design and construction issues related to the use of standard materials such as steel, concrete, and timber. The unit includes several design tasks and a design project with an emphasis on issues associated with the impact of civil infrastructure on the natural environment, the economy, and social and humanitarian outcomes. The topics will provide a sound foundation for the further study of civil infrastructure design, analysis, construction, and maintenance.

First Year: Built Environment stream

DAAE1001
Living Cities

Credit points: 6 **Teacher/Coordinator:** Dr Dallas Rogers **Session:** Semester 2 **Classes:** Lecture 2 hrs/wk (Weeks 1-6), 1 hr/wk (Weeks 7-13); tutorial 1 hr/wk (Weeks 1-6), 2 hrs/wk (Weeks 7-13) **Assumed knowledge:** DECO1006 and DECO1012 and BDES1011 and AWSS1001 **Assessment:** Assessment 1 (30%); Assessment 2 (30%); Assessment 3 (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study reviews the challenges involved in planning the contemporary urban environment. It covers a range of perspectives, including urban planning, urban design and heritage. Students will examine the evolution of towns and cities from the first settlements to the modern metropolis, and explore the cultural, economic, political and digital drivers that shape the urban environment. It asks, 'why did cities evolve?', 'what purpose do cities serve?', 'who is the city for?', and 'how are decisions made about cities?' The contemporary urban environment is explored as a dynamic and continually evolving 'living city' that is co-created by architects, planners, urban designers and other public and private stakeholders. On the successful completion of this unit of study, students will have demonstrated an understanding of the importance of planning in shaping our towns and cities through time. They will have a basic knowledge of the key ideas that are needed for formulating planning and urban design proposals.

Textbooks

Course material, announcements and assessment submission will be available at https://elearning.sydney.edu.au/
Angel, S. (2012). The Planet of Cities, Lincoln Institute of Land Policy
Lynch, K. (1960). Image of the City. Cambridge Massachusetts, MIT Press
The City Reader, (2011), 5th Edition (The Routledge Urban Reader Series) Paperback by Richard T. LeGates (Editor) and Frederic Stout (Editor)
Kostov, S. (1991). The City Shaped. Bulfinch Press, Thames and Hudson
Readings listed as chapter excerpts and articles will be available electronically through the library.

DAAE2001
Australian Architecture

Credit points: 6 **Teacher/Coordinator:** Prof Andrew Leach **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 process development presentation and one 3,000-word essay (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will introduce students to the history of Australian architecture in its various contexts. Lectures and seminars will cover key architects, projects and building types and their relation to Australian history. Students will become familiar with a range of architectural styles and movements 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 factors that shape architectural design and thought in Australia and how these relate to wider social and cultural circumstances. Tutorials will introduce students to key books, essays and journals concerned with Australian architecture. On successful completion of this unit, students will be able to: demonstrate a familiarity with a range of Australian architects, buildings and types; research, record and present a specific project in Sydney; connect specific works to other works of a similar style, period or cultural context. This will be assessed in the submitted essay.

First Year: Software stream

INFO1110
Introduction to Programming

Credit points: 6 **Session:** Intensive July, Semester 1, Semester 2 **Classes:** lectures, laboratories, seminars **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit is an essential starting point for software developers, IT consultants, and computer scientists to build their understanding of principle computer operation. Students will obtain knowledge and skills with procedural programming. Crucial concepts include defining data types, control flow, iteration, functions, recursion, the model of addressable memory. Students will be able to reinterpret a general problem into a computer problem, and use their understanding of the computer model to develop source code. This unit trains students with software development process, including skills of testing and debugging. It is a prerequisite for more advanced programming languages, systems programming, computer security and high performance computing.

INFO1113
Object-Oriented Programming

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** lectures, laboratories, seminars **Prerequisites:** INFO1110 **Prohibitions:** INFO1103 OR INFO1105 OR INFO1905 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Object-oriented (OO) programming is a technique that arranges code into classes, each encapsulating in one place related data and the operations on that data. Inheritance is used to reuse code from a more general class, in specialised situations. Most modern programming languages provide OO features. Understanding and using these are an essential skill to software developers in industry. This unit provides the student with the concepts and individual programming skills in OO programming, starting from their previous mastery of procedural programming.

Second year: All streams

ENGG2850
Introduction to Project Finance

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Laboratories **Prohibitions:** CIVL3812 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is a theory and case study based unit 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 unit 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:** Intensive January, Semester 1 **Classes:** Lectures, Tutorials, Laboratories **Prerequisites:** ENGG1850 AND (MATH1011 OR MATH1001 OR MATH1021 OR MATH1901 OR MATH1921) AND (MATH1002 OR MATH1902) AND (MATH1013 OR MATH1003 OR MATH1023 OR MATH1903 OR MATH1923) AND (MATH1015 OR MATH1005 OR MATH1905) **Assessment:** Through semester assessment (50%) and 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 organisation 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:** Lectures, Tutorials, Laboratories **Prerequisites:** ENGG1850 AND (PSYC1002 OR PMGT1852) **Assessment:** Through semester assessment (100%) **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 unit, we offer a succinct, lively and robust introduction to the subject of organisational 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:** Lectures, Laboratories, Tutorials **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 unit 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 unit 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:** Lectures, Tutorials, Laboratories **Prerequisites:** ENGG1802 OR CIVL1802 **Prohibitions:** AMME2301 **Assumed knowledge:** From (CIVL1802 or ENGG1802), 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 in certain 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%) and 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.

CIVL1810
Engineering Construction and Surveying

Credit points: 6 **Session:** Semester 2 **Classes:** Tutorials, Workgroups, Lectures **Prohibitions:** CIVL2810 **Assumed knowledge:** CIVL1900. Some statistical awareness is an advantage and co-enrolment in MATH1005 Statistics is advised. HSC Mathematics Extension 1 or completion of (MATH1001 or MATH1021) and MATH1002 are sufficient for non-statistical maths preparation **Assessment:** Through semester assessment (70%), Final Exam (30%) **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)

Construction: Fundamental understanding of construction materials and techniques underpins Civil design and complements a rigorous analysis covered in other units such as Structural Mechanics and Soil Mechanics. In this unit students will be introduced to the realities of on-site civil construction. For many students this comes as a completely foreign experience and the methods they need to use to succeed in this unit rely on the student building his or her own awareness of the construction world and how it operates. This will be guided by the lectures and on-line material, but will not be spoon-fed to the students.

This unit presents concepts introducing students to engineering construction including:

- design, control, management, measurement and construction methods for excavation, embankments and other earthworks, hauling and associated operations;

- conceptual and formative exposure to building construction methods and materials, including reinforced concrete, masonry, steel and timber;

- drilling and blasting.

Surveying: The unit also introduces Engineering Survey topics, where the aims are:

- give an overall view of the functions of surveying and it's service role in Civil construction;

- become acquainted with selected specific surveying techniques, such as: (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;

- to give an insight into future trends in the use of GPS and GIS systems.

Students should develop basic competency in earthwork engineering and awareness of costing issues in formulating building proposals (through simplified examples). Economic optimisation is investigated, and how this impinges on decisions of 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 tutorial exercises give practise for students to implement what they have learned from lectures and their own research about 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.

While prior exposure to an actual construction site would be beneficial, in any case the key for success in this unit is for the student to develop a hungry curiosity for the world of construction and the professionals and personalities which form the intricate patchwork of talent which sees complex projects through to successful completion.

Second Year: Built Environment stream

BADP2002
City Form and Development

Credit points: 6 **Teacher/Coordinator:** Dr Adrienne Keane **Session:** Semester 1 **Classes:** Lectures 2 hrs/wk, tutorials 1 hr/wk **Prerequisites:** DAAE1001 or (DAAE2002 and ENGG1850) **Assessment:** Assessment 1 (individual) (30%), Assessment 2 (40%), Assessment 3 (group) (20%), participation (10%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit builds on the content of Living Cities and introduces students to the modern formal domains of planning, urban design and heritage conservation. The focus will be on two main areas of debate, namely, city form and structure, and secondly, the planning and development processes on which the formal planned city is made. The unit will establish the context in which the role of planners, architects and urban designers in the process of building the 'incremental' city is understood, from the site to precinct, neighbourhood and city wide levels. Elements of city form and structure are analysed, as well as mobility, transport, land use, infrastructure and current policy responses at a metropolitan and local level in meeting urban growth needs. The unit will also overview the development process including the framework in which architects, planners and property developers must work. Using a contemporary planning framework, the nature of development assessment, strategic planning and the community's role within this framework are explored. Criticisms and reform agendas around frameworks will be examined. Informal urbanism is also introduced in this unit to address development that occurs outside the domain of formal western regulated planning and design systems.

DESA3011
Introduction to Building Construction

Credit points: 6 **Teacher/Coordinator:** Mr Damien Madell **Session:** Semester 2 **Classes:** 3 hr lecture/tutorial/week **Assessment:** Two assignments (40%) and (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit provides a comprehensive overview of standard domestic scaled construction in Australia. It begins by introducing a number of recurrent themes in construction including the idea of building culture, the various modes of delivery and variety of classifications of buildings and building elements, rational construction and construction detailing from first principles. There follows a review of construction techniques of well-documented and/or accessible exemplars. 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 and energy and resources conservation.

Second Year: Software stream

ISYS2110
Analysis and Design of Web Info Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, tutorials **Prerequisites:** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 **Prohibitions:** INFO2110 **Assessment:** through semester assessment (40%), final exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course discusses the processes, methods, techniques and tools that organisations use to determine how they should conduct their business, with a particular focus on how web-based technologies can most effectively contribute to the way business is organized. The course covers a systematic methodology for analysing a business problem or opportunity, determining what role, if any, web-based technologies can play in addressing the business need, articulating business requirements for the technology solution, specifying alternative approaches to acquiring the technology capabilities needed to address the business requirements, and specifying the requirements for the information systems solution in particular, in-house development, development from third-party providers, or purchased commercial-off-the-shelf (COTS) packages.

ISYS2120
Data and Information Management

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories, Project Work - own time **Prerequisites:** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 OR INFO1003 OR INFO1903 OR DECO1012 **Prohibitions:** INFO2120 OR INFO2820 OR COMP5138 **Assumed knowledge:** Programming skills **Assessment:** through semester assessment (50%), final exam (50%) **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 the SQL database query languages, which is industry standard. Other topics covered will include the important concept of transaction management, application development with a backend database, and an overview of data warehousing and OLAP.

Third year: All streams

ENGG3853
Project Risk Management Tools and Techniques

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Laboratories **Prerequisites:** ENGG2851. **Prohibitions:** CIVL4810 **Assessment:** Through semester assessment (60%) and Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Managing risk is an essential skill to be a successful project manager. This course will provide students with an understanding of what is risk and the key principles of risk management as described in AS/NZS ISO 31000: 2009. The course will show how these principles can be applied to project management both through the project development phase and the project delivery phase. This will include skills on how to measure and value risk and assess the potential impacts it may have on a project outcomes using qualitative and quantitative risk assessment techniques. Using case studies students will learn ways to treat risk to minimise the potential impact. The course will also cover techniques for establishing levels of risk appetite and risk tolerance. It will overview risk reporting tools and templates and conclude with a session on human behaviour and how this impacts on risk acceptance and risk aversion in a project context.

On successful completion of this course students will have a good understanding of the basic principles of risk and risk management, be able to apply risk assessment and treatment techniques, be able to quantify potential risk impacts and to establish a prioritised project risk register.

ENGG3854
Negotiating and Contracting

Credit points: 6 **Session:** Semester 2, Summer Main **Classes:** Lectures, Laboratories, Tutorials **Prerequisites:** ENGG1850 AND ENGG2850 AND ENGG2852. **Prohibitions:** CIVL3813 or CIVL4813 **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

In this unit, 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 unit 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 unit 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:** Lectures, Meeting, Project Work - own time **Prerequisites:** 30 credits of 2nd or 3rd 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 and 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 and 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:** Lectures, Practical Work **Prerequisites:** 30 credits of 2nd year units of study, and PMGT3850 **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 and 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 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:** Lectures, Tutorials **Prerequisites:** ENGG2851 **Assessment:** Through semester assessment (50%) and Final Exam (50%) **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 unit 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:** Lectures, Tutorials **Prerequisites:** ENGG1850 AND ENGG2852. **Assessment:** Through semester assessment (50%) and 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.

Students undertaking a combined BE(Hons)/BPM which includes an Honours Thesis are not required to complete PMGT3850 or PMGT3851 Project Management Capstone units.

Third Year: Civil Engineering Science stream

CIVL2700
Transport Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Assumed knowledge:** (MATH1001 OR MATH1021) AND (MATH1003 OR MATH1023) AND MATH1005 AND ENGG1801. Basic statistics through regression analysis, differential and integral calculus, computer programming. **Assessment:** through semester assessment (60%) and final exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to provide an introduction to transport systems and is assumed knowledge for fourth year units on traffic engineering, transport planning, and city logistics. Topics include: the role of accessibility as the reason for transport; the history of transport technologies in Australia and globally; the characteristics of the principle modes of transport; factors behind the demand for mobility; qualitative choice modeling; agent-based modeling; predicting travel demands; the mechanics of queueing and traffic flow; intelligent transport systems; the microscopic and macroscopic fundamental diagrams; highway capacity and level of service; the design of transport junctions.

Select one of the following units:

CIVL2410
Soil Mechanics

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories **Assumed knowledge:** CIVL2201 AND GEOL1501 AND (CIVL1802 or ENGG1802). 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 CIVL1802 Statics (or ENGG1802 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. Familiarity with partial differential equations, and their analytical and numerical solution. **Assessment:** Through semester assessment (40%) and 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:** Lectures, Tutorials, Laboratories **Assumed knowledge:** CIVL2201 AND (CIVL1802 or ENGG1802) AND (MATH1001 OR MATH1021). 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 (44%) and Final Exam (56%) **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.

CIVL3811
Engineering Design and Construction

Credit points: 6 **Session:** Semester 2 **Classes:** workshops, project work - own time, presentation **Prohibitions:** CIVL4811 **Assumed knowledge:** CIVL1810 OR CIVL2810 **Assessment:** through semester assessment (40%); final exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The twin foci of this unit are: to enable students to participate as design engineers by developing an understanding of the design principles and techniques involved in the planning of a range of construction activities; and to assist students in preparing themselves for the role of a site engineer in a construction project wherein they will become familiar with the planning and execution of those activities, albeit with supervision and guidance from experienced professionals. Construction topics include hard rock tunnelling and general rock excavation; soft ground tunnelling; underground construction; micro tunnelling; cut and cover tunnelling; earth retaining systems; piling; formwork and falsework; dewatering; pavement design and construction - rigid and flexible; 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, OHandS issues in the construction industry; timber engineering; post-tensioned/prestressed concrete construction.

Third Year: Built Environment stream

DAAE3001
Sustainable Architectural Practice

Credit points: 6 **Teacher/Coordinator:** Dr Daniel Ryan **Session:** Semester 1 **Classes:** lecture 2 hrs/wk, tutorial/lab 2 hrs/wk for weeks 1 to 12 **Prerequisites:** BDES1023 or (DAAE1001 and DESA3011) or (DAAE2002 and DESP1001) **Assessment:** Case Studies (30%), Design Exercise (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

The unit of study begins by exploring the concept of ecologically sustainable design as it applies to architectural practice and defines those key attributes of buildings which make them sustainable. It discusses the implication of applying sustainable design principles upon contemporary architectural practice. This unit will cover the fundamentals of passive solar design, the environmental impact of building materials, water sensitive design and the environmental certification of buildings. Through the use of case studies and project work students will learn about how to design environmentally sustainable buildings by understanding contemporary trends in sustainable architectural practice, methods to critically evaluate environmental claims about buildings and will develop a personal position on applying sustainable design principles to architecture. This unit is an Architecture Elective in the Bachelor of Design in Architecture and elective in other courses.

BADP3002
Property and the Built Environment

Credit points: 6 **Teacher/Coordinator:** Dr Adrienne Keane **Session:** Semester 2 **Classes:** lecture 2hrs/week; tutorial 1hr/week **Prerequisites:** BAEN3001 or (DAAE1001 and DESA3011) or (DAAE2002 and DESP1001) **Corequisites:** BAEN3002 or ENGG3854 **Assessment:** Assessment 1 (25%), Assessment 2 (25%) and Assessment 3 (50%). One or more of these assessments may be group tasks. **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides an introduction to the Property Development (PD) process with the aim of imparting an understanding of the professional's role, delivered through a review of the stages involved in PD, an overview of the different sectors, project types and stakeholders. The unit will introduce the broad objectives of financial feasibility preparation and give insights to the feasibility aspects that accompany design criteria, to determine which projects are developed. It will present an overview of risk factors, which may be encountered in the process, including risk assessment/management, the risk matrix and possible counter measures. The unit introduces basic construction types, preparation of costings from industry publications, an overview of the construction industry, project stakeholders and the hierarchy of a construction project. On completion it is envisaged students will be able to identify major stakeholders, prepare initial construction costings and project feasibility reports outlining risks with mitigation measures. Students will have developed an understanding of PD, its effects on cities, its role in the economy, the processes and stakeholders involved. Students will also have gained an insight into construction, initial project cost planning, risk management and feasibility for a property development project.

Third Year: Software stream

ELEC3609
Internet Software Platforms

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Project Work - own time **Prerequisites:** (INFO1103 OR INFO1110) AND (INFO2110 OR ISYS2110) AND (INFO2120 OR INFO2820 OR ISYS2120) **Prohibitions:** EBUS4001 **Assessment:** Through semester assessment (60%) and Final Exam (40%) **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, Project Work - own time, Presentation, Tutorials **Prohibitions:** EBUS3003 **Assessment:** Through semester assessment (70%) and 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.

Notes

1. 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 which offers the unit.2. 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.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 School before enrolling.

Recommended Electives

In addition to the core units in the above table candidates for the single degree must complete electives to gain a total of 144 credit points as required for the degree. The following are recommended elective units of study.

Project Management Electives

Candidates enrolled in a combined degree must complete a minimum of 18 credit points of Project Management Electives

PMGT2800
Project Placement A

Credit points: 6 **Session:** Semester 1 **Classes:** practical experience, workshops, meetings **Assumed knowledge:** ENGG1850 AND MATH1005 AND BUSS1040 AND PMGT1852. This unit of study is only available to students who have a credit average or above and who have obtained approval from the program director. **Assessment:** through semester assessment (100%) **Mode of delivery:** Field experience

Note: Department permission required for enrolment.

This unit of study provides student with internship and/or work placement opportunities in the field of project management. It allows student to translate their learning from their junior and intermediate units of study within Bachelor of Project Management degree into experiential learning in a real world context. Students will be required to work with the supporting/host organisation for a minimum of 120 hours or 20 working days and this arrangement needs to be endorsed by both the academic director of the program or equivalent and the supervisor of the host organisation prior to the beginning of the placement. Students will gain valuable industry and professional experience from this unit of study including communication and key aspects of project management skills such as planning, scheduling, costing, coordinating, resourcing, budgeting, monitoring and reporting. It is anticipated that this unit of study would enrich the learning experience as well as enhance future business development or job employment opportunities in the project management context.

PMGT2801
Project Placement B

Credit points: 6 **Session:** Semester 1 **Classes:** practical experience, workshops, meetings **Assumed knowledge:** ENGG1850 AND MATH1005 AND BUSS1040 AND PMGT1852 **Assessment:** through semester assessment (100%) **Mode of delivery:** Field experience

Note: Department permission required for enrolment.

This unit of study provides student with internship and/or work placement opportunities in the field of project management. It allows student to translate their learning from their junior and intermediate units of study within Bachelor of Project Management degree into experiential learning in a real world context. Students will be required to work with the supporting/host organisation for a minimum of 120 hours or 20 working days and this arrangement needs to be endorsed by both the academic director of the program or equivalent and the supervisor of the host organisation prior to the beginning of the placement. Students will gain valuable industry and professional experience from this unit of study including communication and key aspects of project management skills such as planning, scheduling, costing, coordinating, resourcing, budgeting, monitoring and reporting. It is anticipated that this unit of study would enrich the learning experience as well as enhance future business development or job employment opportunities in the project management context. This unit of study is only available to students who have a credit average or above and who have obtained approval from the program director.

PMGT2854
Implementing Concurrent Projects

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories, Tutorials **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:** Lectures, Tutorials **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 not only in terms of economic capital but 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, whilst considering social and environmental impacts these projects may have. Cases discussed in this unit 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:** Lectures, Laboratories, Tutorials **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit 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.

Other Recommended Electives

CIVL2110

Materials

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prohibitions:** AMME1362 **Assumed knowledge:** ENGG1802 or CIVL1802 **Assessment:** Through semester assessment (50%) and 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.

CIVL2611

Introductory Fluid Mechanics

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories **Assumed knowledge:** CIVL2201 AND (CIVL1802 or ENGG1802) AND (MATH1001 OR MATH1021). 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 (44%) and Final Exam (56%) **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.

COMP2017

Systems Programming

Credit points: 6 **Session:** Semester 1 **Classes:** lectures, laboratories **Prerequisites:** INFO1113 OR INFO1105 OR INFO1905 OR INFO1103 **Corequisites:** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **Prohibitions:** COMP2129 **Assessment:** through semester assessment (50%), final exam (50%) **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.

COMP2022

Programming Languages, Logic and Models

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Prerequisites:** INFO1103 OR INFO1903 OR INFO1113 **Prohibitions:** COMP2922 **Assumed knowledge:** MATH1004 OR MATH1904 OR MATH1064 OR MATH2069 OR MATH2969 **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides an introduction to the foundations of computational models, and their connection to programming languages/tools. The unit covers various abstract models for computation including Lambda Calculus, and Logic calculi (e. g. concept of formal proofs in propositional, predicate, and temporal logic). For each abstract model, we introduce programming languages/tools that are built on the introduced abstract computational models. We will discuss functional languages including Scheme/Haskell, and Prolog/Datalog.

COMP2123

Data Structures and Algorithms

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prerequisites:** INFO1110 OR INFO1113 OR DATA1002 OR INFO1103 OR INFO1903 **Prohibitions:** INFO1105 OR INFO1905 OR COMP2823 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will teach some powerful ideas that are central to solving algorithmic problems in ways that are more efficient than naive approaches. In particular, students will learn how data collections can support efficient access, for example, how a dictionary or map can allow key-based lookup that does not slow down linearly as the collection grows in size. The data structures covered in this unit include lists, stacks, queues, priority queues, search trees, hash tables, and graphs. Students will also learn efficient techniques for classic tasks such as sorting a collection. The concept of asymptotic notation will be introduced, and used to describe the costs of various data access operations and algorithms.

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.

DAAE2008
Innovative Building Structures

Credit points: 6 **Teacher/Coordinator:** Mr Michael Muir **Session:** Semester 2 **Classes:** Lecture 2 hrs/wk; tutorial 1 hr/wk **Prerequisites:** BDES1023 **Prohibitions:** DESA2206 **Assessment:** Group Report (40%); Physical Test (20%);Individual Report (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The aim of this unit is to engage students in detailed studies of innovative building structures, covering the three aspects of innovation in architectural and structural design (modeling, materials and technology). The main topics covered are: architectural form and structural function; interpretation of basic (arch, beam, column, space and spatial portal) and advanced (truss, vault, dome, shell) structural principles with an intuitive graphical method (Load Path Method - LPM). Examples of significant case studies will be shown and interpreted (works by A. Gaudi, B. Fuller, F. Otto, N. Grimshaw, S. Calatrava, N. Foster, R. Piano and others); biomimetics; bioinspired structures as a way to increase structural efficiency. Innovative structural materials: the use of glass as structural material, innovative reinforcements for composite structures, smart and nanostructured materials; kinetic architecture: structural movement as the 4th architectural dimension. A case study assignment will be used to assess student's competence in investigating and presenting case studies and being able to identify and evaluate issues and factors contributing to innovative structural solutions.

DAAE2011
Intro to Visual Communication Design

Credit points: 6 **Teacher/Coordinator:** Mr Nathaniel Fay **Session:** Semester 1, Summer Main, Winter Main **Classes:** Online: expected total workload is approximately 35 hours online, plus independent study and preparation. **Prohibitions:** DAAE2009 or DECO1015 or DECO2101 **Assessment:** Visual Design Assignments (85%), Quiz (15%) **Mode of delivery:** Online

This unit of study introduces students to the principles and practices of visual communication design for non-designers. Visual communication is an essential skill in todayÂ¿s complex world, for effectively communicating ideas, information, perspectives and proposals to diverse audiences in a variety of contexts. Students will learn about the theories of visual perception and psychology underlying visual design principles, and strategies for the composition of visual elements to produce effective and compelling visual presentations. On the successful completion of this unit of study, students will have demonstrated knowledge and skills in the understanding and application of visual design to produce and evaluate effective visual communication materials for a range of audiences.

DATA1001
Foundations of Data Science

Credit points: 6 **Teacher/Coordinator:** Dr Di Warren **Session:** Semester 1, Semester 2 **Classes:** lecture 3 hrs/week; computer tutorial 2 hr/week **Prohibitions:** MATH1005 or MATH1905 or MATH1015 or MATH1115 or ENVX1001 or ENVX1002 or ECMT1010 or BUSS1020 or STAT1021 **Assessment:** assignments, quizzes, presentation, exam **Mode of delivery:** Normal (lecture/lab/tutorial) day

DATA1001 is a foundational unit in the Data Science major. The unit focuses on developing critical and statistical thinking skills for all students. Does mobile phone usage increase the incidence of brain tumours? What is the public's attitude to shark baiting following a fatal attack? Statistics is the science of decision making, essential in every industry and undergirds all research which relies on data. Students will use problems and data from the physical, health, life and social sciences to develop adaptive problem solving skills in a team setting. Taught interactively with embedded technology, DATA1001 develops critical thinking and skills to problem-solve with data. It is the prerequisite for DATA2002.

Textbooks
Statistics, Fourth Edition, Freedman Pisani Purves

DATA1002
Informatics: Data and Computation

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories, Project Work - own time **Prohibitions:** INFO1903 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit covers computation and data handling, integrating sophisticated use of existing productivity software, e.g. spreadsheets, with the development of custom software using the general-purpose Python language. It will focus on skills directly applicable to data-driven decision-making. Students will see examples from many domains, and be able to write code to automate the common processes of data science, such as data ingestion, format conversion, cleaning, summarization, creation and application of a predictive model.

DATA2001
Data Science: Big Data and Data Diversity

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratories, Project Work - own time **Prerequisites:** DATA1002 OR INFO1110 OR INFO1903 OR INFO1103 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course focuses on methods and techniques to efficiently explore and analyse large data collections. Where are hot spots of pedestrian accidents across a city? What are the most popular travel locations according to user postings on a travel website? The ability to combine and analyse data from various sources and from databases is essential for informed decision making in both research and industry.

Students will learn how to ingest, combine and summarise data from a variety of data models which are typically encountered in data science projects, such as relational, semi-structured, time series, geospatial, image, text. As well as reinforcing their programming skills through experience with relevant Python libraries, this course will also introduce students to the concept of declarative data processing with SQL, and to analyse data in relational databases. Students will be given data sets from, eg. , social media, transport, health and social sciences, and be taught basic explorative data analysis and mining techniques in the context of small use cases. The course will further give students an understanding of the challenges involved with analysing large data volumes, such as the idea to partition and distribute data and computation among multiple computers for processing of 'Big Data'.

DATA2002
Data Analytics: Learning from Data

Credit points: 6 **Teacher/Coordinator:** Jean Yang **Session:** Semester 2 **Classes:** lecture 3 hrs/week; computer tutorial 2 hr/week **Prerequisites:** [DATA1001 or ENVX1001 or ENVX1002] or [MATH10X5 and MATH1115] or [MATH10X5 and STAT2011] or [MATH1905 and MATH1XXX (except MATH1XX5)] or [BUSS1020 or ECMT1010 or STAT1021] **Prohibitions:** STAT2012 or STAT2912 **Assumed knowledge:** (Basic Linear Algebra and some coding) or QBUS1040 **Assessment:** written assignment, presentation, exams **Mode of delivery:** Normal (lecture/lab/tutorial) day

Technological advances in science, business, engineering has given rise to a proliferation of data from all aspects of our life. Understanding the information presented in these data is critical as it enables informed decision making into many areas including market intelligence and science. DATA2002 is an intermediate course in statistics and data sciences, focusing on learning data analytic skills for a wide range of problems and data. How should the Australian government measure and report employment and unemployment? Can we tell the difference between decaffeinated and regular coffee ? In this course, you will learn how to ingest, combine and summarise data from a variety of data models which are typically encountered in data science projects as well as reinforcing their programming skills through experience with statistical programming language. You will also be exposed to the concept of statistical machine learning and develop the skill to analyze various types of data in order to answer a scientific question. From this unit, you will develop knowledge and skills that will enable you to embrace data analytic challenges stemming from everyday problems.

DECO2103
Architectural Modelling and Prototyping

Credit points: 6 **Teacher/Coordinator:** Dr Rizal Muslimin **Session:** Semester 1 **Classes:** Lecture 1 hr/wk, tutorial 2 hrs/wk **Prerequisites:** DESA1555 and completion of at least 36 credit points **Assumed knowledge:** Basic understanding of design principles and design processes and how to apply them in practical design projects **Assessment:** Assessment 1 (25%), Assessment 2 (35%), Assessment 3 (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit teaches students basic understanding of digital modelling and architectural prototyping. Students will develop skills in creating and using 3D modelling software for various design tasks. The unit further introduces students to rapid prototyping fabrication techniques, such as 3D printing and laser cutting with the aim to understand how to prepare a digital model for physical fabrication. Students will learn how physical objects are represented in 3D digital models by modelling various 3D geometric entities. Key concepts covered in this unit include: joinery, composite material and solid modelling.

ISYS2110
Analysis and Design of Web Info Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, tutorials **Prerequisites:** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 **Prohibitions:** INFO2110 **Assessment:** through semester assessment (40%), final exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course discusses the processes, methods, techniques and tools that organisations use to determine how they should conduct their business, with a particular focus on how web-based technologies can most effectively contribute to the way business is organized. The course covers a systematic methodology for analysing a business problem or opportunity, determining what role, if any, web-based technologies can play in addressing the business need, articulating business requirements for the technology solution, specifying alternative approaches to acquiring the technology capabilities needed to address the business requirements, and specifying the requirements for the information systems solution in particular, in-house development, development from third-party providers, or purchased commercial-off-the-shelf (COTS) packages.

ISYS2120
Data and Information Management

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories, Project Work - own time **Prerequisites:** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 OR INFO1003 OR INFO1903 OR DECO1012 **Prohibitions:** INFO2120 OR INFO2820 OR COMP5138 **Assumed knowledge:** Programming skills **Assessment:** through semester assessment (50%), final exam (50%) **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 the SQL database query languages, which is industry standard. Other topics covered will include the important concept of transaction management, application development with a backend database, and an overview of data warehousing and OLAP.

ISYS2160
Information Systems in the Internet Age

Credit points: 6 **Session:** Semester 2 **Classes:** lectures, tutorials **Prohibitions:** ISYS2140 **Assumed knowledge:** INFO1003 OR INFO1103 OR INFO1903 OR INFO1113 **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 the Internet era. Key topics covered include: system thinking and system theory, basic concepts of information systems, internet and e-commerce, e-payment and m-commerce, online marketing and social media, information systems for competitive advantage, functional and enterprise systems, business intelligence, information systems development and acquisition, information security, ethics, and privacy

MATH2021
Vector Calculus and Differential Equations

Credit points: 6 **Session:** Semester 1 **Classes:** 3x1-hr lectures; 1x1-hr tutorial; and 1x1-hr practice class per week **Prerequisites:** (MATH1X21 or MATH1931 or MATH1X01 or MATH1906) and (MATH1XX2) and (MATH1X23 or MATH1933 or MATH1X03 or MATH1907) **Prohibitions:** MATH2921 or MATH2065 or MATH2965 or MATH2061 or MATH2961 or MATH2067 **Assessment:** assessment for this unit consists of quizzes, assignments, and a final exam **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit opens with 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, through cylinders, spheres and other parametrised surfaces), Gauss' and Stokes' theorems. The unit then moves to topics in solution techniques for ordinary and partial differential equations (ODEs and PDEs) with applications. It provides a basic grounding in these techniques to enable students to build on the concepts in their subsequent courses. The main topics are: second order ODEs (including inhomogeneous equations), higher order ODEs and systems of first order equations, solution methods (variation of parameters, undetermined coefficients) the Laplace and Fourier Transform, an introduction to PDEs, and first methods of solutions (including separation of variables, and Fourier Series).

Textbooks

As set out in the Intermediate Mathematics Handbook

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:** (MATH1X21 or MATH1011 or MATH1931 or MATH1X01 or MATH1906) and (MATH1014 or MATH1X02) and (MATH1X23 or MATH1933 or MATH1X03 or MATH1907) **Prohibitions:** MATH2001 or MATH2901 or MATH2002 or MATH2902 or MATH2961 or MATH2067 or MATH2021 or MATH2921 or MATH2022 or MATH2922 **Assessment:** One 2 hour exam, assignments, quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This unit of study is only available to Faculty of Engineering and Information Technologies students.

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.

MATH2068
Number Theory and Cryptography

Credit points: 6 **Session:** Semester 2 **Classes:** Three 1 hour lectures, one 1 hour tutorial and one 1 hour computer laboratory per week. **Prerequisites:** 6

credit points of Junior Mathematics units **Prohibitions:** MATH2988 or MATH3009 or MATH3024 **Assumed knowledge:** MATH1014 or MATH1002 or MATH1902 **Assessment:** 2 hour exam, assignments, quizzes (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Cryptography is the branch of mathematics that provides the techniques for confidential exchange of information sent via possibly insecure channels. This unit introduces the tools from elementary number theory that are needed to understand the mathematics underlying the most commonly used modern public key cryptosystems. Topics include the Euclidean Algorithm, Fermat's Little Theorem, the Chinese Remainder Theorem, Möbius Inversion, the RSA Cryptosystem, the Elgamal Cryptosystem and the Diffie-Hellman Protocol. Issues of computational complexity are also discussed.

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 Mathematics units **Prohibitions:** MATH2011 or MATH2009 or 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).

MATH2070
Optimisation and Financial Mathematics

Credit points: 6 **Session:** Semester 2 **Classes:** Three 1 hour lectures, one 1 hour tutorial and one 1 hour computer laboratory per week. **Prerequisites:** (MATH1X21 or MATH1011 or MATH1931 or MATH1X01 or MATH1906) and (MATH1014 or MATH1X02) **Prohibitions:** MATH2010 or MATH2033 or MATH2933 or MATH2970 or ECMT3510 **Assumed knowledge:** MATH1X23 or MATH1933 or MATH1X03 or MATH1907 **Assessment:** One 2 hour exam, assignments, quiz, project (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Students may enrol in both MATH2070 and MATH3075 in the same semester

Problems in industry and commerce often involve maximising profits or minimising costs subject to constraints arising from resource limitations. The first part of this unit looks at programming problems and their solution using the simplex algorithm; nonlinear optimisation and the Kuhn Tucker conditions.

The second part of the unit deals with utility theory and modern portfolio theory. Topics covered include: pricing under the principles of expected return and expected utility; mean-variance Markowitz portfolio theory, the Capital Asset Pricing Model, log-optimal portfolios and the Kelly criterion; dynamical programming. Some understanding of probability theory including distributions and expectations is required in this part.

Theory developed in lectures will be complemented by computer laboratory sessions using MATLAB. Minimal computing experience will be required.

PSYC1002
Psychology 1002

Credit points: 6 **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 2.5hr exam, one 1000 word research report, multiple tutorial tests, experimental participation (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: This unit is also offered in the Sydney Summer School. For more information consult the web site: http://sydney.edu.au/summer/

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: neuroscience; human mental abilities; learning and motivation; 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

Available on-line once semester commences

QBUS3330
Methods of Decision Analysis

Credit points: 6 **Session:** Semester 2 **Classes:** 1 x 2hr lecture and 1 x 1hr tutorial per week **Prerequisites:** BUSS1020 or DATA1001 or ECMT1010 or ENVX1001 or ENVX1002 or STAT1021 or ((MATH1005 or MATH1015) and MATH1115) or 6 credit points of MATH units which must include MATH1905. **Prohibitions:** QBUS2320; ECMT2630; ENGG1850; CIVL3805 **Assessment:** assignment 1 (10%), assignment 2 (10%), mid-semester exam (30%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This introductory unit on decision analysis addresses the formal methods of decision making. These methods include measuring risk by subjective probabilities; growing decision trees; performing sensitivity analysis; using theoretical probability distributions; simulation of uncertain events; modelling risk attitudes; estimating the value of information; and combining quantitative and qualitative considerations. The primary goal of the unit is to demonstrate how to build models of real business situations that allow the decision maker to better understand the structure of decisions and to automate the decision process by using computer decision tools.

QBUS2810
Statistical Modelling for Business

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** 1x 2hr lecture and 1x 1hr tutorial per week **Prerequisites:** 2018 Commencing students: QBUS1040; 2018 continuing students: BUSS1020 or DATA1001 or ECMT1010 or ENVX1001 or ENVX1002 or STAT1021 or ((MATH1005 or MATH1015) and MATH1115) or 6 credit points of MATH units which must include MATH1905. **Prohibitions:** ECMT2110 **Assumed knowledge:** This unit relies on mathematical knowledge at the level of the Maths in Business program, including calculus and matrix algebra. Students who do not meet this requirement are strongly encouraged to acquire the needed mathematical skills prior to enrolling in this unit. **Assessment:** individual assignment 1 (5%); individual assignment 2 (10%); individual assignment 3 (5%); group project (25%); mid-semester exam (20%); final exam (35%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Statistical analysis of quantitative data is a fundamental aspect of modern business. The pervasiveness of information technology in all aspects of business means that managers are able to use very large and rich data sets. This unit covers a range of methods to model and analyse the relationships in such data, extending the introductory methods in BUSS1020. The methods are useful for detecting, analysing and making inferences about patterns and relationships within the data so as to support business decisions. This unit offers an insight into the main statistical methodologies for modelling the relationships in both discrete and continuous business data. This provides the information requirements for a range of specific tasks that are required, e.g. in financial asset valuation and risk measurement, market research, demand and sales forecasting and financial analysis, among others. The unit emphasises real empirical applications in business, finance, accounting and marketing, using modern software tools.

QBUS2820
Predictive Analytics

Credit points: 6 **Session:** Semester 2 **Classes:** 1x 2hr lecture and 1x 1hr tutorial per week **Prerequisites:** QBUS2810 or ECMT2110 or DATA2002 **Assumed knowledge:** This unit assumes mathematical knowledge at the level of the Maths in Business program (including calculus and matrix algebra) and basic computer programming skills at the level of QBUS2810. **Assessment:** assignment 1 (20%), assignment 2 (20%), mid-term exam (20%), final exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Predictive analytics are a set of tools to enable managers to exploit the patterns found in transactional and historical data. For example major retailers invest in predictive analytics to understand, not just consumers' decisions and preferences, but also their personal habits, so as to more efficiently market to them. This unit introduces different techniques of data analysis and modelling that can be applied to traditional and non-traditional problems in a wide range of areas including stock forecasting, fund analysis, asset allocation, equity and fixed income option pricing, consumer products, as well as consumer behaviour modelling (credit, fraud, marketing). The forecasting techniques covered in this unit are useful for preparing individual business forecasts and long-range plans. The unit takes a practical approach with many up-to-date datasets used for demonstration in class and in the assignments.

SOFT2201
Software Construction and Design 1

Credit points: 6 **Session:** Semester 2 **Classes:** lectures, laboratories **Prerequisites:** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 **Prohibitions:** INFO3220 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces the foundations of software design and construction. It covers the topics of modelling software (UML, CRC, use cases), software design principles, object-oriented programming theory (inheritance, polymorphism, dynamic subtyping and generics), and simple design patterns. The unit aims to foster a strong technical understanding of the underlying software design and construction theory (delivered in the lecture) but also has a strong emphasis of the practice, where students apply the theory on practical examples.

SOFT2412
Agile Software Development Practices

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories, Project Work - own time **Prerequisites:** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit builds students skills to follow defined processes in software development, in particular, working in small teams in an agile approach. Content covers the underlying concepts and principles of software processes, their analysis, measurement and improvement. Students will practice with a variety of professional-strength tool support for the practices that ensure quality outcomes. The unit requires students to enter already skilled in individual programming; instead this unit focuses on the complexities in a team setting.

WORK1004
Foundations of Management

Credit points: 6 **Session:** Semester 2 **Classes:** 1 x 2 hour lecture and 1 x 1 hour tutorial per week **Prohibitions:** WORK2201 **Assessment:** practice quiz (5%), main quiz (15%), group presentation and facilitation (15%), individual analysis and reflection (15%), tutorial participation (10%), final exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is a foundational unit in the Management and IR&HRM subject areas. An introductory overview of management methods and approaches is provided which forms the basis of study for an advanced specialisation in management. The unit examines management as a process of planning, organising, leading and controlling the efforts of organisational members and discusses how recent trends such as globalisation, economic change and the effects of new technology have led to profound changes in how organisations are managed. The unit explores these issues with respect to both large and small, public and private, and domestic and foreign organisations.

WORK2210
Strategic Management

Credit points: 6 **Session:** Semester 1 **Classes:** 2 x 1hr lectures and 1x 1hr lab time **Prerequisites:** 40 credit points worth of units of study **Assessment:** case simulation (40%), case study report (25%), final exam (35%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit explores how strategy is formulated, implemented and evaluated. Strategic management concepts, frameworks and tools are applied to organizational case studies. Current debates in strategic management are evaluated for their relevance to strategists in a range of organizational contexts.

WORK2218
Managing Organisational Behaviour

Credit points: 6 **Session:** Semester 2 **Classes:** 1x 2 hour lecture and 1x 1 hour tutorial hour per week **Prerequisites:** 24 Junior credit points **Assessment:** quiz 1 (5%), quiz 2 (15%), written assignment (part 1)(15%), written assignment (part 2)(15%), group presentation (10%), group report (10%), final exam (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to give students the ability to understand how organisations operate. As an introductory organisational behaviour unit, it covers key debates across a range of social science disciplines including business, management, psychology, sociology, and communication studies. Key topics explored include power, control, networks, and organisational culture.

WORK3205
Organisational Communication

Credit points: 6 **Session:** Intensive July, Semester 2 **Classes:** 1 x 2hr lecture and 1 x 1hr tutorial per week **Prohibitions:** WORK2221 **Assessment:** tutorial attendance and participation (10%), communication analysis report (30%), team case analysis report (15%), team case analysis presentation (10%), final exam (35%) **Mode of delivery:** Normal (lecture/lab/tutorial) day, Block mode

Communication is integral to many organisational processes; for instance, effective planning, decision-making, negotiation, conflict management, change management and leadership all rely upon effective communication by organisational actors. At the same time, organisational communication has become more complex due to increasing levels of diversity in the workplace and an increasing reliance on emergent and rapidly changing communication technologies. Drawing on communication research models, theories and case studies, this unit provides students with insight into how to manage the complexities of contemporary organisational communication. The unit focuses primarily on internal organisational communication and examines communication processes at various levels: interpersonal (dyadic), group and organisation.

WORK3202
Leadership

Credit points: 6 **Session:** Semester 1 **Classes:** 1 x 2 hour lecture and 1 x 1 hour tutorial per week **Prohibitions:** WORK2222 **Assessment:** group assessment (30%), reflective essays (30%), final exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Leadership is increasingly seen to be a key factor affecting the performance of contemporary organisations and is an important area of study in the fields of management and organisational behaviour. While leadership principles are often associated with the work of senior management, they also have potential application to all members of organisations. This unit explores conventional and alternative perspectives on leadership and also examines the practice of leadership in diverse organisational contexts. Practitioner perspectives, experiences and case studies of business leaders are also presented.

Alternative elective units may be taken with approval of the Head of School.

Project Management Honours

A candidate for Honours in Project Management must enrol in the following Honours Project units:

PMGT4850
Project Management Honours Project A

Credit points: 12 **Session:** Semester 1, Semester 2 **Classes:** Research, Lectures, Meetings **Prerequisites:** Students are required to achieve a minimum 65% average mark in the 2000-level and 3000-level or higher 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 Director)

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 **Classes:** Lectures, Meeting, Research **Prerequisites:** Students are required to achieve a minimum 65% average mark in the 2000-level and 3000-level or higher 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.

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Candidates for Honours in Project Management must select 24 credit points from the following list of electives.

PMGT5875
Project Innovation Management

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, E-Learning **Assessment:** Through semester assessment (100%) **Mode of delivery:** Block mode, Online

Innovation is widely-recognised as a major driver of economic growth. Yet innovation projects can be difficult to manage: they typically involve a high level of uncertainty, and many organisations are unsatisfied with the level of innovation they achieve. In this unit of study, we focus on issues in the management of innovation projects at the individual project level, organisational level and across networks of organisations. Since a systematic approach can and does improve our effectiveness in managing innovation, we begin by exploring several different process models of the stages through which innovation projects are managed. We discuss context and challenges which impact such projects, as well as the concepts of creativity and intellectual property management. Using focused case studies, we analyse best practice in the structures and processes that organisations can provide to enable innovation, as well as to support the search, selection, implementation, dissemination, feedback and evaluation stages of their innovative projects. We also examine the impact of networks on innovation (e.g. collaboration networks), national innovation policies and systems, and trends towards open innovation.

PMGT5876
Strategic Delivery of Change

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Seminars, E-Learning **Prohibitions:** WORK6026 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Online, Normal (lecture/lab/tutorial) day

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 and storytelling. You will learn quite a bit about these ideas 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: be they in private, public or third sector.

PMGT5879
Strategic Portfolio and Program Management

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lectures, Tutorials, E-Learning **Assessment:** Through semester assessment (100%) **Mode of delivery:** Block mode, 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:** Lectures, Tutorials **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) evening

Note: Department permission required for enrolment.

Students should achieve an understanding of dynamical systems methods applied to complex adaptive systems (CAS). CAS is a new approach to engineering and management that studies and models how relationships between parts give rise to collective and dynamic system-level behaviours, for example, in communication and transport networks, megaprojects, social and eco-systems. Effectively implemented, the methods can dramatically improve a manager's effectiveness in today's complex and interconnected business world, by helping to predict and evaluate indirect effects of actions and policies. This course provides managers with many practical quantitative tools to enhance individual, team, and organisational learning, change, and performance.

PMGT6867
Quantitative Methods: Project Management

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lectures, Tutorials, E-Learning **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 (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) evening, 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 unit 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 2000-level and 3000-level or higher units of the above program to be eligible for entry to Honours.2. Students undertaking the Honours program may enrol in alternative postgraduate Project Management units with permission of the Program Director.

For a standard enrolment plans for the various Project Management streams visit CUSP https://cusp.sydney.edu.au

Engineering unit of study descriptions

ENGG – Engineering unit of study descriptions

ENGG1000
History and Philosophy of Engineering

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lectures, Tutorials, E-Learning, Independent Research **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 fulfill 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.

ENGG1111
Integrated Engineering 1

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lectures, Tutorials **Prohibitions:** ENGG1803 or ENGG1061 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Integrated Engineering 1 is an introductory Unit of Study within the Faculty of Engineering and Information Technologies. It aims to provide commencing undergraduate engineering students with an understanding of the nature and diversity of engineering practice and begin the development of a set of intellectual tools for integrating their ongoing personal, academic, and professional development.

The unit highlights foundational engineering and professional practice skills, and the application of these skills to real world projects and workplace practice. It demonstrates the role that various professional and academic competencies play in the ability to manage contemporary professional engineering issues. The students are introduced to the Engineers Australia (EA) competency standards as one framework for evaluating their professional development, and students establish a preliminary portfolio which includes a self-assessment of their current understanding and capabilities against this framework. This portfolio will then be maintained and evolved throughout (and ideally beyond) their degree as a way of demonstrating current competencies and planning future development. This component also considers the way in which the diverse elements of their degree integrate together synergistically to establish emergent professional capabilities.

In developing knowledge of the discipline, students enhance their capacity for lifelong learning through critical reflection and self-assessment, creating and monitoring career goals as well as building a sense of responsibility for their learning. Through case studies, design projects and challenges, students expand their communication skills, develop competency in team-based problem solving and in creating innovative solutions, as well as apply critical thinking and inquiry. The activities encourage the development of research skills, experience of the engineering design process, leading and managing projects, and the significance of ethics, safety and sustainability.

Dalyell students may enrol in ENGD1000 Building a Sustainable World in place of ENGG1111

ENGG1800
Introduction to Engineering Disciplines

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratories **Prohibitions:** CIVL1900 OR CHNG1108 OR MECH1560 OR AERO1560 OR AMME1960 OR MTRX1701 OR ENGG1960 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit gives a brief introduction to a range of specialisations in Engineering including Aeronautical, Biomedical, Chemical, Civil, Mechanical, Electrical and Information Engineering. First-year students have the opportunity to experience aspects of each engineering stream and thus be able to better select which area they wish to pursue in their future studies. There are four Schools in the Faculty and each School will deliver a three-week module covering its specialisations.

School of Chemical and Biomolecular Engineering.

This module enables students to gain an appreciation of the methods in transforming raw materials to value-added products. Students gain an insight into the application of the basic principles of chemistry, mathematics, material and energy balance in assessing and designing processes, operations and maintenance and safety requirements and procedures. This is achieved through a project based activity that involves a paper-based study of a process followed by construction and testing of performance.

School of Civil Engineering.

Introductory lectures in Engineering Economics and Construction Planning, Foundation Engineering, Structural Engineering, Materials, Environmental Engineering. Each student is involved in the erection and dismantling of several Scaled Model Structures in the Civil Engineering Courtyard. Preliminary lectures related to the models include safety issues, loading, static analysis, foundation calculations, construction management, engineering drawings and detailing, geometric calculations, and survey measurements. Exercises related to these issues are performed before assembly and disassembly of the models.

School of Electrical and Information Engineering.

Overview of Electrical Engineering, Basic circuit analysis: circuits, currents and voltages: Power and Energy; Ohms law, KCL, KVL. Resistive circuits: Resistance in series and parallel; voltage divider and current divider circuits. Introduction to digital systems: Basic logic circuit concepts, Synthesis of logic circuits, Sequential logic circuits. Microcomputers: Computer Organisation, Memory types, Digital process control, assembly language and programming. There are laboratory exercises based on the above topics.

School of Aerospace, Mechanical and Mechatronic Engineering (AMME).

AMME has four degree streams: Aerospace, Mechanical, Biomedical and Mechatronics. Two or three of these streams are covered during this module in any year.

Mechanical Engineering demonstrates aspects of mechanical design and manufacturing techniques with a hands-on building task. Aerospace has a lecture on fundamentals of aircraft design. And a hands-on Design-Build-Test task where students work in small teams to gain an introduction to lightweight structures, aerodynamics and flight stability and control. Mechatronics covers software control of machines, including basic electronic knowledge with examples, concepts of software and hardware integration. Group based activity is to design and implement a simple mechatronics system using a Mindstorm Lego set. Biomedical engineering provides a hands-on design project to develop a joint replacement concept. The design process captures inputs such as joint range of motion considerations, biomaterials selection, manufacturing route, design risk analysis.

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ENGG1801
Engineering Computing

Credit points: 6 **Session:** Semester 1, Summer Main **Classes:** Lectures, Tutorials **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces students to solving engineering problems using computers. Students learn how to organise data to present and understand it better using a spreadsheet (Excel), and also how to instruct the computer exactly what to do to solve complex problems using programming (Matlab). Real engineering examples, applications and case-studies are given, and students are required to think creatively and solve problems using computer tools.

Matlab will cover three-quarters of the unit. The remaining one-quarter will be devoted to the use of Excel in engineering scenarios. Furthermore, cross integration between Matlab and Excel will also be highlighted.

No programming experience is required or assumed. Students are assumed to have a basic understanding of mathematics and logic, and very elementary computing skills.

ENGG1802
Engineering Mechanics

Credit points: 6 **Session:** Intensive January, Semester 2, Summer Main **Classes:** Lectures, Tutorials **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

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 visualisation 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.

ENGG1805
Professional Engineering and IT

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratories, Project Work - own time **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

ENGG1805 aims to introduce students to the fundamental principles that underlie professional practice in information technologies. It lays the foundation for later studies, and presents to the students challenges common to a multidisciplinary IT environment. The subject also provides students with the opportunity to develop important attributes such as communication skills, an understanding of professional ethics, and of working as a part of a team. Tool use is an important aspect of this unit: students are required to learn to use tools for testing, managing artefacts, planning and completing work, and communicating within the team. A selection of guest speakers will address students on different career paths.

ENGG1813
Engineering Critical Thinking

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Workgroups **Assessment:** Through semester assessment (80%) and Final Exam (20%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit concentrates on the rigors of communication in an engineering context including technical writing, teamwork, formal presentations and critical analysis. It is a precursor to ENGG1803 Professional Engineering 1 for students with a non-English speaking background in degrees that have a free elective available to students, and takes the place of one free elective. Students who enrol in this unit in 1st year will defer ENGG1803 Professional Engineering to 2nd year.

Aims: The Unit concerns critical thinking and Intensive English language (in an engineering context) aimed at building skills and confidence in students so that they better engage in the educational process at Sydney University by:

- Enhancing student ability to meet the challenges of study in Engineering in the Australian university context.

- Intensive focus on the language of Engineering in English.

- Developing cross-cultural awareness with a focus on consolidating the essential facets and practices in the tradition of science and research-based skills of sound reasoning.

- Increasing critical thinking capacity and preparing students for engaged enquiry in an Engineering context.

ENGG1850
Introduction to Project Management

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Laboratories **Prohibitions:** CIVL3805 or QBUS2350 **Assessment:** Through semester assessment (50%) and 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.

ENGG2005
Engineering Studies C

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

Note: Department permission required for enrolment.

Special project specified for individual requirements.

ENGG2062
Engineering Project: Business Plan 2 Adv

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Project Work - in class, Project Work - own time, Research, Presentation **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.

ENGG2111
Integrated Engineering 2

Credit points: 2 **Session:** Intensive February, Semester 2 **Classes:** Lectures, Tutorials **Prerequisites:** ENGG1111 or ENGG1061 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The aim of this unit is to enhance the capacity of students to assess, plan improve and evaluate their learning needs in relation to becoming a professional engineer. This unit will continue the development of both academic and professional skills through relevant and authentic activities and a project. Integrated Engineering 2 (ENGG2111) will use management and projects as a perspective to explore engineering approaches to addressing open-ended problems. The unit requires students to engage in a project that requires a degree of independence, innovation, resilience and resourcefulness as well as to investigate key skills associated with managing projects and relate these to national and global employability skills.

The project raises awareness about the complexity of engineering in that problems may be vague or ambiguous with no clear right or wrong answers, and students are encouraged to explore and critique ideas, use logical problem solving, and reflect on the process and decisions made with the explicit purpose of becoming critical thinkers. There are two main components: projects and professional development. Students learn project management skills which are then applied to a project. The professional development aspect involves students rating themselves and their peers on teamwork skills, including communication and conflict resolution. Achievements throughout the semester are documented for presentation in the students' e-portfolio. By the end of the semester students are expected to have a well-developed career concept that aligns with engineering competencies.

ENGG2850
Introduction to Project Finance

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Laboratories **Prohibitions:** CIVL3812 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is a theory and case study based unit 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 unit 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:** Intensive January, Semester 1 **Classes:** Lectures, Tutorials, Laboratories **Prerequisites:** ENGG1850 AND (MATH1011 OR MATH1001 OR MATH1021 OR MATH1901 OR MATH1921) AND (MATH1002 OR MATH1902) AND (MATH1013 OR MATH1003 OR MATH1023 OR MATH1903 OR MATH1923) AND (MATH1015 OR MATH1005 OR MATH1905) **Assessment:** Through semester assessment (50%) and 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 organisation 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:** Lectures, Tutorials, Laboratories **Prerequisites:** ENGG1850 AND (PSYC1002 OR PMGT1852) **Assessment:** Through semester assessment (100%) **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 unit, we offer a succinct, lively and robust introduction to the subject of organisational 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:** Lectures, Laboratories, Tutorials **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 unit 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 unit 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.

ENGG3062
Technology Education (Advanced)

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

Note: Department permission required for enrolment.

This unit 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 unit 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.

ENGG3111
Integrated Engineering 3

Credit points: 2 **Session:** Semester 1 **Classes:** Lecture, Tutorial, Independent Study, Workshop, E-Learning, **Prerequisites:** ENGG2111 AND (84cp UoS from Engineering) **Prohibitions:** ENGG3062 **Assessment:** Portfolio 70%, Writing - Technical 20%, Oral Presentation 10% **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit focuses on the development of students' abilities with respect to creativity and engineering design through project work and self guided learning building on achievements of the previous semester. Students explore the generation of alternative solutions in design such as lateral thinking, brainstorming, TRIZ, synectics and evaluate these alternatives. In preparation for industry experience, students evaluate their values, those of social responsibility and sustainable development relating these to engineering frameworks, such as the Professional Performance Innovation and Risk Protocol (PPIR), developed by the Warren Centre for Advanced Engineering at the University.

There are two main areas of work. One is where students work in groups on a project to be completed by the end of semester. The other is a self managed component in which students complete a number of workshops and online modules over the year that align with their individual learning plans. Workshops consist of an online module and a face-to-face session. Achievements over the year are documented for presentation in the student portfolio. The portfolio is also used for self and peer assessment. By the end of the year students are expected to have a well developed portfolio containing a CV and evidence of achievement of a set of Engineering Australia Stage 1 competencies demonstrating a commitment to continuing professional development.

ENGG3800
Industry and Community Projects

Credit points: 6 **Session:** Semester 1 **Classes:** E-Learning, Seminars, Project Work - own time **Assessment:** through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit is designed for third year students to undertake a project that allows them to work with one of the University's industry and community partners. Students will work in teams on a real-world problem provided by the partner. This experience will allow students to apply their academic skills and disciplinary knowledge to a real-world issue in an authentic and meaningful way. Participation in this unit will require students to submit an application.

ENGG3853

Project Risk Management Tools and Techniques

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Laboratories **Prerequisites:** ENGG2851. **Prohibitions:** CIVL4810 **Assessment:** Through semester assessment (60%) and Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Managing risk is an essential skill to be a successful project manager. This course will provide students with an understanding of what is risk and the key principles of risk management as described in AS/NZS ISO 31000: 2009. The course will show how these principles can be applied to project management both through the project development phase and the project delivery phase. This will include skills on how to measure and value risk and assess the potential impacts it may have on a project outcomes using qualitative and quantitative risk assessment techniques. Using case studies students will learn ways to treat risk to minimise the potential impact. The course will also cover techniques for establishing levels of risk appetite and risk tolerance. It will overview risk reporting tools and templates and conclude with a session on human behaviour and how this impacts on risk acceptance and risk aversion in a project context.

On successful completion of this course students will have a good understanding of the basic principles of risk and risk management, be able to apply risk assessment and treatment techniques, be able to quantify potential risk impacts and to establish a prioritised project risk register.

ENGG3854

Negotiating and Contracting

Credit points: 6 **Session:** Semester 2, Summer Main **Classes:** Lectures, Laboratories, Tutorials **Prerequisites:** ENGG1850 AND ENGG2850 AND ENGG2852. **Prohibitions:** CIVL3813 or CIVL4813 **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

In this unit, 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 unit 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 unit further contains coverage on forming contracts, restitution, contract interpretation, modification and dispute resolution. We also discuss remedies, performance, and third-party beneficiaries.

ENGG4000

Practical Experience

Session: Intensive April, Intensive August, Intensive December, Intensive February, Intensive January, Intensive July, Intensive June, Intensive March, Intensive May, Intensive November, Intensive October, Intensive September **Classes:** Practical Experience **Prerequisites:** 36 credits of at least 3rd year units of study **Prohibitions:** ENGP1000 OR ENGP2000 OR CHNG4811 OR AMME4010 OR ELEC4714 OR ENGG5217 **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 BE requires students to obtain industrial work experience of twelve weeks duration (60 working days) or its equivalent towards satisfying the requirements for award of the degree. Students are recommended to undertake their work experience in the break between Year 3 and 4, however any engineering work taken after Year 2 may be accepted for the requirements of this unit.

Students must be exposed to professional engineering practice to enable them to develop an engineering approach and ethos, and to gain an appreciation of engineering ethics. and to gain an appreciation of engineering ethics.

The student is required to login to Sonia and start your Practical experience proposal applications. Assessment in this unit is by the submission portfolio containing written reports on the involvement of industry. Assessments is via Sonia. For details of the reporting requirements, go to the faculty's Practical Experience website http://sydney.edu.au/engineering/practical-experience/index.shtml. Students normally enrol in ENGG4000 after completing the practical work and will be assessed via written submission.

ENGG4061

Innovation/Technology Commercialisation

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Project Work - in class, Project Work - own time **Assumed knowledge:** Advanced competence in technical engineering and moderate competence in professional engineering and management **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study is designed as a 'Master Class' for final year Engineering students to grapple with the challenges of engaging in, facilitating and managing innovation and technology commercialisation. Key learning outcomes are: developing an understanding of the processes of management, and in particular of innovation, dealing with uncertain and inadequate information, how to communicate effectively to and motivate a group of people to work out what to do, and how to do it.

Content will include the challenges of modern management; understanding of the new rules of international competitiveness; effects of globalisation on Australia's economic performance; the competitiveness of Australian firms; the generation of employment and wealth; the changing requirements of the engineer; the engineer as manager and strategist; the role of innovation in business management; product innovation and commercialisation; IP recognition and management; starting a high-tech company.

ENGG4064
Advanced Engineering Design A

Credit points: 6 **Session:** Semester 2 **Classes:** Project Work - own time **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 optimisation, 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 **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 This Unit is an extension of the ENGG4064 unit of study and exists to allow students to extend the work they do in ENGG4064 and penetrate much more deeply into the subject in hand, so that it becomes much more like a thesis. The nature of these advanced engineering courses meaning the subject matter is negotiated every year The project in mind has to be amenable to extension in this way so agreement with the course coordinator needs to be sought at an early stage by anyone considering this unit. 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 optimisation, Equipment design and costing, Hazard assessment, Environmental Impact Assessment, Project financial Analysis, Business planning.

ENGG4111
Integrated Engineering 4

Credit points: 2 **Session:** Semester 2 **Classes:** Lecture, Tutorial, Workshop, E-Learning **Prerequisites:** ENGG2111 AND (84cp UoS from Engineering) **Prohibitions:** ENGG4064 OR ENGG4065 **Assessment:** Other 50%, Portfolio 50% **Mode of delivery:** Normal (lecture/lab/tutorial) day

At this level, students are expected to work autonomously and collaboratively to generate innovative designs and solutions, and are conscious of the responsibilities and accountabilities of engineers and of directing the development of professional skills. The focus for this unit is on fostering systems thinking skills where students are encouraged to approach problems holistically, drawing together the disparate elements of their developing capacities, and show how the nature and boundaries are understood in order to formulate technically sound solutions as well as address broader needs. Through a number of activities, students are provided opportunities to demonstrate skills in leadership, implement innovative design solutions, and mentor others.

Students prepare for the transition from 4th year to post-graduate or employment assessing choices, refining options through a well developed, strategically focused academic or career plan. By the end of the year students are expected to have a sophisticated portfolio demonstrating achievements in alignment with Engineering Australia Stage 1 competencies thus demonstrating a commitment to the profession and capacity to achieve chartered engineering status.

ENGP1000
Professional Engagement Program 1

Session: Semester 1, Semester 2 **Classes:** practical experience **Prohibitions:** ENGG4000 OR ENGG5217 **Assessment:** through semester assessment (100%) **Mode of delivery:** Professional practice

The BEHonours degree (and all associated combined degrees) requires all students to develop a deep understanding of the professional and social contexts in which their engineering knowledge can be applied, and how this context shapes the application of their knowledge. This involves a strong engagement with the practice of their profession and ensuring that they are responsive to the needs and context of industry and community. This engagement is met through the completion of the PEP - Professional Engagement Program - a degree-long integrated program of professional development activities that involves students in contextualising their learning, progressively taking greater responsibility for their own development, and building the foundations of a strong professional engineering career.

Once students have completed the requirements of the first stage of the Professional Engagement Program they will pass PEP1.

ENGP2000
Professional Engagement Program 2

Session: Semester 2 **Classes:** practical experience **Prerequisites:** ENGP1000 **Prohibitions:** ENGG4000 OR ENGG5217 **Assessment:** through semester assessment (100%) **Mode of delivery:** Professional practice

The BEHonours degree (and all associated combined degrees) requires all students to develop a deep understanding of the professional and social contexts in which their engineering knowledge can be applied, and how this context shapes the application of their knowledge. This involves a strong engagement with the practice of their profession and ensuring that they are responsive to the needs and context of industry and community. This engagement is met through the completion of the PEP - Professional Engagement Program - a degree-long integrated program of professional development activities that involves students in contextualising their learning, progressively taking greater responsibility for their own development, and building the foundations of a strong professional engineering career.

Once students have completed the requirements of the second stage of the Professional Engagement Program they will pass PEP2.

ENGD1000
Building a Sustainable World

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** lectures, tutorials **Prohibitions:** ENGG1111 OR INFO1111 **Assumed knowledge:** HSC Mathematics Extension 1 and HSC studies in one or more Science subjects. Students must have an ATAR equivalent score of at least 98 and faculty permission **Assessment:** through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Real engineering in 1st year! The course is designed to introduce Dalyell students to the essential professional engineering skills of leadership, communication, problem identification and solution, design, teamwork, project management 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.

ENGP3000 and ENGD2000 will be available from 2019.

Aerospace Engineering unit of study descriptions

AERO – Aerospace Engineering unit of study descriptions

AERO1400
Intro to Aircraft Construction and Design
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Workshops **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

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.

AERO1560
Introduction to Aerospace Engineering
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Workshops/ PC Labs **Prohibitions:** ENGG1800 OR MECH1560 OR MTRX1701 OR CIVL1900 OR CHNG1108 OR AMME1960 OR ENGG1960 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study 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 tools that they are expected to apply their engineering knowledge to, during their aerospace engineering profession. Experiential learning is facilitated through developing skills with machine and hand tools; solid modelling; and microcontrollers in a supervised environment, to develop fundamentals of practical aerospace vehicle component design, manufacture, control, servicing, and repair.

Manufacturing Technology: An overview of a range of processes related to the design and manufacture of aerospace components is provided through hands-on experience. Manufacturing Technology practical work is undertaken in: (a) Hand tools, Machining, and Fibreglassing - an introduction to basic manufacturing processes used to fabricate aerospace engineering hardware. Safety requirements: All students are required to provide their own personal protective equipment (PPE) and comply with the workshop safety rules provided in class. 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. (b) Solid Modelling - the use of computer aided design (CAD) tools to model geometry and create engineering drawings of engineering components. (c) Microcontrollers - ubiquitous in modern engineered products - will be introduced through experiential learning with development kits.

AERO2703
Aircraft Performance and Operations
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Prerequisites:** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923) AND ENGG1801 **Assumed knowledge:** AERO1560 or ENGG1800, Familiarity with fundamental Aerospace concepts. **Assessment:** Through semester assessment (50%) and 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 and performance of aircraft. The students will acquire an ability to make accurate and meaningful measurements of take-off, climb, cruise, turn, descent and landing performance; to perform weight and balance calculations; to understand the use of aerodynamic derivatives and their impact on aircraft 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.

AERO2705
Space Engineering 1
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Prerequisites:** (AERO1560 OR MECH1560 OR MTRX1701 OR ENGG1800) AND (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923). Entry to this unit requires that students are eligible for the Space Engineering Major. **Assumed knowledge:** ENGG1801. First Year Maths and basic MATLAB programming skills. **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

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.

AERO2711
Aerospace Engineering Project 1
Engineering and Information Technologies

Credit points: 6 **Session:** Intensive January, Intensive July, Semester 1, Semester 2 **Classes:** Meeting, Project Work - own time **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: Note 1: A WAM of > 75% is required as well as an Invitation from the Dean to participate in the Advanced Engineering Program. Note 2: 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 Aerospace 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, autonomous vehicle research, flight simulation research or advanced propulsion systems research.

AERO3260
Aerodynamics 1
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Laboratories, Lectures, Tutorials **Prerequisites:** (AMME2200 or AMME2261) **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%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study 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
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prerequisites:** AMME2200 or (AMME2261 and AMME2262) **Assumed knowledge:** Good knowledge of fluid dynamics and thermodynamics **Assessment:** Through semester assessment (55%) and Final Exam (45%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study 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.

AERO3360
Aerospace Structures 1
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prerequisites:** AMME2301 **Assessment:** Through semester assessment (45%) and 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 unit of study 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 principles 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
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Project Work - in class, Project Work - own time **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 familarity with the operating environment that must be considered when designing components; and understanding of some of the legal and ethical requirements of aircraft design engineers to give a basic understanding of the regulatory framework in which aircraft design is conducted.

AERO3465
Aerospace Design 2
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Prerequisites:** AMME2301 and MECH2400 **Assumed knowledge:** AERO1400 AND AMME2302 AND AMME1362 **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.

AERO3560
Flight Mechanics 1
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories **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%) and 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.

AERO3711
Aerospace Engineering Project 2
Engineering and Information Technologies

Credit points: 6 **Session:** Intensive January, Intensive July, Semester 1, Semester 2 **Classes:** Meeting, Project Work - own time **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: Note 1: A WAM of > 75% is required as well as departmental permission from the Space Engineering coordinator. Note 2: 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 Aerospace 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, autonomous vehicle research, flight simulation research or advanced propulsion systems research.

AERO3760
Space Engineering 2
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Practical Experience **Prerequisites:** Students must have a 65% average in (AMME2500 AND AMME2261 AND AMME2301 AND AERO2705) OR (AMME2500 AND AMME2301 AND MTRX2700 AND AERO2705). Note: MUST have passed AERO2705 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study 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 unit 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.

AERO4260
Aerodynamics 2
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prerequisites:** AMME2200 OR AMME2261 **Assessment:** Through semester assessment (30%) and 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
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratories/Tutorials **Prerequisites:** AERO3360 **Assumed knowledge:** AERO3465 **Assessment:** Through semester assessment (55%) and 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; 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.

AERO4460
Aerospace Design 3
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Project Work - in class, Project Work - own time **Prerequisites:** AERO3260 and AERO3261 and AERO3360 and AERO3460 **Assumed knowledge:** AERO1400 and 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.

AERO4560
Flight Mechanics 2
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories **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%) and 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.

AERO4701
Space Engineering 3
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prerequisites:** [65% average in (AERO3460 AND AERO3360 AND AERO3560 AND AERO3760) OR (MECH3660 AND MECH3261 AND MECH3361 AND AERO3760) OR (MECH3660 AND AMME3500 AND MTRX3700 AND AERO3760)] AND [Must have passed AERO3760]. Students must have achieved a 65% average mark in 3rd year for enrolment in this unit. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to teach students the fundamental principles and methods of designing solutions to estimation and control problems in aerospace engineering applications. Students will apply learned techniques in estimation and control theory to solving a wide range of different problems in engineering such as satellite orbit determination, orbit transfers, satellite attitude determination, satellite positioning systems and remote sensing. Students will learn to recognise and appreciate the coupling between the different elements within an estimation and control task, from a systems-theoretic perspective. Students will learn to use this system knowledge and basic design principles to design and test a solution to a given estimation task, with a focus on aerospace applications (such as satellite remote sensing).

AERO4711
Aerospace Engineering Project 3
Engineering and Information Technologies

Credit points: 6 **Session:** Intensive January, Intensive July, Semester 1, Semester 2 **Classes:** Meeting, Project Work - own time **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: Note 1: A WAM of > 75% is required as well as departmental permission from the Space Engineering coordinator. Note 2: 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 Aerospace 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, autonomous vehicle research, flight simulation research or advanced propulsion systems research.

AERO5200
Advanced Aerodynamics
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **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

Objectives/Expected Outcomes: To develop a specialist knowledge in the fields of computational, non-linear and unsteady aerodynamics. The develop familiarity with the techniques for predicting airflow/structure interactions for aerospace vehicles.

Syllabus Summary: 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. Unsteady supersonic one-dimensional flow. Hypersonic flow; real gas effects. Introduction to the use of CFD for transonic flow.

AERO5206
Rotary Wing Aircraft
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Prerequisites:** (AERO3260 OR AERO9260) AND (AERO3560 OR AERO9560) **Assumed knowledge:** Concepts from 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.

AERO5400
Advanced Aircraft Design Analysis

Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Project Work - in class, Lectures, Meetings **Prerequisites:** AERO3460 or AERO5410 or AERO9460 **Prohibitions:** AERO4491 **Assumed knowledge:** Undergraduate level 1, 2 and 3 or Foundation Masters units in Aerospace Design are expected to have been completed before undertaking this unit. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study 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 covered 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 multidisciplinary 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
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prerequisites:** AERO5510 OR AERO9560 OR AERO3560 **Assumed knowledge:** BE in 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.

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
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lectures, Workgroup, Laboratories, Demonstration **Prerequisites:** AMME5510 OR AERO9560 OR (AERO2703 AND 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)
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Prerequisites:** (AERO3760 AND AERO4701) OR AERO9760 **Assumed knowledge:** AERO3760 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

Estimation techniques are applied to a wide range of aerospace systems. In this subject optimal estimation techniques will be presented as a collection of algorithms and their implementation.

AERO5750
Unmanned Air Vehicle Systems
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Project Work - in class **Assumed knowledge:** AERO1560, AERO1400, AMME2700, AERO3460, AERO3560, AERO3260, AERO3261 and AERO4460. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

Objectives/Expected Outcomes: To develop specialist knowledge and understanding of Unmanned Air Vehicle (UAV) systems. To be able to assess, evaluate and perform preliminary design analysis on complete UAV systems.

Syllabus summary: This course will focus on understanding UAVs from a system perspective. It will consider a variety of key UAV subsystems and look at how these interact to determine the overall effectiveness of a particular UAV system for a given mission. Based on this understanding it will also look at the evaluation and design of a complete UAV system for a given mission specification. Some of the primary UAV subsystems that will be considered in this course are as follows.

Airframe and Propulsion: The role of the basic airframe/propulsion subsystem of the UAV in setting operational mission bounds for different classes of UAVs, from micro UAVs, through to larger vehicles.

Flight Control and Avionics: Typical UAV primary flight control systems; Sensor requirements to support different levels of operation (eg auto-land vs remote-control landing etc. ,); Redundancy requirements.

Navigation: Navigation requirements; inertial navigation; aiding via use of GPS; strategies to combat GPS failures.

Typical Payloads: Electro-Optical (EO); Infra-Red (IR); Electronic Warfare (EW); Electronic Surveillance (ES); Radar and others. Payload stabilization and pointing accuracy requirements.

Air-Ground Communication Link: Typical Civilian and Military communication links. Range, Security, Bandwidth, Cost issues.

Ground Control Station(GCS): Air-vehicle monitoring; payload monitoring; data dissemination; control of multiple vehicles.

The course will also consider other general issues associated with modern UAV systems including multi-vehicle systems, certification of UAV systems and others. As part of the course students will spend 1 day operating a UAV system, with their own mission guidance/mission control software on board.

Chemical and Biomolecular engineering unit of study descriptions

CHNG – Chemical and Biomolecular Engineering unit of study descriptions

CHNG1103
Conservation of Mass and Energy
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Assessment:** Through semester assessment (50%) and 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.

Mass conservation 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 conservation includes 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.

CHNG1108
Introduction to Chemical Engineering
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Laboratories **Prohibitions:** ENGG1800 OR CIVL1900 OR MECH1560 OR AERO1560 OR AMME1960 OR MTRX1701 OR ENGG1960 **Assumed knowledge:** HSC Mathematics and Chemistry **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will introduce students to the profession of chemical engineering. It will give students an appreciation of the variety of the chemical and process industries, their history, the economic importance and the scale of their operations both in Australia and globally.

The unit will make use of virtual process plants and industrial leaders as guest speakers.

CHNG2801
Fluid Mechanics
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Laboratories, Presentation **Prerequisites:** CHNG1103 **Corequisites:** CHNG2802 OR AMME2960 **Assumed knowledge:** Calculus, Computations (Matlab, Excel), Mass and Energy Balances. **Assessment:** Through semester assessment (60%) and Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course covers the principal concepts and methods of fluid statics and fluid dynamics. The topics covered include dimensional analysis, fluid properties, conservation of mass and momentum, measurement of flow, and flow in pipes. The course provides an introduction to Computational Fluid Dynamics for the solution of flow regimes.

CHNG2802
Applied Maths for Chemical Engineers
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prerequisites:** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923) AND (MATH1005 OR MATH1015 OR MATH1905) AND CHNG1103 **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
Heat and Mass Transfer
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratories, Project Work - in class **Prerequisites:** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923) AND (MATH1005 OR MATH1905) AND CHNG1103 AND ENGG1801 **Corequisites:** (CHNG2802 OR AMME2960) AND CHNG2801 **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 (40%) and Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study teaches principles of heat and mass transfer required for chemical and biomolecular engineering. It covers steady and transient conduction and diffusion, convective transport of heat and mass, and radiative heat transfer.

It runs concurrently with CHNG2801 (Fluid Mechanics) to provide students with the tools and know-how to tackle engineering problems related to transport phenomena.

It includes project-based study components including a research project on heat transfer in food processing, a heat exchanger design project using engineering design software and a lab session on operation of a heat exchanger.

The integrated course structure helps students to develop a physical understanding of the underlying transport phenomena and gain the ability to solve real heat and mass transfer problems of engineering significance.

CHNG2804
Chemical Engineering Thermodynamics
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Prerequisites:** CHNG1103 AND (CHEM1101 OR CHEM1111) AND (CHEM1102 OR CHEM1112) **Corequisites:** (CHNG2805 AND CHNG2806) OR MECH2901 **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%) and 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 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 chemicalsystems in terms of state variables. The course delivery mechanism is problem-based, and examples from thermal and chemical processes will be considered, covering molecular to macro-systems scale. The course builds naturally from the second year first semester course in heat and mass transfer, 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
Engineering for a Sustainable Society
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Prerequisites:** CHNG1103 **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%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course involves the study of the fundamental concepts which underpin sustainable development, including technical and economic efficiency, environmental stewardship and social responsibility.

The course examines both the material and non-material economies from an engineering perspective. Tools such as life-cycle assessment, input-output analysis and multi-criteria decision analysis are examined and implications for resource and energy consumption, pollution and waste generation are analysed.

A number of governing sustainability frameworks are discussed to determine their suitability within the context of chemical and biomolecular engineering. A range of approaches and tools for determining the environmental impact of human activities on small and large scale are introduced as part of a sustainability framework. Energy production and use, and product design are investigated from a sustainability perspective.

CHNG2806
Separation Processes
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Practicals **Prerequisites:** CHNG1103 AND CHNG2803 **Corequisites:** CHNG2804 **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%) and Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will cover the general principles and the development of quantitative models of separation processes based on equilibrium and rate processes. Concepts of phase equilibria, transport phenomena and mass and energy balance will be used to model the separation units. Understanding of these principles will provide the basis for analysis and preliminary design calculations of large scale separation units of importance to manufacturing industries. The principles will be applied to units operations of distillation (binary, multicomponent), solvent extraction, absorption, adsorption and membrane processes

CHNG3041
Exchange Program 3A
Engineering and Information Technologies

Credit points: 24 **Session:** Semester 1, Semester 2 **Prerequisites:** 96 credit points in Chemical Engineering stream **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
Engineering and Information Technologies

Credit points: 24 **Session:** Semester 1, Semester 2 **Prerequisites:** 96 credit points in Chemical Engineering stream **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.

CHNG3043
Exchange Program 3C
Engineering and Information Technologies

Credit points: 6 **Session:** Intensive January, Intensive July **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: 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.

The unit is a Year 3 elective unit of study for the Bachelor degree in Chemical Engineering. The unit enables Chemical Engineering undergraduates to undertake an overseas learning activity during the university's winter break while completing the academic and professional requirements of the University of Sydney degree program. The learning activity may comprise either a short project under academic or industry supervision or summer or winter unit of study at an approved overseas institution. The learning activity should demonstrate outcomes and workload equivalent to a 6 credit point senior unit in the student's current award program.

CHNG3044
Exchange Program 3D
Engineering and Information Technologies

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

Note: 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.

The unit is a Year 3 elective unit of study for the Bachelor degree in Chemical Engineering. The unit enables Chemical Engineering undergraduates to undertake an overseas learning activity during the university's summer or winter break while completing the academic and professional requirements of the University of Sydney degree program. The learning activity may comprise either a short project under academic or industry supervision or summer or winter school unit of study at an approved overseas institution. The learning activity should demonstrate outcomes and workload equivalent to a 6 credit point senior unit in the student's current award program.

CHNG3801
Process Design
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratories, Project Work - in class **Prerequisites:** (CHNG2801 AND CHNG2802 AND CHNG2803 AND CHNG2804 AND CHNG2805 AND CHNG2806) OR (CHNG2801 AND CHNG2803 AND CHNG2804 AND AMME2960) **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%) and Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study teaches principles of particle technology and solid separation process required for chemical and biomolecular engineering.

It runs after CHNG2801 (Fluid Mechanics), CHNG2803 (Heat and Mass Transfer) and CHNG2806 (Separation Processes) to provide students with the tools and know-how to tackle unit operation tasks related to chemical engineering.

It also includes project-based study components including a research project on fluidisation of solid particles, a dyer design project and a lab session on chromatograph.

The integrated course structure helps students to develop a physical understanding of particle technology and solid separation process and gain the ability to solve problems of engineering significance.

CHNG3802
Control and Reaction Engineering
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prerequisites:** (CHNG2801 AND CHNG2802 AND CHNG2803 AND CHNG2804 AND CHNG2805 AND CHNG2806) OR (CHNG2801 AND CHNG2803 AND CHNG2804 AND AMME2960) **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%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The scope and importance of process control technology expands continuously with the growth of industrial automation. For this reason, knowledge of process control tools and theory is vital for chemical engineers involved in plant operation or design. This unit covers the development of linear models, control system analysis, the design and performance of feedback control systems, and the use of control related software. Skills developed in the unit include:

- Designing a feedback control system.
- Analysing the system's performance for a range of process applications using both traditional and software-based techniques.
- Designing common control enhancements.
- Appreciating the role, possibilities and limitations of process control tools and methods.

CHNG3803
Chemical/Biological Process Design

Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Project Work - in class **Prerequisites:** (CHNG2801 AND CHNG2802 AND CHNG2803 AND CHNG2804 AND CHNG2805 AND CHNG2806) OR (CHNG2801 AND CHNG2803 AND CHNG2804 AND AMME2960) **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%) and 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 knowledge of process modelling, the design of rate and equilibrium processes, the control of chemical processes and 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, designing individual items of equipment and designing small flowsheets.

CHNG3804
Biochemical Engineering
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Project Work - in class, Laboratories **Prerequisites:** (CHNG2801 AND CHNG2802 AND CHNG2803 AND CHNG2804 AND CHNG2805 AND CHNG2806) OR (CHNG2801 AND CHNG2803 AND CHNG2804 AND AMME2960) **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%) and 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.

CHNG3805
Product Formulation and Design
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, 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%) and 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
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **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
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Workgroups, Project Work - in class, Project Work - own time **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.

CHNG3808
Engineering Macromolecules and Nanocomposites
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prerequisites:** CHNG2801 AND CHNG2806 **Corequisites:** CHNG3802 **Assumed knowledge:** Knowledge of reaction engineering, fluid flow, heat transfer and mass transfer. **Assessment:** Through semester assessment (45%) and Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Macromolecules and composite materials find a wide range of applications from construction, food to biomedical engineering. A significant number of engineers are employed by the related industries. This unit of study will facilitate engagement with a broad spectrum of modern engineering principles that range from the synthesis of such materials to design of products and processes for a range of industries with an innovative approach. The unit will also enable an understanding of developing sustainable technologies with the materials for producing goods used within industries or by consumers. The industrial applications will range from chemical, biomedical to electronics and nanotechnology. New and emerging technologies will be compared with established operating models. The unit will be delivered through workshops, seminars, class work and project-based learning.

At the completion of this Unit of Study students should have developed: An appreciation of the underlying principles of engineering macromolecules and composites; 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; Self-directed learning skills including the ability to critically assess one's own performance in a constructive manner.

CHNG3809
Laboratory and Industrial Practice
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratories, Project Work - in class, Tutorials, Report Writing **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

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 unit will give students experience with examples drawn from the petrochemical, minerals, biotech, pharmaceutical and water industries.

In addition the unit will also give students an additional opportunity to apply the knowledge of experimental design, data analysis and statistics.

CHNG4041
Exchange Program 4A
Engineering and Information Technologies

Credit points: 24 **Session:** Semester 1, Semester 2 **Prerequisites:** 144 credit points in Chemical Engineering stream **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
Engineering and Information Technologies

Credit points: 24 **Session:** Semester 1, Semester 2 **Prerequisites:** Completion of all Year 1, 2 and 3 core units of study in Chemical Engineering stream, 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.

CHNG4203
Major Industrial Project
Engineering and Information Technologies

Credit points: 24 **Session:** Semester 1, Semester 2 **Classes:** Practical Experience **Prerequisites:** 144 CP prior study with >65% WAM **Prohibitions:** CHNG4811 OR CHNG4812 OR ENGG4000 OR CHNG4802 **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 full-time 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.

CHNG4802
Chemical Engineering Design A
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Site Visit **Prerequisites:** CHNG3801,CHNG3802, CHNG3803, CHNG3805, CHNG3806, CHNG3807 **Prohibitions:** CHNG4203 **Assumed knowledge:** CHNG3801 AND CHNG3802 AND CHNG3803 AND CHNG3805 AND CHNG3806 AND CHNG3807. 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

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
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Project Work - own time, Project Work - in class **Prerequisites:** CHNG4802 or CHNG4203 **Assumed knowledge:** CHNG3801 AND CHNG3802 AND CHNG3803 AND CHNG3805 AND CHNG3806 AND CHNG3807. 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

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 unit 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 units (Chemical Engineering Design A and B) run in first and second semester. The primary aim in the first unit 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 unit 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 but on a different schedule.

CHNG4811
Thesis A
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Meetings, Project Work - own time **Prerequisites:** CHNG3801, CHNG3802, CHNG3803, CHNG3805, CHNG3806, CHNG3807. **Prohibitions:** CHNG4813 OR CHNG4814 OR CHNG4203 **Assumed knowledge:** CHNG3801 AND CHNG3802 AND CHNG3803 AND CHNG3805 AND CHNG3806 AND CHNG3807. 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:** 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 project, involving both research and design, is an important skill for professional engineers. The final year thesis units (Thesis A and Thesis B) aim to provide students with the opportunity to carry out a defined piece of independent research and design that fosters the development of engineering skills. These skills include: the capacity to define a problem; carry out systematic research in exploring how it relates to existing knowledge; identifying the tools needed to address the problem; designing a solution, product or prototype; analysing the results obtained; and presenting the outcomes in a report that is clear, coherent and logically structured. The thesis is undertaken across two semesters of enrolment. Taken together, the Thesis A covers initial research into the background of the problem being considered (formulated as a literature review), development of a detailed proposal incorporating project objectives, planning, and risk assessment, preliminary design, modelling and/or experimental work, followed by the detailed work in designing a solution, performing experiments, evaluating outcomes, analysing results, and writing up and presenting the outcomes. The final grade is based on the work done in both Thesis A and B, and will be awarded upon successful completion of Thesis B. 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. For student who are completing a Major within their BE degree, the thesis topic must be within the area of the Major. The theses to be undertaken by students will very often be related to some aspect of a staff member's research interests. Some projects will be experimental in nature, others may involve computer-based simulation and analysis, feasibility studies or the design, construction and testing of equipment. All however will require students to undertake research and design relevant to the topic of their thesis. The 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 thesis must be the student's individual work although it may be conducted as a component of a wider group project. Students undertaking research on this basis will need to take care in ensuring the quality of their own research and design work and their individual 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 they have been in assessing their work and that of others. Students will also be required to present the results of their thesis to their peers and supervisors as part of a seminar program. Whilst thesis topics will be constrained by the available time and resources, the aim is to contribute to the creation of new engineering knowledge, techniques and/or solutions. Students should explore topics that arouse intellectual curiosity and represent an appropriate range and diversity of technical and conceptual research and design challenges.

CHNG4812
Thesis B
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Meetings, Project Work - own time **Corequisites:** CHNG4811 **Prohibitions:** CHNG4813 OR CHNG4814 OR CHNG4203 **Assumed knowledge:** CHNG3801 AND CHNG3802 AND CHNG3803 AND CHNG3805 AND CHNG3806 AND CHNG3807. 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 semester 1.

The ability to plan, systematically conduct and report on a major project, involving both research and design, is an important skill for professional engineers. The final year thesis units (Thesis A and Thesis B) aim to provide students with the opportunity to carry out a defined piece of independent research and design that fosters the development of engineering skills. These skills include: the capacity to define a problem; carry out systematic research in exploring how it relates to existing knowledge; identifying the tools needed to address the problem; designing a solution, product or prototype; analysing the results obtained; and presenting the outcomes in a report that is clear, coherent and logically structured. The thesis is undertaken across two semesters of enrolment. Taken together, the Thesis A covers initial research into the background of the problem being considered (formulated as a literature review), development of a detailed proposal incorporating project objectives, planning, and risk assessment, preliminary design, modelling and/or experimental work, followed by the detailed work in designing a solution, performing experiments, evaluating outcomes, analysing results, and writing up and presenting the outcomes. The final grade is based on the work done in both Thesis A and B, and will be awarded upon successful completion of Thesis B. 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. For student who are completing a Major within their BE degree, the thesis topic must be within the area of the Major. The theses to be undertaken by students will very often be related to some aspect of a staff member's research interests. Some projects will be experimental in nature, others may involve computer-based simulation and analysis, feasibility studies or the design, construction and testing of equipment. All however will require students to undertake research and design relevant to the topic of their thesis. The 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 thesis must be the student's individual work although it may be conducted as a component of a wider group project. Students undertaking research on this basis will need to take care in ensuring the quality of their own research and design work and their individual 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 they have been in assessing their work and that of others. Students will also be required to present the results of their thesis to their peers and supervisors as part of a seminar program. Whilst thesis topics will be constrained by the available time and resources, the aim is to contribute to the creation of new engineering knowledge, techniques and/or solutions. Students should explore topics that arouse intellectual curiosity and represent an appropriate range and diversity of technical and conceptual research and design challenges.

CHNG4813
Engineering Project A
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Meetings, Project Work - own time **Prerequisites:** CHNG3801, CHNG3802, CHNG3803, CHNG3805, CHNG3806, CHNG3807 **Prohibitions:** CHNG4811 or CHNG4812 **Assumed knowledge:** CHNG3801 AND CHNG3802 AND CHNG3803 AND CHNG3805 AND CHNG3806 AND CHNG3807. 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: 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 Project 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 Engineering Project 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.

CHNG4814
Engineering Project B
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Meetings, Project Work - own time **Prerequisites:** CHNG3801 AND CHNG3802 AND CHNG3803 AND CHNG3805 AND CHNG3806 AND CHNG3807. **Corequisites:** CHNG4813 **Prohibitions:** CHNG4811 OR CHNG4812 **Assumed knowledge:** CHNG3801 AND CHNG3802 AND CHNG3803 AND CHNG3805 AND CHNG3806 AND CHNG3807. 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:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment. Note: School permission required for enrolment in 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 (Chemical Engineering Project 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. Students are expected to take the initiative when pursuing their research projects. The supervisor will be available for discussion- typically 1 hour per week.

CHNG5001
Process Systems Engineering
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Project Work - in class, Project Work - own time **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 unit will develop skills in integrating process modelling, simulation, design, optimisation and control concepts. The aims of this unit 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 unit material through a range of individual and group-based activities.

CHNG5003
Green Engineering
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Meetings, Lectures **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
Engineering and Information Technologies

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

CHNG5005
Wastewater Engineering
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Group assignment **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 (70%) and Final Exam (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Key learning objectives are to provide students with an overview of wastewater treatment and the range of technologies currently used.

The key issues considered are: wastewater characterisation; the cost of wastewater treatment and disposal; the (Australian) regulatory framework; primary, secondary and tertiary treatment options; solids management and water reuse; pro-cess integration; an introduction to process simulation.

CHNG5006
Advanced Wastewater Engineering
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories **Assumed knowledge:** CHNG5005 OR CHNG3804. **Assessment:** Through semester assessment (60%) and Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study addresses inter-related issues relevant to wastewater treatment including: the diverse nature of wastewater and its characteristics; an overview of conventional wastewater treatment options; the use of commercial software in designing and evaluating a range of advanced wastewater treatment options including biological nutrient removal; the potential role of constructed wetlands in domestic and industrial wastewater treatment; wastewater management in the food processing, resources, and coal seam gas production industries; researching advanced wastewater treatment options.

CHNG5008
Nanotechnology in Chemical Engineering
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Project Work - own time, Lectures **Prerequisites:** (CHNG3801 OR CHNG9301 OR CHNG5801) AND (CHNG3802 OR CHNG9302 OR CHNG5802) AND (CHNG3805 OR CHNG9305 OR CHNG5805) AND (CHNG3806 OR CHNG9306 OR CHNG5806) **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.

CHNG5020
Capstone Project A
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Meetings, Project Work - own time **Prerequisites:** 96 credit points from the MPE degree program (incuding any credit for prior study) or 24 credit points from the ME degree program (incuding any credit for prior study) **Prohibitions:** CHNG5222 OR CHNG5223 OR CHNG5205 **Assumed knowledge:** (CHNG9301 OR CHNG5801) AND (CHNG9302 OR CHNG5802) AND (CHNG9303 OR CHNG5803) AND (CHNG9305 OR CHNG5805) AND (CHNG9306 OR CHNG5806). **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

The capstone project requires the student to plan and execute a substantial research-based project, using their technical and communication skills to design, evaluate, implement, analyse and theorise about developments that contribute to professional practice thus demonstrating the achievement of AQF Level 9. 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 (Minimum 12 A and B) run over two semesters. 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 Project 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. A thesis at this level will represent a contribution to professional practice or research, however the timeframe available for the thesis also needs to considered when developing project scopes. 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. Finally the ability to plan such a project to achieve results within constraints and the identification of promising areas and approaches for future research is a key assessment criterion.

CHNG5021
Capstone Project B
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Meetings, Project Work - own time **Corequisites:** CHNG5020 **Prohibitions:** CHNG5022 OR CHNG5222 OR CHNG5223 OR CHNG5205 **Assumed knowledge:** Enrolment in this unit of study assumes that Capstone Project A has been successfully completed. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

The capstone project requires the student to plan and execute a substantial research-based project, using their technical and communication skills to design, evaluate, implement, analyse and theorise about developments that contribute to professional practice thus demonstrating the achievement of AQF Level 9. 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 (Minimum 12 A and B) run over two semesters. 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 Project 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. A thesis at this level will represent a contribution to professional practice or research, however the timeframe available for the thesis also needs to considered when developing project scopes. 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. Finally the ability to plan such a project to achieve results within constraints and the identification of promising areas and approaches for future research is a key assessment criterion.

CHNG5022
Capstone Project B Extended
Engineering and Information Technologies

Credit points: 12 **Session:** Semester 1, Semester 2 **Classes:** Meetings, Project Work - own time **Prerequisites:** 42 credit points in the Master of Engineering and WAM >70, or 66 credit points in the Master of Professional Engineering and WAM >70 or exemption **Corequisites:** CHNG5020 **Prohibitions:** CHNG5021 OR CHNG5222 OR CHNG5223 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: Permission required for semester 1 or 2 based on achievement in Capstone Project A and taking other program requirements into consideration.

The capstone project requires the student to plan and execute a substantial research-based project, using their technical and communication skills to design, evaluate, implement, analyse and theorise about developments that contribute to professional practice thus demonstrating the achievement of AQF Level 9.

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 (Capstone Project A and B/B extended) 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 Capstone Project 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. Capstone Project B extended enables the student to undertake a project of greater scope and depth than capstone project B.

A thesis at this level will represent a contribution to professional practice or research, however the timeframe available for the thesis also needs to considered when developing project scopes. 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. Finally the ability to plan such a project to achieve results within constraints and the identification of promising areas and approaches for future research is a key assessment criterion.

CHNG5205
Major Industrial Placement Project
Engineering and Information Technologies

Credit points: 24 **Session:** Semester 1, Semester 2 **Classes:** Professional Placement **Prerequisites:** Passed at least 48 credit points in Master of professional engineering with adequate foundation knowledge in discipline. Students wishing to do this unit of study should contact the Head of School prior to enrolment. **Prohibitions:** CHNG5020 OR CHNG5021 OR ENGG5217 OR CHNG9402 OR CHNG5112 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment. Note: Enrolment by permission only. The students enrolled in this subject should have completed the first year Master of Professional Engineering with specialisation in Chemical and Biomolecular Engineering and a minimum credit average. The candidate will be selected by interview and at the discretion of the Head of School.Students enrolled in this subject are exempted from completing Chemical Engineering Design A (CHNG9402), Capstone Project A and B (CHNG5020 and CHNG5021) and one of the electives from the Specialist Units of Study that students are expected to take in the first semester of the second year. This exemption is granted because students are exposed to the core aspects of these courses through practical exercises undertaken during the MIPPS placement. While undertaking MIPPS, students have a unique opportunity to see and experience the industrial environment around them, in a manner which is not available at University.MIPPS students are required to enroll in Chemical Engineering Design B (CHNG9406) in the following semester.

The purpose of this proposal is to introduce a new subject into the Master of Professional Engineering with specialisation in Chemical and Biomolecular Engineering. The new subject is designed to equip students with practical experience in the area of Chemical and Biomolecular Engineering. Industrial project placement will clearly cover and widen the practical nature of curriculum base studies.

This unit of study will give students a rich experience for undertaking a major project in an industrial environment and developing skills in the preparation and presentation of technical reports. The project is performed under industry supervision supported by School staff and extends over one semester. The students will be engaged full time on the project at the industrial site. Students will be placed with industries, such as mining, oil and gas processing, plastic and paint manufacturing, food production, wastewater and water treatment. The students will learn essential engineering skills, such as how to examine published and experimental data, set objectives, project management, and analysis of results and assess these with theory and existing knowledge.

CHNG5222
Dissertation A
Engineering and Information Technologies

Credit points: 12 **Session:** Semester 1, Semester 2 **Prohibitions:** ENGG5220 OR ENGG5221 OR CHNG5020 OR CHNG5021 OR CHNG5022 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: In order to enrol in a project, students must first secure an academic supervisor in an area that they are interested. The topic of your project must be determined in discussion with the supervisor. The supervisor can come from any of the Engineering Departments, however, they need to send confirmation of their supervision approval to the Postgraduate Administrator.

To complete a substantial research project and successfully analyse a problem, devise appropriate experiments, analyse the results and produce a well-argued, in-depth thesis.

CHNG5223
Dissertation B
Engineering and Information Technologies

Credit points: 12 **Session:** Semester 1, Semester 2 **Corequisites:** CHNG5222 **Prohibitions:** ENGG5220 OR ENGG5221 OR CHNG5020 OR CHNG5021 OR CHNG5022 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: In order to enrol in a project, students must first secure an academic supervisor in an area that they are interested. The topic of your project must be determined in discussion with the supervisor. The supervisor can come from any of the Engineering Departments, however, they need to send confirmation of their supervision approval to the Postgraduate Administrator.

To complete a substantial research project and successfully analyse a problem, devise appropriate experiments, analyse the results and produce a well-argued, in-depth thesis.

CHNG5601
Membrane Science
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures **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 develop students' understanding 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
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures **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
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Project Work - own time **Assumed knowledge:** It is assumed that students have a general knowledge of: (MATH1001 OR MATH1021) AND (MATH1003 OR MATH1023) **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 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
Advanced Membrane Engineering
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories **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

Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Project Work - own time **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.

CHNG5606
Advanced Food Processing
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** lectures, tutorials **Assumed knowledge:** CHNG2801 AND CHNG2802 AND CHNG3804 AND CHNG3805 AND AGEN3004 **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.

Working at an advanced level in the food processing industry requires an ability to independently familiarise yourself with new and emerging challenges and technologies, to recognise the potential and limitations of new tools and methods, and to devise innovative solutions. Students in this unit will critically examine a range of issues and technologies in food processing technologies particularly in the areas of energy requirements, product design and process design. New and emerging technologies will be compared with established operating models. The unit will be delivered through seminars and projects in three parts. In the first part, students will evaluate a range of processes based on their energy requirements. In the second part students will investigate particulate food processing and product design. In the third part of the course students will be tasked with devising and justifying their own optimum solution for a selected food processing challenge.

CHNG5607
Advanced Biochemical Engineering
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** lectures, tutorials **Assumed knowledge:** CHNG2802 AND CHNG2806 AND CHNG3803 AND CHNG3804 **Assessment:** through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Students who have not completed the units listed as assumed knowledge should consult the coordinator before enrolling in the course.

Working in the 21st century bioeconomy requires advanced knowledge of a range of bioreactors. This course covers the modelling of bioreactors from very large to very small scale systems. The modelling of such systems will include the kinetics, transport phemonema and mixing problems that inevitably arise. Examples will be drawn from bio-commodities, bio-specialty chemicals and bio-pharmaceuticals industries. The course will develop students skills in analysing and designing such bioreactor systems.

Civil Engineering unit of study descriptions

CIVL – Civil Engineering unit of study descriptions

CIVL0011
Civil Exchange A
Engineering and Information Technologies
Credit points: 6 **Session:** Intensive January, Intensive July, 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
Engineering and Information Technologies
Credit points: 6 **Session:** Intensive January, Intensive July, 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
Engineering and Information Technologies
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
Engineering and Information Technologies
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
Engineering and Information Technologies
Credit points: 6 **Session:** Semester 1, Semester 2 **Mode of delivery:** Normal (lecture/lab/tutorial) day

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.

CIVL0016
Civil Exchange F
Engineering and Information Technologies
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
Engineering and Information Technologies
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
Engineering and Information Technologies

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.

CIVL1802
Statics
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** lectures, tutorials **Prohibitions:** ENGG1802 **Assessment:** through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Unit will focus on Engineering Statics, covering topics such as resolution of forces and moments, free body diagrams, support reactions, equilibrium in rigid bodies, trusses frames and machines, method of sections, method of joints, centroids, distributed forces, vibrations and friction. There will be extensive use of both 2D and 3D examples and solution methods by either resolution in the principle axes or by using vectors. Its main aim is to prepare students for 2nd year civil units such as Structural Mechanics.

CIVL1810
Engineering Construction and Surveying
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Tutorials, Workgroups, Lectures **Prohibitions:** CIVL2810 **Assumed knowledge:** CIVL1900. Some statistical awareness is an advantage and co-enrolment in MATH1005 Statistics is advised. HSC Mathematics Extension 1 or completion of (MATH1001 or MATH1021) and MATH1002 are sufficient for non-statistical maths preparation **Assessment:** Through semester assessment (70%), Final Exam (30%) **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)

Construction: Fundamental understanding of construction materials and techniques underpins Civil design and complements a rigorous analysis covered in other units such as Structural Mechanics and Soil Mechanics. In this unit students will be introduced to the realities of on-site civil construction. For many students this comes as a completely foreign experience and the methods they need to use to succeed in this unit rely on the student building his or her own awareness of the construction world and how it operates. This will be guided by the lectures and on-line material, but will not be spoon-fed to the students.

This unit presents concepts introducing students to engineering construction including:

- design, control, management, measurement and construction methods for excavation, embankments and other earthworks, hauling and associated operations;

- conceptual and formative exposure to building construction methods and materials, including reinforced concrete, masonry, steel and timber;

- drilling and blasting.

Surveying: The unit also introduces Engineering Survey topics, where the aims are:

- give an overall view of the functions of surveying and it's service role in Civil construction;

- become acquainted with selected specific surveying techniques, such as: (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;

- to give an insight into future trends in the use of GPS and GIS systems.

Students should develop basic competency in earthwork engineering and awareness of costing issues in formulating building proposals (through simplified examples). Economic optimisation is investigated, and how this impinges on decisions of 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 tutorial exercises give practise for students to implement what they have learned from lectures and their own research about 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.

While prior exposure to an actual construction site would be beneficial, in any case the key for success in this unit is for the student to develop a hungry curiosity for the world of construction and the professionals and personalities which form the intricate patchwork of talent which sees complex projects through to successful completion.

CIVL1900
Introduction to Civil Engineering
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prohibitions:** ENGG1800 OR CHNG1108 OR MECH1560 OR AERO1560 OR AMME1960 OR MTRX1701 OR ENGG1960 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The objective of this unit of study is to introduce students to the field of civil engineering and its areas of specialisation: structural engineering, environmental engineering, geotechnical engineering, construction management, transportation engineering, and humanitarian engineering. The unit will cover basic physics concepts relevant to civil engineering. The unit will equip students with knowledge of foundational civil engineering tools and techniques such as the identification and calculation of loads on structures, structural systems, and load paths in structures. The unit covers design and construction issues related to the use of standard materials such as steel, concrete, and timber. The unit includes several design tasks and a design project with an emphasis on issues associated with the impact of civil infrastructure on the natural environment, the economy, and social and humanitarian outcomes. The topics will provide a sound foundation for the further study of civil infrastructure design, analysis, construction, and maintenance.

CIVL2010
Environmental Engineering
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories, Project work **Prohibitions:** CIVL3010 **Assumed knowledge:** ENGG1803 OR ENGG1111 **Assessment:** through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces students to the role of civil engineers and the historical development of the profession, and relates this to the Code of Ethics - Engineers Australia; impact of engineering on the human and natural environment; energy consumption, resourcing and renewal, dealing with variability in climate; definitions and practice of sustainability; environmental assessment tools and life-cycle analyses. As graduates, students may expect to find themselves in a position which touches upon a wide variety of Engineering fields (including legal, institutional, and environmental considerations). In both small and large firms they could be acting as agents and managers of technology-driven change which has social and environmental impact. Engineering decision-making and problem-solving are made more complex by technical, economic, environmental, social and ethical constraints. The goals of this unit are to introduce students to major problems of environmental deterioration 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, video production and written report writing. Lectures, group discussions, case problems and projects are all used in teaching and learning in this unit of study.

The learning objectives of this unit are that students will be able to: (a) identify and analyse ecological, social and ethical issues deriving from technology-driven change, and evaluating these in the benefit model of the project (dealing with issues of long-range air and water pollution, energy use and finite resources); (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 a Life-Cycle Analysis to develop better engineering design solutions; (d) understand the influence of organisational, ethical and legal factors on engineering practice.

The secondary objectives of the unit are to: (a) improve students team-work ability; (b) improve students communication skills, through verbal and written media; (c) improve students skills in research and use of library resources.

CIVL2110
Materials
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prohibitions:** AMME1362 **Assumed knowledge:** ENGG1802 or CIVL1802 **Assessment:** Through semester assessment (50%) and 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.

CIVL2201
Structural Mechanics
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Laboratories **Prerequisites:** ENGG1802 OR CIVL1802 **Prohibitions:** AMME2301 **Assumed knowledge:** From (CIVL1802 or ENGG1802), 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 in certain 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%) and 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.

CIVL2410
Soil Mechanics

Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories **Assumed knowledge:** CIVL2201 AND GEOL1501 AND (CIVL1802 or ENGG1802). 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 CIVL1802 Statics (or ENGG1802 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. Familiarity with partial differential equations, and their analytical and numerical solution. **Assessment:** Through semester assessment (40%) and 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
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories **Assumed knowledge:** CIVL2201 AND (CIVL1802 or ENGG1802) AND (MATH1001 OR MATH1021). 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 (44%) and Final Exam (56%) **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.

CIVL2700
Transport Systems
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Assumed knowledge:** (MATH1001 OR MATH1021) AND (MATH1003 OR MATH1023) AND MATH1005 AND ENGG1801. Basic statistics through regression analysis, differential and integral calculus, computer programming. **Assessment:** through semester assessment (60%) and final exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to provide an introduction to transport systems and is assumed knowledge for fourth year units on traffic engineering, transport planning, and city logistics. Topics include: the role of accessibility as the reason for transport; the history of transport technologies in Australia and globally; the characteristics of the principle modes of transport; factors behind the demand for mobility; qualitative choice modeling; agent-based modeling; predicting travel demands; the mechanics of queueing and traffic flow; intelligent transport systems; the microscopic and macroscopic fundamental diagrams; highway capacity and level of service; the design of transport junctions.

CIVL2812
Project Appraisal
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, E-Learning **Prohibitions:** ENGG2850 OR CIVL3812 **Assumed knowledge:** MATH1005 **Assessment:** through semester assessment (45%) and final exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to introduce students to project valuations using present-value cash flow theory, taxation and probabilities, and the role of these valuations in the decision-making process. Students are taught techniques for making an analysis of issues involved in project appraisal by various methods and these are applied to 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 covers the following concepts: 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; Other influencing factors: price changes and exchange rates, depreciation, taxation; Capitalisation and valuation studies, replacement of assets, real option, project risk analysis, decision-tree analysis, WACC, MARR, equity capital, debt. This unit of study is a second-year core unit for students enrolled in Civil Engineering (any major), and is a possible elective in other schools of engineering.

CIVL3205
Concrete Structures 1
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Laboratories, Assignments **Assumed knowledge:** CIVL2110 AND CIVL2201 AND (CIVL2230 OR CIVL1900). 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 (30%) and Final Exam (70%) **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 and detailing implications), design criteria (for durability, fire- resistance, serviceability and strength), design calculation procedures, reinforcement detailing and structural drawings.

CIVL3206
Steel Structures 1
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories **Assumed knowledge:** CIVL2110 AND CIVL2201 AND (CIVL2230 or CIVL1900) **Assessment:** Through semester assessment (50%) and 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
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Assumed knowledge:** CIVL2110, (CIVL2230 or CIVL1900) AND MATH2061 **Assessment:** Through semester assessment (60%) and 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.

CIVL3310
Humanitarian Engineering
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Assessment:** through semester assessment (70%) and final exam (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Humanitarian Engineering is the application of Engineering design and organisation to improve quality of life, in circumstances where severe conditions of life are preventing the community from achieving those outcomes themselves. It can be anything from large scale infrastructure which benefits provinces to small scale innovations which benefit single families. It can be regarded as developmental aid or as disaster relief. In this unit students will study the world humanitarian sphere and its major and minor players. Students will be expected to critically analyse many of the notions which underpin humanitarian aid by use of various case studies and with reference to scholarly research. The subject will include both historical and contemporary study of engineering application in developmental aid delivered through governments, organisations and individuals. Various humanitarian theories will be studied and applied to specific cases, as well as methods of measuring success. This unit will be first offered in 2017. As well as being a requirement for the Humanitarian major, it is also available to all Civil students as a 3rd year Civil elective and to students from other disciplines as a free elective.

CIVL3411
Geotechnical Engineering
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Assumed knowledge:** CIVL2410 **Assessment:** Through semester assessment (45%) and 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.

CIVL3612
Fluid Mechanics
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Laboratories **Assumed knowledge:** CIVL2611 **Assessment:** Through semester assessment (65%) and Final Exam (35%) **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, pipe flow and pump design.

CIVL3614
Hydrology
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Site Visit, Laboratories **Prerequisites:** CIVL2611 **Assumed knowledge:** (ENGG1802 OR CIVL1802) AND CIVL3612 AND MATH2061 **Assessment:** Through semester assessment (50%) and 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 Excel and Matlab.

CIVL3703
Transport Policy, Planning and Deployment
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** lectures, presentations **Assumed knowledge:** CIVL2700 **Assessment:** through semester assessment (75%), final exam (25%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This subject aims to provide an environment for students to learn essential facts and develop models and frameworks to understand the development of transport policy, the making of transport plans, and the deployment of transport technologies. The unit uses a mixture of traditional lectures, and interactive learning through case studies and role playing. Both the lectures and the cases allow the students to develop an inductive understanding of transportation. The unit will be successful if at the end, the student has developed a worldview on transportation (not necessarily the same as the instructor's), and has an appreciation for merits and demerits of various perspectives on transport issues. The course seeks an integrative approach for transport, and though the stories in lecture will be told mode by mode, there are a number of opportunities to see the relationships between modes, in their structure in function, and in the learning as one mode adopts successful (and unsuccessful) attributes of others.

CIVL3805
Project Scope, Time and Cost Management
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Assessments **Prohibitions:** ENGG1850 or QBUS2350 **Assumed knowledge:** CIVL2810 or CIVL1810 **Assessment:** Through semester assessment (65%) and Final Exam (35%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

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.

CIVL3811
Engineering Design and Construction
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** workshops, project work - own time, presentation **Prohibitions:** CIVL4811 **Assumed knowledge:** CIVL1810 OR CIVL2810 **Assessment:** through semester assessment (40%); final exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The twin foci of this unit are: to enable students to participate as design engineers by developing an understanding of the design principles and techniques involved in the planning of a range of construction activities; and to assist students in preparing themselves for the role of a site engineer in a construction project wherein they will become familiar with the planning and execution of those activities, albeit with supervision and guidance from experienced professionals. Construction topics include hard rock tunnelling and general rock excavation; soft ground tunnelling; underground construction; micro tunnelling; cut and cover tunnelling; earth retaining systems; piling; formwork and falsework; dewatering; pavement design and construction - rigid and flexible; 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, OHandS issues in the construction industry; timber engineering; post-tensioned/prestressed concrete construction.

CIVL4022
Thesis A
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lectures, Research, Meeting **Prerequisites:** 30 Credit points of at least 3rd year units of study, and ISWAM 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 and 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.

The ability to plan, systematically conduct and report on a major project, involving both research and design, is an important skill for professional engineers. The final year thesis units (Thesis A and Thesis B) aim to provide students with the opportunity to carry out a defined piece of independent research and design that fosters the development of engineering skills. These skills include: the capacity to define a problem; carry out systematic research in exploring how it relates to existing knowledge; identifying the tools needed to address the problem; designing a solution, product or prototype; analysing the results obtained; and presenting the outcomes in a report that is clear, coherent and logically structured.

The thesis is undertaken across two semesters of enrolment. Taken together, Thesis A covers initial research into the background of the problem being considered (formulated as a literature review), development of a detailed proposal incorporating project objectives, planning, and risk assessment, preliminary design, modelling and/or experimental work, followed by the detailed work in designing a solution, performing experiments, evaluating outcomes, analysing results, and writing up and presenting the outcomes. The final grade is based on the work done in both Thesis A and B, and will be awarded upon successful completion of Thesis B.

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. For student who are completing a Major within their BE degree, the thesis topic must be within the area of the Major. The theses to be undertaken by students will very often be related to some aspect of a staff member's research interests. Some projects will be experimental in nature, others may involve computer-based simulation and analysis, feasibility studies or the design, construction and testing of equipment. All however will require students to undertake research and design relevant to the topic of their thesis. The 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 thesis must be the student's individual work although it may be conducted as a component of a wider group project. Students undertaking research on this basis will need to take care in ensuring the quality of their own research and design work and their individual 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 they have been in assessing their work and that of others. Students will also be required to present the results of their thesis to their peers and supervisors as part of a seminar program.

Whilst thesis topics will be constrained by the available time and resources, the aim is to contribute to the creation of new engineering knowledge, techniques and/or solutions. Students should explore topics that arouse intellectual curiosity and represent an appropriate range and diversity of technical and conceptual research and design challenges.

CIVL4023
Thesis B
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research, Meeting **Prerequisites:** 30 Credit points of at least 3rd year units of study **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment.

The ability to plan, systematically conduct and report on a major project, involving both research and design, is an important skill for professional engineers. The final year thesis units (Thesis A and Thesis B) aim to provide students with the opportunity to carry out a defined piece of independent research and design that fosters the development of engineering skills. These skills include: the capacity to define a problem; carry out systematic research in exploring how it relates to existing knowledge; identifying the tools needed to address the problem; designing a solution, product or prototype; analysing the results obtained; and presenting the outcomes in a report that is clear, coherent and logically structured.

The thesis is undertaken across two semesters of enrolment. Taken together, Thesis A covers initial research into the background of the problem being considered (formulated as a literature review), development of a detailed proposal incorporating project objectives, planning, and risk assessment, preliminary design, modelling and/or experimental work, followed by the detailed work in designing a solution, performing experiments, evaluating outcomes, analysing results, and writing up and presenting the outcomes. The final grade is based on the work done in both Thesis A and B, and will be awarded upon successful completion of Thesis B.

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. For student who are completing a Major within their BE degree, the thesis topic must be within the area of the Major. The theses to be undertaken by students will very often be related to some aspect of a staff member's research interests. Some projects will be experimental in nature, others may involve computer-based simulation and analysis, feasibility studies or the design, construction and testing of equipment. All however will require students to undertake research and design relevant to the topic of their thesis. The 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 thesis must be the student's individual work although it may be conducted as a component of a wider group project. Students undertaking research on this basis will need to take care in ensuring the quality of their own research and design work and their individual 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 they have been in assessing their work and that of others. Students will also be required to present the results of their thesis to their peers and supervisors as part of a seminar program.

Whilst thesis topics will be constrained by the available time and resources, the aim is to contribute to the creation of new engineering knowledge, techniques and/or solutions. Students should explore topics that arouse intellectual curiosity and represent an appropriate range and diversity of technical and conceptual research and design challenges.

CIVL4024
Engineering Project A

Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lectures, Project Work - own time, Meeting **Prerequisites:** 30 Credit points of at least 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 and 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 and 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
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Meeting, Project Work - own time **Prerequisites:** 30 Credit points of at least 3rd year units of study **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment.

Engineering Project A and 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.

CIVL4810
Mgmnt of People, Quality and Risk in PE
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Project Work - own time **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 and 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.

CIVL4811
Engineering Design and Construction
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Workshops, Project Work - own time, Presentation **Assumed knowledge:** CIVL2810 OR CIVL1810 **Assessment:** Through semester assessment (70%) and Final Exam (30%) **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 engineering; post-tensioned/ pre-stressed 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.

CIVL4813
Contracts Formulation and Management
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Prohibitions:** CIVL3813 OR ENGG3854 **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%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

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.

CIVL4814
Project Procurement and Tendering
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Assumed knowledge:** CIVL3805 **Assessment:** Through semester assessment (30%) and 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
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures **Prerequisites:** CIVL3805 AND (CIVL3812 OR CIVL2812) **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The aim of this unit is to develop students' ability to formulate projects through critically assessing and developing business case and project plan for a real-life engineering project. This unit is relevant for students who intend to pursue career related to project management. The learning activities focus on the project's viability and early stage planning. Strategic needs and possible project options are identified and assessed based on potential benefits, costs and the strategic context. Suitable site/route needs to be selected for the project based on technical and business considerations. Due consideration should also be given to the project's impact on environment and communities. The project's viability can be indicated using Benefit-Cost ratio as well as non-financial indicators such as number of jobs created and the number of life saved. In deriving these indicators, it is important to take project uncertainties into consideration through using techniques such as sensitivity analysis, decision-tree analysis, probabilistic modelling and Monte Carlo simulation. The objective is to justify investment to address the business needs and recommend the most appropriate response to the business needs.

The early stage planning concentrates on defining project requirements and project delivery strategy. The objective is to seek approval/support for project delivery or to critically evaluate the current project plan, depending on the current stage of the project. The exercise is to develop a plan guide project delivery and transition to operation. The plan should cover, but not limited to, the feasibility analysis, project deliverables, plan of activities necessary to move the project to the next stages, procurement strategy, what's needed to enable delivery (e. g. stakeholder management plan, planning and other approvals, funding, time, control processes, community and environment management plan, marketing and sales plan, and risk management plan) and, what is required to complete delivery and transition to operation stages.

CIVL4860
Architectural to Structural Design

Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Project Work - in class, Presentation, Project Work - own time **Prerequisites:** CIVL3235 AND (BDES3023 OR BDES3026) **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
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lectures, Tutorials **Prerequisites:** CIVL3205 and CIVL3206 **Assumed knowledge:** CIVL2410, CIVL3612, (CIVL4811 OR CIVL3811) **Assessment:** Through semester assessment (75%) and Final Exam (25%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

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.

CIVL5020
Capstone Project A
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lectures, Research, Meeting **Prerequisites:** 96 cp from MPE degree program or 24 cp from the ME program (including any credit for previous study) **Prohibitions:** CHNG5222 OR CHNG5223 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

The capstone project requires the student to plan and execute a substantial research-based project, using their technical and communication skills to design, evaluate, implement, analyse and theorise about developments that contribute to professional practice thus demonstrating the achievement of AQF Level 9.

Capstone Project provides an opportunity for students to conduct original research. Students will generally work individually and an individual thesis must be submitted by each student.

Capstone Project 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, Capstone Project A (CIVL5020) and Capstone Project B (CIVL5021). This particular unit of study, which must precede CIVL5021 Capstone Project B, should cover the first half of the work required for a complete Capstone 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.

A thesis at this level will represent a contribution to professional practice or research, however the timeframe available for the thesis also needs to be considered when developing project scopes. 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. Finally the ability to plan such a project to achieve results within constraints and the identification of promising areas and approaches for future research is a key assessment criterion.

CIVL5021
Capstone Project B
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research, Meeting **Corequisites:** CIVL5020 **Prohibitions:** CIVL5222 OR CIVL5223 OR CIVL5022 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

The capstone project requires the student to plan and execute a substantial research-based project, using their technical and communication skills to design, evaluate, implement, analyse and theorise about developments that contribute to professional practice thus demonstrating the achievement of AQF Level 9.

Capstone Project provides an opportunity for students to conduct original research. Students will generally work individually and an individual thesis must be submitted by each student.

Capstone Project 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, Capstone Project A (CIVL5020) and Capstone Project B (CIVL5021). This particular unit of study, which must be preceded by or be conducted concurrently with CIVL5020 Capstone Project A, should cover the second half of the work required for a complete Capstone Project. In particular, it should include completion of all components of the research or investigation project planned but not undertaken or completed in CIVL5020 Capstone Project A.

A thesis at this level will represent a contribution to professional practice or research, however the timeframe available for the thesis also needs to be considered when developing project scopes. 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. Finally the ability to plan such a project to achieve results within constraints and the identification of promising areas and approaches for future research is a key assessment criterion.

CIVL5022
Capstone Project B Extended
Engineering and Information Technologies

Credit points: 12 **Session:** Semester 1, Semester 2 **Classes:** Research, Meeting **Prerequisites:** 42 credit points in the Master of Engineering and WAM >70, or 66 credit points in the Master of Professional Engineering and WAM >70 or exemption. **Prohibitions:** CIVL5021 OR CIVL5222 OR CIVL5223 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment.

The capstone project requires the student to plan and execute a substantial research-based project, using their technical and communication skills to design, evaluate, implement, analyse and theorise about developments that contribute to professional practice thus demonstrating the achievement of AQF Level 9.

Capstone Project 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 Capstone Project course coordinator and the relevant academic supervisor concerned will a student be permitted to undertake a project individually.

Capstone Project 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, Capstone Project A (CIVL5020) and Capstone Project B (CIVL5021) or this unit Capstone Project B extended (CIVL5022) worth 12 credit points. This particular unit of study, which must be preceded by or be conducted concurrently with CIVL5020 Capstone Project A, should cover the second half of the work required for a complete Capstone Project. In particular, it should include completion of all components of the research or investigation project planned but not undertaken or completed in CIVL5020 Capstone Project A.

A thesis at this level will represent a contribution to professional practice or research, however the timeframe available for the thesis also needs to be considered when developing project scopes. 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. Finally the ability to plan such a project to achieve results within constraints and the identification of promising areas and approaches for future research is a key assessment criterion.

CIVL5222
Dissertation A
Engineering and Information Technologies

Credit points: 12 **Session:** Semester 1, Semester 2 **Prohibitions:** CIVL5020 OR CIVL5021 OR CIVL5022 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: In order to enrol in a project, students must first secure an academic supervisor in an area that they are interested. The topic of your project must be determined in discussion with the supervisor. The supervisor can come from any of the Engineering Departments, however, they need to send confirmation of their supervision approval to the Postgraduate Administrator.

To complete a substantial research project and successfully analyse a problem, devise appropriate experiments, analyse the results and produce a well-argued, in-depth thesis.

CIVL5223
Dissertation B
Engineering and Information Technologies

Credit points: 12 **Session:** Semester 1, Semester 2 **Prohibitions:** CIVL5020 OR CIVL5021 OR CIVL5022 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: In order to enrol in a project, students must first secure an academic supervisor in an area that they are interested. The topic of your project must be determined in discussion with the supervisor. The supervisor can come from any of the Engineering Departments, however, they need to send confirmation of their supervision approval to the Postgraduate Administrator.

To complete a substantial research project and successfully analyse a problem, devise appropriate experiments, analyse the results and produce a well-argued, in-depth thesis.

CIVL5266
Steel Structures - Stability
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **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 (45%) and Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This Unit aims to: provide fundamental understanding at advanced level of the behaviour and design of hot-rolled/fabricated and cold-formed steel members; to provide fundamental understanding of newly developed Direct Design Method (DDM) for analysis and design of structural systems; to develop an understanding of the behaviour and design of steel connections in open and hollow sections.

It is anticipated that at the end of this unit of study students should: be familiar with the behaviour of steel structures at advanced level in selected areas, including design for local buckling and design for flexural-torsional buckling of columns and beams; have a sound knowledge of AS 4100 in the areas of section capacity determination of slender cross-sections, and flexural-torsional buckling of beam; have a sound knowledge of AS/NZS 4600 in the areas of section capacity determination of slender cross-sections, and flexural-torsional buckling of columns and beam; have knowledge of the use of FEM software in the design of structural systems; have the skills to assess the behaviour of specific connection; have an appreciation of some practical aspects of economical steel connection design.

CIVL5269
Advanced Concrete Structures
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories **Prerequisites:** CIVL3205 OR CIVL9205 **Assessment:** Through semester assessment (50%) and 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.

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.

CIVL5277
Structural Rehabilitation and Timber Design
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** lectures, tutorials, workshops **Assumed knowledge:** (CIVL2201 AND CIVL3205 AND CIVL3206) OR (CIVL9201 AND CIVL9205 AND CIVL9206) **Assessment:** through semester assessment (60%), final exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course will provide students broader knowledge in timber design and structural rehabilitation. In the first section of the subject, students will learn the engineering properties of timber and requirements to be met for specification of the design, installation and maintenance of timber structures. It includes grading and structural properties; design actions; design of timber columns, beams, tension members and connections; principles of limit state design and serviceability; methods of testing; quality standards and maintenance of timber structures based on AS 1720. 1-2010 timber structures-design methods, and AS NZS 4063. 1-2010 characterization of structural timber-test methods.

The second part covers monitoring, rehabilitation and strengthening techniques of existing structures (concrete/steel/timber/masonry). Students will be introduced to structural inspection and evaluation; durability and deterioration; destructive and non-destructive testing; and design of strengthening systems including advanced fibre reinforced polymer (FRP) materials, epoxy injection, steel plate bonding, and post tensioning according to relevant Australian, ACI and European guidelines.

CIVL5320
Engineering for Sustainable Development
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories, Assignments **Prerequisites:** CIVL3310 OR CIVL9310 **Assessment:** through semester assessment (80%), final exam (20%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit develops Humanitarian Engineering principles towards long-term development outcomes. Students will cover community assessment, participatory technology development, principles of community building, cultural, spiritual, social, and emotional factors, power in a community, humanitarian technology, assessment of outcomes, and the coupling community needs, resources, and aspirations to technologies. The effectiveness of various aid programs and methods will be assessed and compared. Numerous examples of well-intended humanitarian failures will be examined in order to understand the human dimensions which are often overlooked by aid organisations, product designers, etc. Guest lecturers will provide in-depth case studies and analysis of in-situ developmental aid projects.

CIVL5330
Global Engineering Field Work
Engineering and Information Technologies

Credit points: 6 **Session:** Intensive December, Intensive July **Classes:** Practical Experience, Presentation **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 by which the main component is the practical experience of being involved in on-site humanitarian engineering. The on-site duration will be between 2-4 weeks. The main requirement is that the student is directly involved with a community "in need". Experiences would include such things as: Engineering design of the solution, in particular appropriate design for the circumstances, people and environment; management of people delivering the solution; community consultation; economic use of resources, and adapting design to make use of available resources; monitoring development projects (on-time delivery of milestones, contract management, etc.); evaluation (survey of end-users, audit of processes, analysis of cost and resource usage); sustainability of the design and implementation (traditional use of the word "sustain", ongoing viability and continuity); cost-benefit analysis; problem solving at all levels: practical, design and strategic; attending high-level planning meetings; creating interviews and opportunities with other agencies and institutions involved in the area of concern (for example: government departments, UN) which would value-add to the aims of the organisation they are working with; design and execution of surveys; analysis and mitigation of risk.

CIVL5351
Geoenvironmental Engineering
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Geoenvironmental Engineering is an applied science concerned with the protection of the subsurface from human activities. It can be divided into 2 main branches: waste containment and treatment of pollution sites. The former is usually a preventative activity, whereas the latter is corrective, i. e. it occurs after pollution has taken place. Geoenvironmental Engineering draws on fundamental science, especially the chemistry of low-permeability material such as clay, fluid flow in soil and contaminant migration in soil. The goal of CIVL5351 is to introduce you to the science behind Geoenvironmental Engineering and develop your skills at designing waste containment 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
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Project Work - in class, Project Work - own time **Assumed knowledge:** (CIVL2410 AND CIVL3411) OR (CIVL9410 AND CIVL9411). 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%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Geotechnical hazards include landslides, rock falls and mud flows. They are triggered by soil/rock 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-failure 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 using Finite Element modelling.

Senior geotechnical engineers from major companies will deliver some guest lectures presenting on practical case study involving geotechnical hazards throughout the semester.

CIVL5458
Numerical Methods in Civil Engineering
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Demonstration **Assessment:** Through semester assessment (80%) and Final Exam (20%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

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.

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
Fundamentals of Wind Engineering for Design
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Assessment:** Through semester assessment (60%) and Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

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.

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 and Coastal Engineering

Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Assumed knowledge:** CIVL3612 and MATH2061. **Assessment:** Through semester assessment (40%) and 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, 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, natural river systems will be discussed, and the principles of sediment transport and scour, monitoring and management will be introduced. The basic equations for linear and nonlinear wave theories in coastal seas will be introduced, and wave forces on structures and an introduction to design of offshore structures will be discussed.

CIVL5999
Advanced Research and Analysis
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratories, Project Work - in class, Project Work - own time **Assumed knowledge:** CIVL2201 AND CIVL2611 AND CIVL2410 **Assessment:** through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit requires students to use a number of advanced experimental tools and techniques which they learn through project-based learning as well as a structured theoretical lecture program. It will be very useful as co-requisite study for students engaged in an experimental honours thesis topic. It also covers issues of basic electronic circuitry and signal processing, various analysis techniques using both simple and advanced statistics, and advanced data processing methods such as PIV and Fourier filtering. It will also prepare students for further research in industry or academia.

Computer Science unit of study descriptions

COMP – Computer Science unit of study descriptions

COMP2017
Systems Programming

Credit points: 6 **Session:** Semester 1 **Classes:** lectures, laboratories **Prerequisites:** INFO1113 OR INFO1105 OR INFO1905 OR INFO1103 **Corequisites:** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **Prohibitions:** COMP2129 **Assessment:** through semester assessment (50%), final exam (50%) **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.

COMP2022
Programming Languages, Logic and Models

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Prerequisites:** INFO1103 OR INFO1903 OR INFO1113 **Prohibitions:** COMP2922 **Assumed knowledge:** MATH1004 OR MATH1904 OR MATH1064 OR MATH2069 OR MATH2969 **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides an introduction to the foundations of computational models, and their connection to programming languages/tools. The unit covers various abstract models for computation including Lambda Calculus, and Logic calculi (e. g. concept of formal proofs in propositional, predicate, and temporal logic). For each abstract model, we introduce programming languages/tools that are built on the introduced abstract computational models. We will discuss functional languages including Scheme/Haskell, and Prolog/Datalog.

COMP2123
Data Structures and Algorithms

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prerequisites:** INFO1110 OR INFO1113 OR DATA1002 OR INFO1103 OR INFO1903 **Prohibitions:** INFO1105 OR INFO1905 OR COMP2823 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will teach some powerful ideas that are central to solving algorithmic problems in ways that are more efficient than naive approaches. In particular, students will learn how data collections can support efficient access, for example, how a dictionary or map can allow key-based lookup that does not slow down linearly as the collection grows in size. The data structures covered in this unit include lists, stacks, queues, priority queues, search trees, hash tables, and graphs. Students will also learn efficient techniques for classic tasks such as sorting a collection. The concept of asymptotic notation will be introduced, and used to describe the costs of various data access operations and algorithms.

COMP2555
Computer Science Exchange

Credit points: 6 **Session:** Intensive January, Intensive July, 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.

COMP2823
Data Structures and Algorithms (Adv)
Credit points: 6 **Session:** Semester 1 **Classes:** lectures, tutorials **Prerequisites:** Distinction level result in at least one of INFO1110 OR INFO1113 OR DATA1002 OR INFO1103 OR INFO1903 **Prohibitions:** INFO1105 OR INFO1905 OR COMP2123 **Assumed knowledge:** Distinction-level result in at least one the listed 1000 level programming units **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day
Note: Department permission required for enrolment.

This unit will teach some powerful ideas that are central to solving algorithmic problems in ways that are more efficient than naive approaches. In particular, students will learn how data collections can support efficient access, for example, how a dictionary or map can allow key-based lookup that does not slow down linearly as the collection grows in size. The data structures covered in this unit include lists, stacks, queues, priority queues, search trees, hash tables, and graphs. Students will also learn efficient techniques for classic tasks such as sorting a collection. The concept of asymptotic notation will be introduced, and used to describe the costs of various data access operations and algorithms.

COMP2922
Programming Languages, Logic and Models (Adv)
Credit points: 6 **Session:** Semester 2 **Classes:** lectures, tutorials **Prerequisites:** Distinction level result in INFO1103 OR INFO1903 OR INFO1113 **Prohibitions:** COMP2022 **Assumed knowledge:** MATH1004 OR MATH1904 OR MATH1064 OR MATH2069 OR MATH2969 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day
Note: Department permission required for enrolment.

This unit provides an introduction to the foundations of computational models, and their connection to programming languages/tools. The unit covers various abstract models for computation including Lambda Calculus, and Logic calculi (e.g. concept of formal proofs in propositional, predicate, and temporal logic). For each abstract model, we introduce programming languages/tools that are built on the introduced abstract computational models. We will discuss functional languages including Scheme/Haskell, and Prolog/Datalog.

COMP3027
Algorithm Design
Credit points: 6 **Session:** Semester 1 **Classes:** lectures, tutorials **Prerequisites:** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **Prohibitions:** COMP2007 OR COMP2907 OR COMP3927 **Assumed knowledge:** MATH1004 OR MATH1904 OR MATH1064 **Assessment:** through semester assessment (40%), final exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides an introduction to the design techniques that are used to find efficient algorithmic solutions for given problems. The techniques covered included greedy, divide-and-conquer, dynamic programming, and adjusting flows in networks. Students will extend their skills in algorithm analysis. The unit also provides an introduction to the concepts of computational complexity and reductions between problems.

COMP3221
Distributed Systems
Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratories, Project Work - own time **Prerequisites:** (INFO1105 OR INFO1905) OR ((INFO1103 OR INFO1113) AND (COMP2123 OR COMP2823)) **Prohibitions:** COMP2121 **Assessment:** through semester assessment (60%), final exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will provide broad introduction to the principles of distributed computing and distributed systems and their design; provide students the fundamental knowledge required to analyse, design distributed algorithms and implement various types of applications, like blockchains; explain the common algorithmic design principles and approaches used in the design of message passing at different scales (e.g., logical time, peer-to-peer overlay, gossip-based communication).

COMP3308
Introduction to Artificial Intelligence
Credit points: 6 **Session:** Semester 1 **Classes:** Tutorials, Lectures **Prohibitions:** COMP3608 **Assumed knowledge:** Algorithms. Programming skills (e.g. Java, Python, C, C++, Matlab) **Assessment:** Through semester assessment (45%) and Final Exam (55%) **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, neural networks and probabilistic reasoning. 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 2 **Classes:** Lectures, Tutorials **Prerequisites:** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **Assumed knowledge:** Programming skills **Assessment:** Through semester assessment (40%) and Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides a broad introduction to the field of graphics and multimedia computing to meet the diverse requirements of application areas such as entertainment, industrial design, virtual reality, intelligent media management, social media 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.

COMP3520
Operating Systems Internals

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Prerequisites:** (COMP2017 OR COMP2129) AND (COMP2123 OR COMP2823 OR INFO1105 OR INFO1905) **Assessment:** Through semester assessment (40%) and Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit will provide a comprehensive discussion 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.).

COMP3530
Discrete Optimization

Credit points: 6 **Teacher/Coordinator:** Dr Julian Mestre **Session:** Semester 2 **Classes:** Lecture 2 hrs/week; Tutorial 1 hr/week. **Prerequisites:** COMP2007 or COMP2907 **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces students to the algorithmic theory and applications of discrete optimization. The main aims of this unit are: (i) learn how to model various practical problems as abstract optimization problems, (ii) learn the theory underlying efficient algorithms for solving these problems, (iii) learn how to use these tools in practice.

Specific topics include: Linear and integer programming, polyhedral theory, min-cost max-flow problems, approximation algorithms, and fixed parameter tractability.

COMP3556
Computer Science Exchange

Credit points: 6 **Session:** Intensive January, Intensive July, 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.

COMP3600
Computer Science Project (Adv)

Credit points: 6 **Session:** Semester 2 **Classes:** project work, sites visits, meetings **Prerequisites:** (COMP2123 OR COMP2823) AND COMP2017 AND (COMP2022 OR COMP2922) with Distinction level results in at least one of the above listed units **Prohibitions:** INFO3600 OR COMP3615 **Assessment:** through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

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.

COMP3608
Introduction to Artificial Intelligence (Adv)

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prerequisites:** Distinction-level results in some 2nd year COMP or MATH or SOFT units. **Prohibitions:** COMP3308 **Assumed knowledge:** Algorithms. Programming skills (e.g. Java, Python, C, C++, Matlab) **Assessment:** Through semester assessment (45%) and Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: COMP3308 and COMP3608 share the same lectures, but have different tutorials and assessment (the same type but more challenging).

An advanced alternative to COMP3308; covers material at an advanced and challenging level.

COMP3615
Computer Science Project

Credit points: 6 **Session:** Semester 2 **Classes:** Project Work, Site Visit, Meetings **Prerequisites:** (COMP2123 OR COMP2823) AND COMP2017 AND (COMP2022 OR COMP2922) **Prohibitions:** INFO3600 OR COMP3600 **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.

COMP3927
Algorithm Design (Adv)

Credit points: 6 **Session:** Semester 1 **Classes:** lectures, tutorials **Prerequisites:** COMP2123 OR COMP2823 OR INFO1105 OR INFO1905 **Prohibitions:** COMP2007 OR COMP2907 OR COMP3027 **Assumed knowledge:** MATH1004 OR MATH1904 OR MATH1064 **Assessment:** through semester assessment (40%), final exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit provides an introduction to the design techniques that are used to find efficient algorithmic solutions for given problems. The techniques covered included greedy, divide-and-conquer, dynamic programming, and adjusting flows in networks. Students will extend their skills in algorithm analysis. The unit also provides an introduction to the concepts of computational complexity and reductions between problems.

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.

COMP5045
Computational Geometry

Credit points: 6 **Session:** Semester 1 **Classes:** Project Work **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 (72%) and Final Exam (28%) **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
Natural Language Processing

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratory **Assumed knowledge:** Knowledge of an OO programming language **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

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 answering; machine translation; and classifying and clustering of documents. This unit will explore the key challenges of natural language to computational modelling, and the state of the art approaches to the key NLP sub-tasks, including tokenisation, morphological analysis, word sense representation, part-of-speech tagging, named entity recognition and other information extraction, text categorisation, phrase structure parsing and dependency 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 **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%) and Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This is an advanced course on Pervasive Computing, with a focus on the "Internet of Things" (IoT). It introduces the key aspects of the IoT 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.

COMP5048
Visual Analytics

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Assumed knowledge:** It is assumed that students will have basic knowledge of data structures, algorithms and programming skills. **Assessment:** Through semester assessment (60%) and 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, visualisation 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:** Lectures, Tutorials **Assumed knowledge:** COMP5214 OR COMP9103. Software Development in JAVA, or similar introductory software development units. **Assessment:** Through semester assessment (45%) and 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:** Lectures, Tutorials **Assumed knowledge:** Algorithmic skills (as expected from any IT graduate). Basic probability knowledge. **Assessment:** Through semester assessment (60%) and Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The growing connected-ness 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 and probability tackle the problems of communicating (routing, diffusing, aggregating) in dynamic and social networks.

COMP5318
Machine Learning and Data Mining

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Assumed knowledge:** INFO2110 OR ISYS2110 OR COMP9120 OR COMP5138 **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Machine learning is the process of automatically building mathematical models that explain and generalise datasets. It integrates elements of statistics and algorithm development into the same discipline. 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 machine learning and data mining.

Topics to be covered include problems of discovering patterns in the data, classification, regression, feature extraction and data visualisation. Also covered are analysis, comparison and usage of various types of machine learning techniques and statistical techniques.

COMP5328
Advanced Machine Learning

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, tutorials **Assumed knowledge:** COMP5318 **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Machine learning models explain and generalise data. This course introduces some fundamental machine learning concepts, learning problems and algorithms to provide understanding and simple answers to many questions arising from data explanation and generalisation. For example, why do different machine learning models work? How to further improve them? How to adapt them to different purposes?

The fundamental concepts, learning problems and algorithms are carefully selected. Many of them are closely related to practical questions of the day, such as transfer learning, learning with label noise and multi-view learning.

COMP5329
Deep Learning

Credit points: 6 **Session:** Semester 1 **Classes:** Tutorials, Lectures **Assumed knowledge:** COMP5318 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course provides an introduction to deep machine learning, which is rapidly emerging as one of the most successful and widely applicable set of techniques across a range of applications. Students taking this course will be exposed to cutting-edge research in machine learning, starting from theories, models, and algorithms, to implementation and recent progress of deep learning. Specific topics include: classical architectures of deep neural network, optimization techniques for training deep neural networks, theoretical understanding of deep learning, and diverse applications of deep learning in computer vision.

COMP5338
Advanced Data Models

Credit points: 6 **Session:** Semester 2 **Classes:** Tutorials, Lectures **Assumed knowledge:** This unit of study assumes foundational knowledge of relational database systems as taught in COMP5138/COMP9120 (Database Management Systems) or INFO2120/INFO2820/ISYS2120 (Database Systems 1). **Assessment:** Through semester assessment (40%) and 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:** Lectures, Laboratory, Project Work **Assumed knowledge:** COMP9220 or COMP5028. The course assumes basic knowledge on OO design and proficiency in a programming language **Assessment:** Through semester assessment (40%) and Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Nowadays most client facing enterprise applications are running on web or at least with a web interface. The design and implementation of a web application require totally different set of skills to those are required for traditional desktop applications. All web applications are of client/ server architecture. Requests sent to a web application are expected to go through the public Internet, which slows the responsiveness and increases the possible security threat. A typical web application is also expected to handle large number of requests coming from every corner of the Internet and sent by all sorts of client systems. This further complicates the design of such system.

This course aims at providing both conceptual understanding and hand-on experiences for the technologies used in building web applications. We will examine how data/messages are communicated between client and server; how to improve the responsiveness using rich client technology; as well as how to build a secure web application.

At the end of this course, students are expected to have a clear understanding of the structure and technologies of web applications. Students are also expected to have practical knowledge of some major web application environments and to be able to develop and deploy simple web applications. Cloud based platform are increasingly popular as the development and deployment platform. This course will incorporate the cloud aspect of web application development as well.

COMP5348
Enterprise Scale Software Architecture

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratory **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%) and 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:** Lectures, Practical Labs, Project Work **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 COMP9103 Software Development in JAVA **Assessment:** Through semester assessment (45%) and Final Exam (55%) **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.

COMP5415
Multimedia Design and Authoring

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Assessment:** Through semester assessment (40%) and Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides principles and practicalities of creating interactive and effective multimedia products. It gives an overview of the complete spectrum of different media platforms and current authoring techniques used in multimedia production. Coverage includes the following key topics: enabling multimedia technologies; multimedia design issues; interactive 2D and 3D computer animation; multimedia object modelling and rendering; multimedia scripting programming; post-production and delivery of multimedia applications.

COMP5416
Advanced Network Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratory **Assumed knowledge:** ELEC3506 OR ELEC9506 OR ELEC5740 OR COMP5116 **Assessment:** Through semester assessment (40%) and 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:** Lectures, Tutorials **Assessment:** Through semester assessment (40%) and 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 utilising 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, visualisation, registration, modelling, retrieval and management. A broad range of practical integrated clinical applications will be also elaborated.

COMP5425
Multimedia Retrieval

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Assumed knowledge:** COMP9007 or COMP5211. Basic Programming skills and data structure knowledge. **Assessment:** Through semester assessment (40%) and Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The explosive growth of multimedia data, including text, audio, images and video has imposed unprecedented challenges for search engines to meet various information needs of users. This unit provides students with the necessary and updated knowledge of this field in the context of big data, from the information retrieval basics of a search engine, to many advanced techniques towards next generation search engines, such as content based image and video retrieval, large scale visual information retrieval, and social media.

COMP5426
Parallel and Distributed Computing

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Assessment:** Through semester assessment (45%) and Final Exam (55%) **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 optimising 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:** Lectures, Laboratory **Assessment:** Through semester assessment (60%) and 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

Data Science unit of study descriptions

DATA – Data Science unit of study descriptions

DATA1001
Foundations of Data Science
Science

Credit points: 6 **Teacher/Coordinator:** Dr Di Warren **Session:** Semester 1, Semester 2 **Classes:** lecture 3 hrs/week; computer tutorial 2 hr/week **Prohibitions:** MATH1005 or MATH1905 or MATH1015 or MATH1115 or ENVX1001 or ENVX1002 or ECMT1010 or BUSS1020 or STAT1021 **Assessment:** assignments, quizzes, presentation, exam **Mode of delivery:** Normal (lecture/lab/tutorial) day

DATA1001 is a foundational unit in the Data Science major. The unit focuses on developing critical and statistical thinking skills for all students. Does mobile phone usage increase the incidence of brain tumours? What is the public's attitude to shark baiting following a fatal attack? Statistics is the science of decision making, essential in every industry and undergirds all research which relies on data. Students will use problems and data from the physical, health, life and social sciences to develop adaptive problem solving skills in a team setting. Taught interactively with embedded technology, DATA1001 develops critical thinking and skills to problem-solve with data. It is the prerequisite for DATA2002.

Textbooks
Statistics, Fourth Edition, Freedman Pisani Purves

DATA1002
Informatics: Data and Computation
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories, Project Work - own time **Prohibitions:** INFO1903 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit covers computation and data handling, integrating sophisticated use of existing productivity software, e.g. spreadsheets, with the development of custom software using the general-purpose Python language. It will focus on skills directly applicable to data-driven decision-making. Students will see examples from many domains, and be able to write code to automate the common processes of data science, such as data ingestion, format conversion, cleaning, summarization, creation and application of a predictive model.

DATA2001
Data Science: Big Data and Data Diversity
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratories, Project Work - own time **Prerequisites:** DATA1002 OR INFO1110 OR INFO1903 OR INFO1103 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course focuses on methods and techniques to efficiently explore and analyse large data collections. Where are hot spots of pedestrian accidents across a city? What are the most popular travel locations according to user postings on a travel website? The ability to combine and analyse data from various sources and from databases is essential for informed decision making in both research and industry.

Students will learn how to ingest, combine and summarise data from a variety of data models which are typically encountered in data science projects, such as relational, semi-structured, time series, geospatial, image, text. As well as reinforcing their programming skills through experience with relevant Python libraries, this course will also introduce students to the concept of declarative data processing with SQL, and to analyse data in relational databases. Students will be given data sets from, eg. , social media, transport, health and social sciences, and be taught basic explorative data analysis and mining techniques in the context of small use cases. The course will further give students an understanding of the challenges involved with analysing large data volumes, such as the idea to partition and distribute data and computation among multiple computers for processing of 'Big Data'.

DATA2002
Data Analytics: Learning from Data
Science

Credit points: 6 **Teacher/Coordinator:** Jean Yang **Session:** Semester 2 **Classes:** lecture 3 hrs/week; computer tutorial 2 hr/week **Prerequisites:** [DATA1001 or ENVX1001 or ENVX1002] or [MATH10X5 and MATH1115] or [MATH10X5 and STAT2011] or [MATH1905 and MATH1XXX (except MATH1XX5)] or [BUSS1020 or ECMT1010 or STAT1021] **Prohibitions:** STAT2012 or STAT2912 **Assumed knowledge:** (Basic Linear Algebra and some coding) or QBUS1040 **Assessment:** written assignment, presentation, exams **Mode of delivery:** Normal (lecture/lab/tutorial) day

Technological advances in science, business, engineering has given rise to a proliferation of data from all aspects of our life. Understanding the information presented in these data is critical as it enables informed decision making into many areas including market intelligence and science. DATA2002 is an intermediate course in statistics and data sciences, focusing on learning data analytic skills for a wide range of problems and data. How should the Australian government measure and report employment and unemployment? Can we tell the difference between decaffeinated and regular coffee ? In this course, you will learn how to ingest, combine and summarise data from a variety of data models which are typically encountered in data science projects as well as reinforcing their programming skills through experience with statistical programming language. You will also be exposed to the concept of statistical machine learning and develop the skill to analyze various types of data in order to answer a scientific question. From this unit, you will develop knowledge and skills that will enable you to embrace data analytic challenges stemming from everyday problems.

DATA3404
Data Science Platforms
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** lectures, tutorials **Prerequisites:** DATA2001 OR ISYS2120 OR INFO2120 OR INFO2820 **Prohibitions:** INFO3504 OR INFO3404 **Assumed knowledge:** This unit of study assumes that students have previous knowledge of database structures and of SQL. The prerequisite material is covered in DATA2001 or ISYS2120. 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 data science platforms and of systems that manage large data collections. These skills are needed for successful performance tuning and to understand the scalability challenges faced by when processing Big Data. This unit builds upon the second' year DATA2001 - 'Data Science - Big Data and Data Diversity' and correspondingly assumes a sound understanding of SQL and data analysis tasks.

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 data management platform. Topics include: physical data organization and disk-based index structures, query processing and optimisation, and database tuning.

The second part focuses on the large-scale management of big data in a distributed architecture. Topics include: distributed and replicated databases, information retrieval, data stream processing, and web-scale data processing.

The unit will be of interest to students seeking an introduction to data management tuning, disk-based data structures and algorithms, and information retrieval. It will be valuable to those pursuing such careers as Software Engineers, Data Engineers, Database Administrators, and Big Data Platform specialists.

DATA5207
Data Analysis in the Social Sciences
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** lectures, laboratories **Assumed knowledge:** COMP5310 **Assessment:** through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Data science is a new, rapidly expanding field. There is an unprecedented demand from technology companies, financial services, government and not-for-profits for graduates who can effectively analyse data. This subject will help students gain a critical understanding of the strengths and weaknesses of quantitative research, and acquire practical skills using different methods and tools to answer relevant social science questions.

This subject will offer a nuanced combination of real-world applications to data science methodology, bringing an awareness of how to solve actual social problems to the Master of Data Science. We cover topics including elections, criminology, economics and the media. You will clean, process, model and make meaningful visualisations using data from these fields, and test hypotheses to draw inferences about the social world.

Techniques covered range from descriptive statistics and linear and logistic regression, the analysis of data from randomised experiments, model selection for prediction and classification tasks, to the analysis of unstructured text as data, multilevel and geospatial modelling, all using the open source program R. In doing this, not only will we build on the skills you have already mastered through this degree, but explore different ways to use them once you graduate.

Electrical Engineering unit of study descriptions

ELEC – Electrical Engineering unit of study descriptions

ELEC1103
Fundamentals of Elec and Electronic Eng

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratories, Tutorials **Assumed knowledge:** Basic knowledge of differentiation & integration, and HSC Physics **Assessment:** Through semester assessment (40%) and 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

ELEC1601
Introduction to Computer Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories, Tutorials **Assumed knowledge:** HSC Mathematics extension 1 or 2 **Assessment:** Through semester assessment (60%) and Final Exam (40%) **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, machine language, assembly language and high level programming constructs.

ELEC2103
Simulation and Numerical Solutions in Eng

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories, Project Work - own time **Prohibitions:** COSC1001 or COSC1901 **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%) and 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:** Lectures, Tutorials, Laboratories **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%) and 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 specialise in Electrical, Telecommunication or Computer Engineering stream.

ELEC2302
Signals and Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories, E-Learning **Assumed knowledge:** (MATH1001 OR MATH1021) AND MATH1002 AND (MATH1003 OR MATH1023). Basic knowledge of differentiation & integration, differential equations, and linear algebra. **Assessment:** Through semester assessment (30%) and 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:** Lectures, Laboratories, Tutorials, Laboratory pre-work **Assumed knowledge:** ELEC1601. This unit of study assumes some knowledge of digital data representation and basic computer organisation **Assessment:** Through semester assessment (40%) and Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The purpose of this unit is to equip 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 systems (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.

ELEC3104
Engineering Electromagnetics

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **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%) and 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:** Lectures, Laboratories, Tutorials **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%) and 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:** Lectures, Tutorials, Laboratories, Project Work - own time **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%) and Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to provide the fundamentals of power electronics. It provides description of the operation principles and control of these blocks. Through analysis and design methodologies, it delivers an understanding of modern enabling technologies associated with energy conversion. Through laboratory hands-on experience on actual industrial systems, such as electrical motor drives, robotic arms, and power supplies, it enhances the link between the theory and the "real" engineering world.

The following topics are covered:

Introduction to power electronic converters and systems; analysis, design, simulation, and control of power electronic converters; power semiconductor devices; passive devices; the conversion toplogy includes DC/DC, DC/AC, AC/DC, and AC/AC for various applications.

ELEC3206
Electrical Energy Conversion Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories, Project Work - own time **Prerequisites:** ELEC3203 **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%) and 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: Have a broad view of electrical energy conversion systems including transformers, DC machines, induction machines and synchronous machines; Be able to analyse and solve problems in transformers and electric machines; 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:** Lectures, Tutorials, Laboratories **Prerequisites:** ELEC2302 AND (MATH2061 OR MATH2067 OR MATH2021 OR MATH2961 OR AMME2000) **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%) and 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:** Lectures, Tutorials, Laboratories, Project Work - own time **Prerequisites:** ELEC2302 **Assumed knowledge:** 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%) and 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:** Lectures, Tutorials, Laboratories **Assumed knowledge:** A background in basic electronics and circuit theory is assumed. **Assessment:** Through semester assessment (50%) and Final Exam (50%) **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.

ELEC3405
Communications Electronics and Photonics

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories, Tutorials **Assumed knowledge:** ELEC2104. A background in basic electronics and circuit theory is assumed. **Assessment:** Through semester assessment (25%) and 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:** Lectures, Laboratories, Tutorials **Prerequisites:** ELEC2302. 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 (100%) **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:** Lectures, Laboratories, Tutorials **Prohibitions:** NETS2150 **Assessment:** Through semester assessment (50%) and 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:** Lectures, Laboratories **Prerequisites:** ELEC1601 AND ELEC2602 AND COMP2017 **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%) and 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:** Lectures, Tutorials, Project Work - own time **Prerequisites:** ELEC2602 **Assumed knowledge:** ELEC3607. Basic knowledge of assembly language and microprocessor systems is required. **Assessment:** Through semester assessment (40%) and 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.

ELEC3609
Internet Software Platforms

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Project Work - own time **Prerequisites:** (INFO1103 OR INFO1110) AND (INFO2110 OR ISYS2110) AND (INFO2120 OR INFO2820 OR ISYS2120) **Prohibitions:** EBUS4001 **Assessment:** Through semester assessment (60%) and Final Exam (40%) **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, Project Work - own time, Presentation, Tutorials **Prohibitions:** EBUS3003 **Assessment:** Through semester assessment (70%) and 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.

ELEC3702
Management for Engineers

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures **Prohibitions:** ENGG3005 or MECH3661 **Assessment:** Through semester assessment (30%) and 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.

ELEC3802
Fundamentals of Biomedical Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Project Work - in class **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 (50%) and Final Exam (50%) **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.

ELEC3803
Bioelectronics

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories, Tutorials **Prerequisites:** ELEC2104 OR ELEC2602. **Assessment:** Through semester assessment (40%) and Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

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.

ELEC3901
Electrical Exchange Unit 1A

Credit points: 6 **Session:** Intensive January, Intensive July, 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 and Information Engineering. The enrolment in this unit needs to be approved by the school. The enrolment 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 and Information Engineering. The enrolment in this unit needs to be approved by the school. The enrolment 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 and Information Engineering. The enrolment in this unit needs to be approved by the school. The enrolment 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:** Intensive January, Intensive July, 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 and Information Engineering. The enrolment in this unit needs to be approved by the school. The enrolment 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 and Information Engineering. The enrolment in this unit needs to be approved by the school. The enrolment 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 and Information Engineering. The enrolment in this unit needs to be approved by the school. The enrolment 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.

ELEC4505
Digital Communication Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Laboratories **Prerequisites:** ELEC3505 **Assessment:** Through semester assessment (45%) and Final Exam (55%) **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: Intensive April, Intensive August, Intensive December, Intensive February, Intensive January, Intensive July, Intensive June, Intensive March, Intensive May, Intensive November, Intensive October, Intensive September **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 login to Sonia and start your Practical experience proposal applications. Assessment in this unit is by the submission portfolio containing written reports on the involvement of industry. Assessments is via Sonia. For details of the reporting requirements, go to the faculty's Practical Experience website http://sydney.edu.au/engineering/practical-experience/index.shtml.

ELEC4710
Engineering Project A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Project Work - own time **Prerequisites:** 36 credits of at least 3rd year units of study **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

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.

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.

This unit of study builds on the technical competencies introduced in the previous years. The project work is spread over two units (Engineering Project A and B). In Engineering Project A, students are required to plan and begin work on their project and roughly complete half the work required for the whole 'final year' project. In particular, it should include almost all the planning, literature review, and a significant proportion of the experimental or analytical work required of the project. The student will prepare a Progress Report at the end of semester detailing the context of the problem, relevant background research and progress to date. The progress at the end of Engineering Project A will be evaluated by the supervisor based on the thoroughness of the proposed program and the progress achieved during the semester. The student can only progress to Engineering Project B on attainment of a satisfactory result in Engineering Project A.

In Engineering Project B, the students are required to complete the remaining aspects of the project, present their results to their peers and academic staff in a seminar format, and prepare and submit a detailed Treatise.

The final grade is based on the work done in both Engineering Project A and B, and will be awarded upon successful completion of Engineering Project B.

ELEC4711
Engineering Project B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Project Work - own time **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.

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.

ELEC4712
Thesis A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Project Work - own time **Prerequisites:** 36 credits of at least 3rd year units of study **Prohibitions:** ELEC4714 **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.

The ability to plan, systematically conduct and report on a major project, involving both research and design, is an important skill for professional engineers. The final year thesis units (Thesis A and Thesis B) aim to provide students with the opportunity to carry out a defined piece of independent research and design that fosters the development of engineering skills. These skills include: the capacity to define a problem; carry out systematic research in exploring how it relates to existing knowledge; identifying the tools needed to address the problem; designing a solution, product or prototype; analysing the results obtained; and presenting the outcomes in a report that is clear, coherent and logically structured.

The thesis is undertaken across two semesters of enrolment. Taken together, the Thesis A covers initial research into the background of the problem being considered (formulated as a literature review), development of a detailed proposal incorporating project objectives, planning, and risk assessment, preliminary design, modelling and/or experimental work, followed by the detailed work in designing a solution, performing experiments, evaluating outcomes, analysing results, and writing up and presenting the outcomes. The final grade is based on the work done in both Thesis A and B, and will be awarded upon successful completion of Thesis B.

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. For student who are completing a Major within their BE degree, the thesis topic must be within the area of the Major. The theses to be undertaken by students will very often be related to some aspect of a staff member's research interests. Some projects will be experimental in nature, others may involve computer-based simulation and analysis, feasibility studies or the design, construction and testing of equipment. All however will require students to undertake research and design relevant to the topic of their thesis. The 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 thesis must be the student's individual work although it may be conducted as a component of a wider group project. Students undertaking research on this basis will need to take care in ensuring the quality of their own research and design work and their individual 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 thesis to their peers and supervisors as part of a seminar program.

Whilst thesis topics will be constrained by the available time and resources, the aim is to contribute to the creation of new engineering knowledge, techniques and/or solutions. Students should explore topics that arouse intellectual curiosity and represent an appropriate range and diversity of technical and conceptual research and design challenges.

ELEC4713
Thesis B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Project Work - own time **Prohibitions:** ELEC4714 **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.

The ability to plan, systematically conduct and report on a major project, involving both research and design, is an important skill for professional engineers. The final year thesis units (Thesis A and Thesis B) aim to provide students with the opportunity to carry out a defined piece of independent research and design that fosters the development of engineering skills. These skills include: the capacity to define a problem; carry out systematic research in exploring how it relates to existing knowledge; identifying the tools needed to address the problem; designing a solution, product or prototype; analysing the results obtained; and presenting the outcomes in a report that is clear, coherent and logically structured.

The thesis is undertaken across two semesters of enrolment. Taken together, the Thesis A covers initial research into the background of the problem being considered (formulated as a literature review), development of a detailed proposal incorporating project objectives, planning, and risk assessment, preliminary design, modelling and/or experimental work, followed by the detailed work in designing a solution, performing experiments, evaluating outcomes, analysing results, and writing up and presenting the outcomes. The final grade is based on the work done in both Thesis A and B, and will be awarded upon successful completion of Thesis B.

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. For student who are completing a Major within their BE degree, the thesis topic must be within the area of the Major. The theses to be undertaken by students will very often be related to some aspect of a staff member's research interests. Some projects will be experimental in nature, others may involve computer-based simulation and analysis, feasibility studies or the design, construction and testing of equipment. All however will require students to undertake research and design relevant to the topic of their thesis. The 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 thesis must be the student's individual work although it may be conducted as a component of a wider group project. Students undertaking research on this basis will need to take care in ensuring the quality of their own research and design work and their individual 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 thesis to their peers and supervisors as part of a seminar program.

Whilst thesis topics will be constrained by the available time and resources, the aim is to contribute to the creation of new engineering knowledge, techniques and/or solutions. Students should explore topics that arouse intellectual curiosity and represent an appropriate range and diversity of technical and conceptual research and design challenges.

ELEC4714
Major Industrial Project

Credit points: 24 **Session:** Semester 1, Semester 2 **Classes:** Practical Experience **Prerequisites:** 36 credits of at least 3rd year units of study **Prohibitions:** ELEC4710 OR ELEC4711 OR ELEC4712 OR ELEC4713 OR ENGG4000 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment.

Students spend 6 months at an industrial placement working on a major engineering project relevant to their engineering stream. This is a 24 credit point unit, which may be undertaken as an alternative to ELEC4702 Practical Experience, ELEC4712/4713 Thesis A and B, and two recommended electives. This unit of study gives students 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, with the student essentially being engaged full time on the project at the industrial site.

ELEC5020
Capstone Project A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Project Work - own time **Prerequisites:** 96 cp from MPE degree program or 24 cp from the ME program (including any credit for previous study) **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

The capstone project requires the student to plan and execute a substantial research-based project, using their technical and communication skills to design, evaluate, implement, analyse and theorise about developments that contribute to professional practice thus demonstrating the achievement of AQF Level 9.

The Capstone Project 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. Capstone Project is undertaken across two semesters of enrolment, in two successive Units of Study of 6 credits points each. Capstone Project A covers first steps of thesis research starting with development of research proposal. Capstone Project 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.

A thesis at this level will represent a contribution to professional practice or research, however the timeframe available for the thesis also needs to be considered when developing project scope. 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. Finally, the ability to plan such a project to achieve results within constraints, and also the identification of promising areas and approaches for future research, are key assessment criteria.

ELEC5021
Capstone Project B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Project Work - own time **Corequisites:** ELEC5020 **Prohibitions:** ELEC5022 OR ELEC5222 OR ELEC5223 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment.

The capstone project requires the student to plan and execute a substantial research-based project, using their technical and communication skills to design, evaluate, implement, analyse and theorise about developments that contribute to professional practice thus demonstrating the achievement of AQF Level 9.

The Capstone Project 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. Capstone Project is undertaken across two semesters of enrolment, in two successive Units of Study of 6 credits points each. Capstone Project A covers first steps of thesis research starting with development of research proposal. Capstone Project 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.

A thesis at this level will represent a contribution to professional practice or research, however the timeframe available for the thesis also needs to be considered when developing project scope. 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. Finally, the ability to plan such a project to achieve results within constraints, and also the identification of promising areas and approaches for future research, are key assessment criteria.

ELEC5022
Capstone Project B Extended

Credit points: 12 **Session:** Semester 1, Semester 2 **Classes:** Project Work - own time **Prerequisites:** 42 credit points in the Master of Engineering and WAM >70, or 66 credit points in the Master of Professional Engineering and WAM >70 or exemption **Prohibitions:** ELEC5021 OR ELEC5222 OR ELEC5223 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment.

The capstone project requires the student to plan and execute a substantial research-based project, using their technical and communication skills to design, evaluate, implement, analyse and theorise about developments that contribute to professional practice thus demonstrating the achievement of AQF Level 9.

The Capstone Project 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. Capstone Project is undertaken across two semesters of enrolment, in two successive Units of Study of 6 credits points each. Capstone Project A covers first steps of thesis research starting with development of research proposal. Capstone Project B covers the second of stage writing up and presenting the research results, and Capstone Project B extended allows the student to investigate a topic of greater depth and scope.

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.

A thesis at this level will represent a contribution to professional practice or research, however the timeframe available for the thesis also needs to be considered when developing project scopes. 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. Finally the ability to plan such a project to achieve results within constraints and the identification of promising areas and approaches for future research is a key assessment criterion.

ELEC5101
Antennas and Propagation

Credit points: 6 **Session:** Semester 2 **Classes:** Laboratories, Lectures **Assessment:** Through semester assessment (40%) and Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The basics of antenna radiation are introduced with emphasis on the important performance characteristics of the radiation field pattern (in 3 dimensions) and feed impedance. The omnidirectional and Hertzian dipole antennas (both hypothetical in practise but robust theoretically) provide the starting point to analyse real antenna operation. Mutual coupling between close antennas and important 'ground' imaging effects lead to the design of antenna arrays to increase gain and directivity. Aperture antennas and frequency broadbanding techniques are introduced. Ionospheric propagation is discussed and also the the reception efficiency of receiving antennas which allows consideration of a Transmitter - Receiver 'Link budget'. The important 'Pocklington' equation for a wire dipole is developed from Maxwell's equations and leads to the numerical analysis of wire antennas using 'Moment' methods. Real world applications are emphasised throughout and are reinforced by the hands on laboratory program which includes design projects.

ELEC5203
Topics in Power Engineering

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories **Assumed knowledge:** ELEC3203 Power Engineering and ELEC3204 Power Electronics and Drives.Familiarity with basic mathematics and physics; competence with basic circuit theory and understanding of electricity grid equipment such as transformers, transmission lines and associated modeling; and fundamentals of power electronic technologies. **Assessment:** Through semester assessment (40%) and Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to give students an in depth understanding of modern power electronic equipment supporting the intelligent grid of the future and the associated electronic control. Electronic power systems rely on a complex system of methods and equipment for controlling the voltage levels and for maintaining the stability and security of the supply. It covers recent findings in the fundamental theory and the massive change of modern power electronic equipment and methods supporting the electricity grids. It also looks at the huge influence of computer-aided analysis of electric power systems and the effects of the deregulation of the industry.

The specific topics covered are as follows: Introduction to power electronic systems and applications in the electrical grid, power semiconductors, reactive power control in power systems, flexible AC transmission systems (FACTS), high-voltage direct-current transmission (HVDC), static reactive power compensator, dynamic voltage restorer, unified-power flow controller, line-commutated converters, thyristor-controlled equipment, phase-angle regulators, voltage-source converter based power electronic equipment, harmonics, power quality, passive and active filters, distributed generation, grid-interconnection of renewable energy sources, intelligent grid technologies.

ELEC5204
Power Systems Analysis and Protection

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Laboratories **Prerequisites:** (ELEC3203 OR ELEC9203 OR ELEC5732) AND (ELEC3206 OR ELEC9206 OR ELEC5734) **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%) and 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:** Lectures, Tutorials, Laboratories, Project Work - in class **Prerequisites:** (ELEC3203 OR ELEC9203 OR ELEC5732) AND (ELEC3206 OR ELEC9206 OR ELEC5734) **Assumed knowledge:** The following previous knowledge is assumed for this unit. Circuit analysis techniques, electricity networks, power system fundamentals. **Assessment:** Through semester assessment (60%) and 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.

ELEC5206
Sustainable Energy Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories, Project Work - own time **Assumed knowledge:** Following concepts are assumed knowledge for this unit of study: familiarity with transformers, ac power, capacitors and inductors, electric circuits such as three-phase circuits and circuits with switches, and basic electronic circuit theory. **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit builds upon the knowledge of engineering mathematics, electronic devices and circuit theory and simulation techniques. It deals with both technical and business aspects of sustainable electrical energy systems. In technical aspect, it focuses on energy conversion and electrical characteristics of different renewable energy sources and integration of multiple energy sources into power system both at distribution and transmission levels. In business aspect, it focuses on economical, marketing and political aspects of installing and managing sustainable electrical energy systems in present and future society. It lays a solid foundation of practical and managerial skills on electronics and electrical (power) engineering and later studies such as intelligent electricity networks and advanced energy conversion and power systems. The following topics are covered: modern power systems; distributed generation; co-generation; tri-generation; microturbines; fuel cells; renewable energy sources: solar, wind, hydro, biomass, wind turbines; photovoltaic; grid-connected power systems; stand-alone power systems.

ELEC5207
Advanced Power Conversion Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorias, Laboratories, Project Work - own time **Assumed knowledge:** ELEC3204 **Assessment:** Through semester assessment (45%) and Final Exam (55%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit aims to cover advanced topics in power electronics and it applications. In particular, the power electronics interface design and implementation for microgrid, smart grids and modern power systems which have received tremendous attention in recent years. Many countries including Australia are developing different power electronics technologies such as integrating renewable energy sources into the grid, managing charging and discharging of high power energy storage system, controlling the reactive power of power electronics interfaces for grid stability, and adding communication capability to power electronics interfaces for smart meter implementation. The unit assumes prior fundamental knowledge of power electronics systems and applications, including the ability to analyse basic power converters for all four conversions (ac-ac, ac-dc, dc-ac, and ac-dc), and design and implement various applications, such as motor drive and battery charger, with the consideration of electrical characteristics of semiconductors and passive elements. This unit will cover advanced technologies on power electronics interfaces for smart grids and microgrid implementation, which include dynamic voltage restorer, active power filter, reactive power compensation, energy storage management, hybrid energy sources optimisation, multilevel inverter and control, D-STATCOM, etc. To analyse these advanced power conversion systems, some analytical techniques will be introduced. This includes resonant converters, soft-switching technique, ac equivalent circuit modeling, converter control and input/output filter design.

ELEC5208
Intelligent Electricity Networks

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Laboratories, Project Work - own time **Assumed knowledge:** Fundamentals of Electricity Networks, Control Systems and Telecommunications **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to give students an introduction to the planning and operation of modern electricity grids, also known as "smart" grids. Traditional power networks featured a small number of large base-load plants sending power out over transmission lines to be distributed in radial lower voltage networks to loads. In response to the need to reduce carbon impact, future networks will feature diverse generation scattered all over the network including at distribution levels. Also there will be new loads such as electric vehicles and technologies including energy storage and lower voltage power flow control devices. The operation of these new networks will be possible by much greater use of information and communication technology (ICT) and control over the information networks.

The unit will cover recent relevant developments in energy technologies as well as important components of 'smart grids' such as supervisory control and data acquisition (SCADA), substation automation, remote terminal units (RTU), sensors and intelligent electronic devices (IED). Operation of these electricity grids requires a huge amount of data gathering, communication and information processing. The unit will discuss many emerging technologies for such data, information, knowledge and decision processes including communication protocols and network layouts, networking middleware and coordinated control. Information systems and data gathering will be used to assess key performance and security indicators associated with the operation of such grids including stability, reliability and power quality.

ELEC5211
Power System Dynamics and Control

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Laboratories **Prerequisites:** ELEC3203 OR ELEC9203 OR ELEC5732 **Assumed knowledge:** The pre-required knowledge for learning this UoS is a deep understanding on circuit analysis and its applications in power system steady state analysis. **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit deals with power systems modelling, analysis and simulation under dynamic conditions.

The unit will cover the following topics: The links between power system steady state analysis and transient analysis; Basics of dynamic system in general and stability analysis methods; Analysis of power systems subject to electromagnetic and electromechanical transients. Power system modelling for stability analysis and electromagnetic transients analysis: Synchronous machine modelling using Park's transformation; Modelling of excitation systems and turbine governors; Modelling of the transmission system; Load modelling. Simulation of interconnected multi-machine systems; Stability analysis- Transient stability, Small signal stability, Voltage stability; Power system control: Voltage control, Power system transient stability control, Power system dynamic stability control, Emergency control; The unit is a specialist Unit for MPE (Power and Electrical) and ME (Power and Electrical). It is also available as a recommended elective for BE Electrical (Power).

ELEC5212
Power System Planning and Markets

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories **Prerequisites:** ELEC3203 or ELEC9203 OR ELEC5732 **Assumed knowledge:** The pre-required knowledge for learning this UoS is power system steady state analysis **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Deregulation of the electricity industry has fundamentally changed the power systems operation paradigm. The focus has shifted from central planning of vertically integrated utilities to market driven operation. Traditional electric energy producers and consumers play new roles in a power market environment and their behaviors are affected by the economic incentives to a large extent. Nevertheless, electric energy is a special commodity and cannot be traded as the other common goods. So a power market design has many special considerations compared with a conventional commercial market design. Knowledge of the power market mechanisms has become a necessary part in fully understanding the whole power system operations. To equip students with necessary skills to address the challenges of modern power systems, the unit will cover the following topics:

-Overview of the traditional electricity industry structure and operation: Economic dispatch, Power system operation states and respective reliability requirements.

-Drivers for the restructuring of the electricity industry.

-Electricity market design: Market structures (spot, bilateral, hybrid); Energy market; Ancillary services market; Key components in an electricity market.

-Electricity market participants and their roles in a market.

-Electricity economics: Power market from suppliers' view (Supply curve) and from demands' view (Demand curve); Market mechanism; Price and its elasticity; Cost and supply; Market power and monopoly.

-Cost of capital: Time value of money; Project evaluation methods from investments' point of view; Risk and return.

-Operation mechanisms of various designs of power markets.

-Power market practices around the world.

-Power system expansion planning: Fundamental knowledge of power system planning considerations, procedures and methods; Transmission planning; Generation planning; Power system adequacy assessment.

ELEC5212 is a specialist Unit for MPE (Power) and ME (Electrical and Power). It is also available as a recommended elective for BE Electrical (Power). This unit focuses on the power market principles and practices. Based on the knowledge of the power market operation, the power system planning procedures and methods will also be discussed.

ELEC5222
Dissertation A

Credit points: 12 **Session:** Semester 1, Semester 2 **Prohibitions:** ELEC8901 or ENGG5223 or ENGG5222 or ELEC8902 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: In order to enrol in a project, students must first secure an academic supervisor in an area that they are interested. The topic of your project must be determined in discussion with the supervisor. The supervisor can come from any of the Engineering Departments, however, they need to send confirmation of their supervision approval to the Postgraduate Administrator.

To complete a substantial research project and successfully analyse a problem, devise appropriate experiments, analyse the results and produce a well-argued, in-depth thesis.

ELEC5223
Dissertation B

Credit points: 12 **Session:** Semester 1, Semester 2 **Prohibitions:** ELEC8901 or ELEC8902 or ENGG5222 or ENGG5223 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: In order to enrol in a project, students must first secure an academic supervisor in an area that they are interested. The topic of your project must be determined in discussion with the supervisor. The supervisor can come from any of the Engineering Departments, however, they need to send confirmation of their supervision approval to the Postgraduate Administrator.

To complete a substantial research project and successfully analyse a problem, devise appropriate experiments, analyse the results and produce a well-argued, in-depth thesis.

ELEC5303
Computer Control System Design

Credit points: 6 **Teacher/Coordinator:** Dr Yash Shrivastava **Session:** Semester 1 **Classes:** Lecture 2 hrs/week; Tutorial 2 hrs/week. **Assumed knowledge:** This unit assumes a basic knowledge of calculus, functions of real variables, Laplace transform, matrix theory and control theory. **Assessment:** Through semester assessment (44%) and Final Exam (56%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit aims to teach the basic issues involved in the analysis and design of computer-controlled systems. The emphasis is on theory rather than technological application or industrial practice.

However, students are expected to test some of these ideas on a few benchmark control problems in the laboratory. Completion of the unit will facilitate progression to advanced study in the area and to work in industrial control. This unit assumes a basic knowledge of calculus, functions of real variables, Laplace transform, matrix theory and control theory.

The following topics are covered. Sampled data systems: aliasing. Zero order hold equivalent: inverse of sampling, sampling system with time delay. Properties of difference equations: solution, stability, change of co-ordinates, Z transform. Input output models: pulse response, pulse transfer operator, pulse transfer function, interpretation of poles and zeros.

Analysis of discrete time system: stability (Jury's test, Nyquist criterion, Lyapunov method), sensitivity and robustness, observability (observers, reduced order observers), reachability and controllers, loss of reachability/observability through sampling, output feedback, the Separation theorem. Optimal control: Kalman filter, linear quadratic regulator, output feedback, the Separation theorem.

Approximating continuous time controllers. Finite word length mplementations.

Textbooks

Astrom and Wittenmark/Computer Controlled System: Theory and Design/3rd/1997/0133148998//

ELEC5304
Multidimensional Signal Processing

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratories **Assumed knowledge:** Mathematics (e.g. probability and linear algebra) and programming skills (e.g. Matlab/Java/Python/C++) **Assessment:** through semester assessment (30%) and final exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study introduces basic and advanced concepts and methodologies in image processing and computer vision. This course mainly focuses on image processing and analysis methods as well as intelligent systems for processing and understanding multidimensional signals such as images, which include basic topics like multidimensional signal processing fundamentals and advanced topics like visual feature extraction and image classification as well as their applications for face recognition and object/scene recognition. It mainly covers the following areas: multidimensional signal processing fundamentals, image enhancement in the spatial domain and frequency domain, edge processing and region processing, imaging geometry and 3D stereo vision, object recognition and face recognition.

ELEC5305
Acoustics, Speech and Signal Processing

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Project work **Assumed knowledge:** (ELEC2302 OR ELEC9302) AND (ELEC3305 OR ELEC9305). Linear algebra, fundamental concepts of signals and systems as covered in ELEC2302/ELEC9302, fundamental concepts of digital signal processing as covered in ELEC3305/9305. It would be unwise to attempt this unit without the assumed knowledge- if you are not sure, please contact the instructor. **Assessment:** through semester assessment (75%) and final exam (25%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The course is designed to meet the needs of the increasing demand for advanced signal processing in the areas of acoustics and speech, biology and medicine, sonar and radar, communication and networks. Modern systems typically incorporate large sensor arrays, multiple channels of information, and complex networks. The course will cover topics in compressed sensing, multiresolution analysis, array signal processing, and adaptive processing such as kernel recursive least squares. The course will develop concrete examples in areas such as microphone arrays and soundfield analyses, medical signal processing, tomography, synthetic aperture radar and speech and audio. The concepts learnt in this unit will be heavily used in various engineering applications in sensor arrays, wearable medical systems, communication systems, and adaptive processing for complex financial, power, and network systems. The Defense, Science, and Technology Organisation will contribute to this course with teaching support and data.

ELEC5403
Radio Frequency Engineering

Credit points: 6 **Teacher/Coordinator:** Dr Zihuai Lin **Session:** Semester 1 **Classes:** Tutorial 2 hrs/week; Lecture 2 hrs/week; Laboratory 3 hrs/week. **Assumed knowledge:** Students will be expected to be familiar with ELEC3404 - Electronic Circuit Design , ELEC3104 - Engineering Electromagnetics and the third year course in Circuit Design: ELEC3105 - Circuit Theory and Design. **Assessment:** Through semester assessment (30%) and Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study builds upon earlier work and provides an introduction to radio frequency components and systems used in wireless and satellite communications as well as in other high frequency applications. It assumes some knowledge of: basic circuit analysis; semiconductor device models and behaviour; transistor operation as switches and amplifiers; transistor operation as current sources and current mirrors; differential amplifiers.

The following topics are covered: RF circuit element models, high-frequency effects and biasing in active devices, transmission lines and the Smith Chart, RF system characteristics, RF amplifiers, oscillators, mixers, power amplifiers, microwave measurements.

Textbooks

Pozar, David M./Microwave Engineering/2nd ed//

ELEC5507
Error Control Coding

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Project Work - own time, Tutorials **Assumed knowledge:** Fundamental mathematics including probability theory and linear algebra. Basic knowledge on digital communications. Basic MATLAB programming skills is desired. **Assessment:** Through semester assessment (40%) and Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit deals with the principles of error control coding techniques and their applications in various communication and data storage systems. Its aim is to present the fundamentals of error control coding techniques and develop theoretical and practical skills in the design of error control encoders/decoders. Successful completion of this unit will facilitate progression to advanced study or to work in the fields of telecommunications and computer engineering. It is assumed that the students have some background in communications principles and probability theory.

The following topics are covered: Introduction to error control coding, Linear algebra, Linear block codes, Cyclic codes, BCH codes, Reed-Solomon codes, Applications of block codes in communications, Convolutional codes, Viterbi algorithm, Applications of convolutional codes in communications, Soft decision decoding of block and convolutional codes, LDPC codes, Turbo codes, MIMO and rateless codes.

ELEC5508
Wireless Engineering

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories **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 (40%) and Final Exam (60%) **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. Wireless channel: Multipath fading, frequency selective fading, Doppler spread, statistical models, diversity, GSM, OFDM. Capacity and Interference: Cell types, coverage, frequency reuse, interference management, SIMO, MISO, multiuser diversity, CDMA, OFDMA, beamforming, superposition coding. MIMO: SVD, waterfilling, beamforming, V-BLAST, SIC, MMSE, Power Allocation. LTE/LTE-Advanced: Uplink-downlink channels, control signals, data transmission, spatial multiplexing, CoMP, spectrum reuse, heterogeneous networks, inter-cell interference coordination, carrier aggregation. Queueing theory: basic models, queueing systems, waiting time, delay, queue length, priority queues, wireless network virtualization (WNV) queues.

ELEC5509
Mobile Networks

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **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 (100%) **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.

ELEC5510
Satellite Communication Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Site Visit, Project Work - own time, Tutorials, Laboratories **Assumed knowledge:** Knowledge of error probabilities, analog and digital modulation techniques and error performance evaluation studied in ELEC3505 Communications and ELEC4505 Digital Communication Systems, is assumed. **Assessment:** Through semester assessment (30%) and Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Satellite communication systems provide fixed and mobile communication services over very large areas of land, sea and air. This unit presents the fundamental knowledge and skills in the analysis and design of such systems. It introduces students to the broad spectrum of satellite communications and its position in the entire telecommunications network; helps students to develop awareness of the key factors affecting a good satellite communications system and theoretical and practical skills in the design of a satellite communications link.

Topic areas include: satellite communication link design; propagation effects and their impact on satellite performance; satellite antennas; digital modem design, speech codec design; error control for digital satellite links.

ELEC5511
Optical Communication Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Assumed knowledge:** (ELEC3405 OR ELEC9405) AND (ELEC3505 OR ELEC9505). Basic knowledge of communications, electronics and photonics **Assessment:** Through semester assessment (25%) and Final Exam (75%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: -

Optical telecommunications has revolutionized the way we receive information and communicate with one another. This course will provide an understanding of the fundamental principles of optical fibre communication systems. It commences with a description of optical fibre propagation characteristics and transmission properties. We will then consider light sources and the fundamental principles of laser action in semiconductor and other lasers including quantum well lasers, tunable lasers and fibre lasers, and also the characteristics of optical transmitters based on semiconductor and electro-optic modulation techniques. The characteristics of optical amplifiers will also be discussed. On the receiver side, the principles of photodetection and optical receiver sensitivity will be presented. Other aspects such as fibre devices and multiple wavelength division multiplexing techniques will also be discussed. Finally, the complete optical fibre communication system will be studied to enable the design of data transmission optical systems, local area networks and multi-channel optical systems.

ELEC5512
Optical Networks

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Assumed knowledge:** Knowledge of digital communications, wave propagation, and fundamental optics **Assessment:** Through semester assessment (30%) and Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit builds upon the fundamentals of optical communication introduced in ELEC3405 (Communications Electronics and Photonics). It focuses on photonic network architectures and protocols, network design, enabling technologies and the drivers for intelligent optical network.

Students will learn how to analyse and design optical networks and optical components.

Introduction, photonic network architectures: point to point, star, ring, mesh; system principles: modulation formats, link budgets, optical signal to noise ratio, dispersion, error rates, optical gain and regeneration; wavelength division multiplexed networks; WDM components: optical filters, gratings, multiplexers, demultiplexers, wavelength routers, optical crossconnects, wavelength converters, WDM transmitters and receivers; Wavelength switched/routed networks, ultra high speed TDM, dispersion managed links, soliton systems; broadcast and distribution networks, multiple access, subcarrier multiplexed lightwave video networks, optical local area and metropolitan area networks; protocols for photonic networks: IP, Gbit Ethernet, SDH/SONET, FDDI, ATM, Fibre Channel.

ELEC5514
Networked Embedded Systems

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories **Prerequisites:** ELEC5509 **Assumed knowledge:** ELEC3305, ELEC3506, ELEC3607 and ELEC5508 **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aim to teach the fundamentals concepts associated with: Networked Embedded Systems, wireless sensor networks; Wireless channel propagation and radio power consumption; Wireless networks, ZigBee, Bluetooth, etc. ; Sensor principle, data fusion, source detection and identification; Multiple source detection, multiple access communications; Network topology, routing, network information theory; Distributed source channel coding for sensor networks; Power-aware and energy-aware communication protocols; Distributed embedded systems problems such as time synchronization and node localisation; 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.

Ability to identify the main issues and trade-offs in networked embedded systems; Understanding of the state-of-the-art solutions in the area; Based on the above understanding, ability to analyse requirements and devise first-order solutions for particular networked embedded systems problems; Familiarisation with a simulator platform and real hardware platforms for network embedded systems through the students involvement in projects.

ELEC5516
Electrical and Optical Sensor Design

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, E-Learning, Laboratories **Assumed knowledge:** Math Ext 1, fundamental concepts of signal and systems, fundamental electrical circuit theory and analysis **Assessment:** Through semester assessment (40%) and Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The course focuses on environmentally friendly, intelligent sensors for multiple parameters monitoring to be used in power network and broadband network. The concepts learnt in this unit will be heavily used in various engineering applications in power systems, fiber optic systems and health monitoring. These concepts include: 1) Theory, design and applications of optical fiber sensors. 2) Sensor technologies for the growth of smart grid in power engineering. 3) Actuators and motors for electrical sensor and its applications. 4) Wearable sensor technologies for ehealth monitoring.

ELEC5517
Software Defined Networks

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories, Project Work - own time **Prerequisites:** ELEC3506 OR ELEC9506 **Assessment:** through semester assessment (60%) and final exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study will introduce an emerging networking paradigm- Software Defined Networks (SDNs). By separating the control logics from the physical networks, the software defined networks allow an automated and programmable software program to logically control and manage the network. This unit introduces the basic principles of software defined networks, its architecture, abstraction, SDN programming, programmable control plane and data plane protocols, network update, network virtualisation, traffic management as well as its applications and implementations. Student will learn and practice SDN programming, testing and debugging on SDNs platforms through experiments and group projects. It is assumed that the students have some knowledge on data communications and networks.

ELEC5518
IoT for Critical Infrastructures

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratories, Project work - own time **Assessment:** through semester assessment (55%) and final exam (45%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Connected smart objects, platforms and environments have been identified as the next big technology development. The intelligent network for automatic interaction and processing between objects and environments is referred to as the Internet of Things (IoT). This unit aims to introduce the design, processing and operation of critical IoT applications, including smart grids, intelligent transportation systems, smart cities and healthcare. The unit will cover the IoT architecture, important components of IoT, such as sensors, communications networks and information processing, critical IoT applications, and the design and operations of these IoT systems and infrastructures. The students will be engaged in IoT programming and system development using advanced IoT platforms.

ELEC5616
Computer and Network Security

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Laboratories, Project Work - own time **Assumed knowledge:** A programming language, basic maths. **Assessment:** Through semester assessment (50%) and 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:** Lectures, Tutorials **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 throughout the week and make sure that time is truly productive. **Assessment:** Through semester assessment (40%) and 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, Project Work - own time, Presentation, Tutorials **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:** Lectures, Tutorials, Laboratories, Project Work - in class, Project Work - own time **Assumed knowledge:** A programming language, basic maths. **Assessment:** Through semester assessment (80%) and Final Exam (20%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

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.

ELEC5622
Signals, Software and Health

Credit points: 6 **Session:** Semester 2 **Classes:** Project Work - in class, Project Work - own time, Presentation, Tutorials, Laboratories **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 systems that use sensor data, such as those from physiology and activity tracking, often combined with patients self-reports. As sensing devices become ubiquitous, data processing, storage and visualisation techniques are becoming part of all health systems, both institutionalised and individually driven.

The unit is related to, but distinct, to health informatics- an area that focuses on the the use of computing to deliver cost efficient healthcare and the area of bioinformatics, that explores the role of computing in understanding biology at the cellular level (e. g. genome). This unit focuses on the technical and non-technical problems of developing increasingly ubiquitous devices and systems that can be used for personal and clinical monitoring.

ELEC5701
Technology Venture Creation

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Workgroups **Prohibitions:** ENGG5102 **Assessment:** Through semester assessment (40%) and 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 and viability of business models around it, the formulation of a funding-reading business plan and financials, capital raising options and process, venture capital, building distribution channels, intellectual property protection, putting together an A-grade management team, term sheets and 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 and 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 and venture capital. The course will include a number of guest lectures by industry.

Information Systems unit of study descriptions

ISYS – Information Systems unit of study descriptions

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.

ISYS2110
Analysis and Design of Web Info Systems
Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, tutorials **Prerequisites:** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 **Prohibitions:** INFO2110 **Assessment:** through semester assessment (40%), final exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course discusses the processes, methods, techniques and tools that organisations use to determine how they should conduct their business, with a particular focus on how web-based technologies can most effectively contribute to the way business is organized. The course covers a systematic methodology for analysing a business problem or opportunity, determining what role, if any, web-based technologies can play in addressing the business need, articulating business requirements for the technology solution, specifying alternative approaches to acquiring the technology capabilities needed to address the business requirements, and specifying the requirements for the information systems solution in particular, in-house development, development from third-party providers, or purchased commercial-off-the-shelf (COTS) packages.

ISYS2120
Data and Information Management
Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories, Project Work - own time **Prerequisites:** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 OR INFO1003 OR INFO1903 OR DECO1012 **Prohibitions:** INFO2120 OR INFO2820 OR COMP5138 **Assumed knowledge:** Programming skills **Assessment:** through semester assessment (50%), final exam (50%) **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 the SQL database query languages, which is industry standard. Other topics covered will include the important concept of transaction management, application development with a backend database, and an overview of data warehousing and OLAP.

ISYS2160
Information Systems in the Internet Age
Credit points: 6 **Session:** Semester 2 **Classes:** lectures, tutorials **Prohibitions:** ISYS2140 **Assumed knowledge:** INFO1003 OR INFO1103 OR INFO1903 OR INFO1113 **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 the Internet era. Key topics covered include: system thinking and system theory, basic concepts of information systems, internet and e-commerce, e-payment and m-commerce, online marketing and social media, information systems for competitive advantage, functional and enterprise systems, business intelligence, information systems development and acquisition, information security, ethics, and privacy

ISYS2554
Information Systems Exchange
Credit points: 6 **Session:** Intensive January, Intensive July, 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.

ISYS3400
Information Systems Project
Credit points: 6 **Session:** Semester 2 **Classes:** Project Work - in class, Project Work - own time, Site Visits, Meetings **Prerequisites:** (INFO2110 OR ISYS2110) AND (INFO2120 OR ISYS2120) AND (ISYS2140 OR ISYS2160) **Prohibitions:** INFO3600 or ISYS3207 **Assessment:** Through semester assessment (80%) and 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
Information Technology Evaluation
Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prerequisites:** (INFO2110 OR ISYS2110) AND (INFO2120 OR ISYS2120) AND (ISYS2140 OR ISYS2160) **Assumed knowledge:** INFO2110 and ISYS2140 **Assessment:** Through semester assessment (35%) and Final Exam (65%) **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.

ISYS3402
Decision Analytics and Support Systems
Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories, Project Work - own time **Prerequisites:** (ISYS2110 OR INFO2110) AND (ISYS2120 OR INFO2120) **Assumed knowledge:** Database Management AND Systems Analysis and Modelling **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

With the rapid increases in the volume and variety of data available, the problem of providing effective support to facilitate good decision making has become more challenging. This unit of study will provide a comprehensive understanding the diverse types of decision and the decision making processes. It will introduce decision modelling and the design and implementation of application systems to support decision making in organisational contexts. It will include a range of business intelligence and analytics solutions based on online analytical processing (OLAP) models and technologies. The unit will also cover a number of modelling approaches (optimization, predictive, descriptive) and their integration in the context of enabling improved, data-driven decision making.

ISYS3554
Information Systems Exchange
Credit points: 6 **Session:** Intensive January, Intensive July, 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.

ISYS5050
Knowledge Management Systems

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Assumed knowledge:** An undergraduate degree in Computer Science or Information Systems. Good grasp of database technologies and the role of information systems in organisations. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The need to track and facilitate the sharing of the core knowledge resources in contemporary organisations is widely recognised. This course will provide a comprehensive introduction to the area of Knowledge Management (KM) from both technological and organisational perspectives. We will review and discuss a range of published papers, case studies, and other publications that deal with a range of important KM-related topics. One of the key knowledge management technologies, Business Intelligence Systems, will be covered in detail. It will also include hands-on work using the BI (Online Analytical Processing- OLAP) tool, COGNOS.

Some of the main themes to be covered will include: KM- Conceptual Foundations; Taxonomies of organizational knowledge and KM mechanisms; Case/Field Studies of KM Initiatives; Data Warehousing and OLAP/Business Analytics; Data, text, and web mining; Social media,crowdsourcing, and KM; Big data and actionable knowledge.

ISYS5070
Change Management in IT

Credit points: 6 **Session:** Summer Main, Winter Main **Classes:** Lectures, Tutorials, Presentation, Project Work - own time **Assumed knowledge:** The unit is expected to be taken after the following related units INFO6007 Project Management in IT and COMP5206/INFO5206 Information Technologies and Systems. **Assessment:** Through semester assessment (70%) and 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.

Information Technology unit of study descriptions

INFO – Information Technology unit of study descriptions

INFO1110
Introduction to Programming

Credit points: 6 **Session:** Intensive July, Semester 1, Semester 2 **Classes:** lectures, laboratories, seminars **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit is an essential starting point for software developers, IT consultants, and computer scientists to build their understanding of principle computer operation. Students will obtain knowledge and skills with procedural programming. Crucial concepts include defining data types, control flow, iteration, functions, recursion, the model of addressable memory. Students will be able to reinterpret a general problem into a computer problem, and use their understanding of the computer model to develop source code. This unit trains students with software development process, including skills of testing and debugging. It is a prerequisite for more advanced programming languages, systems programming, computer security and high performance computing.

INFO1111
Computing 1A Professionalism

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratories, Project Work - own time **Prohibitions:** ENGG1805 OR ENGG1111 OR ENGD1000 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces students to the fundamental principles that underlie professional practice in computing. It lays the foundation for later studies, and presents to the students challenges common to a multidisciplinary IT environment. The subject also provides students with the opportunity to develop important attributes such as communication skills, an understanding of professional ethics, and of working as a part of a team. Tool use is an important aspect of this unit: students are required to learn to use tools for planning and completing work, managing artefacts including reports, and communicating within the team. A selection of guest speakers will address students on different career paths.

Dalyell students may enrol in ENGD1000 Building a Sustainable World in place of INFO1111

INFO1112
Computing 1B OS and Network Platforms

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories **Corequisites:** ELEC1601 AND (INFO1110 OR INFO1103 OR INFO1113). For most students, INFO1110 should have already been passed in semester 1. **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit introduces principles and concepts of modern computer systems, including mobile computers and the Internet, to provide students with fundamental knowledge of the environments in which modern, networked applications operate. Students will have basic knowledge to understand how computers work and are aware of principles and concepts they are likely to encounter in their career. The unit covers: Principles of operating systems and the way applications interact with the OS, including the particularities of modern operating systems for mobile devices Principles of computer networking, including mobile networking Writing applications that use facilities of the OS and networking, including understanding the challenges that are common in distributed systems

INFO1113
Object-Oriented Programming

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** lectures, laboratories, seminars **Prerequisites:** INFO1110 **Prohibitions:** INFO1103 OR INFO1105 OR INFO1905 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Object-oriented (OO) programming is a technique that arranges code into classes, each encapsulating in one place related data and the operations on that data. Inheritance is used to reuse code from a more general class, in specialised situations. Most modern programming languages provide OO features. Understanding and using these are an essential skill to software developers in industry. This unit provides the student with the concepts and individual programming skills in OO programming, starting from their previous mastery of procedural programming.

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.

INFO1591
Advanced Information Technology 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.

INFO1592
Advanced Information Technology 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.

INFO1911
IT Special Project 1A

Credit points: 6 **Session:** Semester 1 **Classes:** Meetings, Project Work - own time **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:** Meetings, Project Work - own time **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 and is talented 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.

INFO2222
Computing 2 Usability and Security

Credit points: 6 **Session:** Semester 1 **Classes:** Meetings, Laboratories, Project Work - own time **Prerequisites:** 12CP 1000-level INFO **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides an integrated treatment of two critical topics for a computing professional: human computer interaction (HCI) and security. The techniques and core ideas of HCI will be studied with a particular focus on examples and case studies related to security. This unit builds the students' awareness of the deep challenges in creating computing systems that can meet people's needs for both HCI and security. It will develop basic skills to evaluate systems for their effectiveness in meeting people's needs within the contexts of their use, building knowledge of common mistakes in systems, and approaches to avoid those mistakes.

INFO2150
Introduction to Health Data Science

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Prerequisites:** (INFO1003 OR INFO1903 OR INFO1103 OR INFO1110 OR DATA1002) AND (DATA1001 OR MATH1005 OR MATH1905 OR MATH1015) **Corequisites:** DATA2001 or ISYS2120 OR INFO2120 OR INFO2820 OR INFO1903 **Assumed knowledge:** Basic knowledge of Entity Relationship Modelling, database technology and SQL **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Health organisations cannot function effectively without computer information systems. Clinical data are stored and distributed in different databases, different formats and different locations. It requires a lot of effort to create an integrated and clean-up version of data from multiple sources, This unit provides basic introduction to the process and knowledge to enable the analysis of health data. The unit will be of interest to students seeking the understanding of the various coding standards in health industry, data retrieval from databases, data linkage issue, cleaning and pre-processing steps, necessary statistical techniques and presentation of results.

It will be valuable to those who want to work as health-related occupations, such as health informatics analysts, healthcare administrators, medical and health services manager or research officers in hospitals, government health agencies and research organisations. Having said that, a good understanding of health data analysis is a useful asset to all students.

INFO2551
Information Technology Exchange

Credit points: 6 **Session:** Intensive January, Intensive July, 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.

INFO2591
Advanced Information Technology 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.

INFO2592
Advanced Information Technology 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.

INFO2911
IT Special Project 2A

Credit points: 6 **Session:** Semester 1 **Classes:** Meetings, Project Work - own time **Prerequisites:** [85% average in IT units of study in previous year] AND [Permission 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 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:** Meetings, Project Work - own time **Prerequisites:** [85% average in IT units of study in previous year] AND [Permission 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 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.

INFO3220
Object Oriented Design

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Project Work - own time **Prerequisites:** INFO2110 and COMP2129 **Assessment:** Through semester assessment (50%) and 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:** Lectures, Laboratories **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This is a first subject in HCI, Human Computer Interaction. It is designed for students who want to be involved in one of the many roles required to create future technology. There are three main parts: the human foundations from psyschology and physiology; HCI methods for design and evaluation of interfaces; leading edge directions for technologies.

This subject is highly multi-disciplinary. At the core, it is a mix of Computer Science Software Engineering combined with the design discipline, UX - User Experience. It draws on psychology, both for relevant theories and user study methods. The practical work is human-centred with project work that motivates the formal curriculum. This year the projects will be in area of health and wellness.

INFO3333
Computing 3 Management

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratories, Project Work - own time **Prerequisites:** 12CP 2000-level COMP, INFO or ISYS **Corequisites:** INFO2222 **Prohibitions:** INFO3402 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit teaches students vital skills for an effective professional career: preparing them to eventually be a leader, who ensures that others achieve high-quality outcomes. Building on experiences from earlier units (that covered working in a team, agile development practices, paying attention to needs and characteristics of users, and the value of data) this unit teaches students key concepts needed as a manager, or when working with managers. The focus includes managing projects, managing services, and ensuring governance.

INFO3406
Introduction to Data Analytics

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories **Prerequisites:** (MATH1005 OR MATH1905) AND (INFO2120 OR INFO2820). **Assumed knowledge:** Basic statistics and database management. **Assessment:** Through semester assessment (40%) and Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Big Data refers to datasets that are massive, heterogenous, and dynamic that are beyond current approaches for the capture, storage, management, and analysis of the data. The focus of this unit is on understanding and applying relevant concepts, techniques, algorithms, and tools for the analysis, management and visualization of big data - with the goal of keeping abreast of the continual increase in the volume and complexity of data sets and enabling discovery of information and knowledge to guide effective decision making.

INFO3551
Information Technology Exchange

Credit points: 6 **Session:** Intensive January, Intensive July, 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.

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.

INFO3591
Advanced Information Technology 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.

INFO3592
Advanced Information Technology 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.

INFO3593
Advanced Information Technology 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.

INFO3594
Advanced Information Technology 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.

INFO3600
Major Development Project (Advanced)
Credit points: 12 **Session:** Semester 2 **Classes:** Project Work - in class, Site Visits, Project Work - own time, Meetings **Prerequisites:** INFO3402 **Prohibitions:** COMP3615 or ISYS3400 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment. Note: Only available to students in BIT, BCST(Adv) or BSc(Adv).

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.

INFO3616
Principles of Security and Security Eng
Credit points: 6 **Session:** Semester 1 **Classes:** lectures, tutorials, research **Prohibitions:** ELEC5616 **Assumed knowledge:** INFO1110 AND INFO1112 AND INFO1113 AND MATH1064. Knowledge equivalent to the above units is assumed; this means good programming skills in Python or a C-related language, basic networking knowledge, skills from discrete mathematics. A technical orientation is expected. **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit provides an introduction to the many facets of security in the digital and networked world, the challenges that IT systems face, and the design principles that have been developed to build secure systems and counter attacks. The unit puts the focus squarely on providing a thorough understanding of security principles and engineering for security. At the same time, we stress a hands-on approach to teach the state-of-the-art incarnations of security principles and technology, and we practice programming for security. We pay particular attention to the fact that security is much more than just technology as we discuss the fields of usability in security, operational security, and cyber-physical systems. At the end of this unit, graduates are prepared for practical demands in their later careers and know how to tackle new, yet unforeseen challenges.

This unit also serves as the initial step for a specialisation in computer and communications security.

INFO3911
IT Special Project 3A
Credit points: 6 **Session:** Semester 1 **Classes:** Meetings, Project Work - own time **Prerequisites:** [85% average in IT units of study in previous year] AND [Permission from the School of IT] **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:** Meetings, Project Work - own time **Prerequisites:** [85% average in IT units of study in previous year] AND [Permission from the School of IT] **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.

INFO4991
IT Research Thesis A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research **Prerequisites:** Enrolment in BIT Honours **Corequisites:** INFO5993 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

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 **Prerequisites:** Enrolment in BIT Honours **Corequisites:** INFO4991 and INFO5993 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

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 **Prerequisites:** Permission of the Head of Department **Mode of delivery:** Normal (lecture/lab/tutorial) day

All SIT Honours students must enrol in this non assessable unit of study in their final semester.

INFO5010
IT Advanced Topic A

Credit points: 6 **Session:** Semester 1, Semester 2 **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 **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.

INFO5060
Data Analytics and Business Intelligence

Credit points: 6 **Session:** Summer Main **Classes:** Lectures, Tutorials, Laboratories, Presentation, Project Work - own time **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%) and 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:** Lectures, Tutorials **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%) and 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.

INFO5551
Postgraduate IT Exchange A

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.

INFO5552
Postgraduate IT Exchange B

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.

INFO5553
Postgraduate IT Exchange C

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.

INFO5554
Postgraduate IT Exchange D

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.

INFO5990
Professional Practice in IT

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lectures, Tutorials **Assumed knowledge:** Students enrolled in INFO5990 are assumed to have previously completed a Bachelors degree in some area of IT, or have completed a Graduate Diploma in some area of IT, or have many years experience as a practising IT professional. **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) evening

Note: The main focus of the subject is to provide students with the necessary tools, basic skills, experience and adequate knowledge so they develop an awareness and an understanding of the responsibilities and issues associated with professional conduct and practice in the information technology sector. This unit is for MIT, MITM, MIT/MITM students only.

This Unit of Study introduces the students to some of the concepts, standards and techniques associated with the current professional practice in information technology in the business environment.

Students will encounter a range of concepts, techniques and professional issues including interpersonal and organisational communication, human resources and conflict resolution, globalisation, professional ethics, social impacts of IT, data security, data quality assurance, system audit, investigative research and project management practice. Practical and real world case studies will be used as part of the learning to enhance the in-class teachings to the needs of industry.

INFO5991
Services Science Management and Engineering

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lectures, Seminars **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

The service economy plays a dominant and growing role in economic growth and employment in most parts of the world. Increasingly, the improved productivity and competitive performance of firms and nations in services relies on innovative and effective design, engineering, and management of IT-centric services.

This unit offers IT graduates and professionals an understanding of the role of IT-centric services in a social, economic and business context, as well as knowledge of the principles of their design, engineering and management in a service-oriented IT framework. Delivery of the unit is driven by a critical approach to the literature, live case studies presented by industry professionals and writing a Consultants' Report. Its learning outcomes are based on industry needs. Three modules address the range of topics in Services Science, Management and Engineering (SSME).

1. Service fundamentals context and strategy: the service economy and the nature of service systems; the role IT-centric services in a social, economic and business context; IT-centric services optimisation and innovation.

2. Designing and Engineering IT-centric services: service design; service oriented enterprise and IT architecture.

3. Sourcing, governing, and managing IT-centric services: outsourcing IT-centric services (including services in the cloud); IT-centric services governance and management (COBIT and ITIL; service level agreements.

Critical analysis of articles and the persuasive use of evidence in writing are cornerstones of the unit. Students learn how to apply these skills in business consulting processes to a business case drawn from a recent consulting project at a large multinational organisation. The processes include:clarifying the client's situation and problems, researching evidence related to it, analysing the evidence, developing options for solving the problems, presenting recommendations persuasively to the client both orally and in a written Consultants' Report. These steps are scaffolded for the student, with formative assessment, and increasing levels of difficulty.

Students need to be able to read, critically analyse, and report on an article or case study every three weeks. If you are not confident of your skills in these areas, you can enroll in the free courses provided by the University's Learning Centre in Academic Reading and Writing and Oral Communication Skills. Some of these courses are specifically designed for students with a non-English speaking background. Familiarity with using Library reference tools and the ability to locate scholarly resources in the Library's electronic databases is also necessary. See the Library's Research and information skills page for help with this http://www.library.usyd.edu.au/skills/

INFO5992
Understanding IT Innovations

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lectures, Tutorials **Prohibitions:** PMGT5875 **Assumed knowledge:** INFO5990 **Assessment:** Through semester assessment (40%) and Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

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.

INFO5993
IT Research Methods

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Seminars **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. Students will learn research ethics. 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.

INFO6007
Project Management in IT

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lectures, Workshops, Assignments, Exam Preparation **Prohibitions:** PMGT5871 **Assumed knowledge:** Students enrolled in INFO6007 are assumed to have previously completed a Bachelors degree in some area of IT, or have completed a Graduate Diploma in some area of IT, or have three years experience as a practising IT professional. Recent work experience, or recent postgraduate education, in software project management, software process improvement, or software quality assurance is an advantage. **Assessment:** Through semester assessment (60%) and Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study covers the key components of successfully managing a wide variety of Information Technology projects. The course covers both quantitative and qualitative aspects of project management. Topics include the management of time, scope, budget, risk, quality, and resources through each of the phases of a project.

INFO6010
Advanced Topics in IT Project Management

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials (applied workshop), E-Learning **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%) and 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 and Value

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Flexible Sessions **Assumed knowledge:** COMP5206 **Assessment:** Through semester assessment (55%) and Final Exam (45%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

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 organisationÂ¿s strategic directions is important for successfully managing the major changes that the IT function has undergone in recent years. Topics covered will include assessment of IT impacts, achieving sustainable competitive advantage through IT, relationship between IT strategy and value, IT strategy formulation and implementation, evaluation of strategic investments in IT, IT portfolio management, IT sourcing 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 also provide students with models, tools, and techniques to evaluate an organisationÂ¿s IT strategic position, and hence to help make appropriate strategic choices.

AMME unit of study descriptions

AMME – AMME unit of study descriptions

AMME0011
International Exchange B
Credit points: 6 **Session:** Intensive January, Intensive July, 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:** Intensive January, Intensive July, 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

AMME1362
Materials 1
Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories **Prohibitions:** CIVL2110 or AMME2302 **Assessment:** Through semester assessment (51%) and Final Exam (49%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

AMME1362 is an introductory course 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 most of their learning by independent study.

AMME1960
Biomedical Engineering 1A

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Workshops **Prohibitions:** ENGG1960 or ENGG1800 or CIVL1900 or CHNG1108 or AERO1560 or MECH1560 or MTRX1701 **Assumed knowledge:** HSC Mathematics Extension 1 (3 Unit) **Assessment:** Through semester assessment (70%) and Final Exam (30%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Biomedical Engineering 1A introduces students to the biomedical engineering discipline of study and profession.

Initial lectures will introduce the various Biomedical Technologies in the global market, and currently under development, as well as the Biomedical Engineering Sector itself. It will address the question: "what is biomedical engineering and what are the career opportunities?".

The healthcare sector will be outlined, including the roles of hospitals and clinics and how these are anticipated to evolve in the future. A virtual tour of a hospital with a focus on engineering-relevant areas will be provided. Students will be required to research and present a short overview of the background, capabilities, facilities, and specializations for a select hospital or clinic in the Sydney region.

Biomed design projects will be set up to provide students the opportunity to get hands-on experience in "lean start-up" teams. The semester-long projects will provide students with the opportunity to learn and practice how to effectively develop then propose innovative biomedical engineering solutions that address defined health needs and market opportunity. Succinct project reports and presentations with technical basis and specifications will be generated to be accessible to broad audiences. The projects will be presented by the teams at an innovation competition with industry guests at the end of semester.

Subsequent lecture content will introduce biomedical engineering design background to support teams in their project objectives:

- The approach to developing the innovation case to address specific health needs.
- The ISO standard background to designing and developing medical devices and technologies.
- Defining design requirements, specifying risks, and managing design risk.
- Generating engineering specifications including drawing and CAD methods.
- Materials selection accounting for design constraints and manufacturing specifications.
- Prototyping and manufacturing guidelines along with medical device regulatory constraints

Lectures will be reviewed and assessed in tutorials to provide opportunity for regular feedback.

A Manufacturing Technology Workshop (worth 40% of this unit's assessment mark) provides an overview of a range of processes related to the design and manufacture of components through hands-on experience.

Manufacturing Technology practical work is undertaken in:

(a) Hand tools, Machining. Students will gain an understanding of manufacturing processes used to fabricate engineering hardware, systems and solutions. Safety requirements: All students are required to provide their own personal protective equipment (PPE eg safety glasses, safety boots, hair net) and comply with the workshop safety rules provided in class. Students who fail to do this will not be permitted to enter the workshops. Approved industrial footwear must be worn, and long hair must be protected by a hair net. Safety glasses must be worn at all times.

(b) Solid Modelling - the use of computer aided design (CAD) tools to model geometry and create engineering drawings of engineering components.

(c) Microcontrollers - ubiquitous in modern engineered products - will be introduced through experiential learning with development kits.

(d) Biomedical Manufacturing - 3D anatomic scans, 3D Printing and Templating, Biomedical Textiles, Clean processes, Packaging and Sterilization

A map of subsequent course units, and areas of specialisation and majors available through the biomedical engineering program will be provided.

The rationale and outcomes for each pathway will be discussed. Opportunities to address questions relating to program selection and ensuing career paths will be provided.

AMME1961
Biomedical Engineering 1B

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials/ Lab Classes **Assumed knowledge:** HSC Biology and HSC Chemistry. Summer bridging courses are available for students who did not complete HSC Biology or Chemistry **Assessment:** Through semester assessment (60%) and Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Note: CHEM1101 is scheduled for semester 1 Year 1 and AMME1961 for Semester 2 Year 1. Students should ideally ensure that they follow this schedule.

This biomedical engineering core junior unit of study provides an introduction to the relatively recent, and rapidly growing, biotechnology industry, with a focus on the current key commercial applications. In the 1990s, the word "biotech" entered our lexicon as a synonym for overnight investment wealth. The biotechnology acronym GM (genetically modified) also entered our lexicon in the 1990s. Biotechnology can be broadly defined as the commercial exploitation of biological processes for industrial and other purposes. A significant focus for commercial activities has been GM technology: GM microorganisms, plants, animals, and even humans (gene therapy). The "biotech industry" arose rapidly in the late 20th century, and is now one of the largest industries in the world, and is one of the cornerstones of the global biomedical industry which comprises three main sectors: Medical Devices, Pharmaceuticals, and Biotechnology. Significant global commercial biotechnology activity concerns the manufacture of therapeutic compounds from GM microorganisms using bioreactors, for example insulin. Another significant sector is agricultural: "agri-biotech" which concerns GM higher lifeforms (plants and animals) primarily for the food industry, and also other industries such as the energy industry (biofuels). The third sector concerns therapeutic GM of humans, known as "gene-therapy". Some other important biotechnologies will also be explored including monoclonal antibodies, genome sequencing and personalised medicine, and RNA-interference technology (RNAi).

This unit of study begins with an industry focus, overviewing the rise of the biotechnology industry, the key corporations, and their products. It then moves to a historical and technological overview of the developments on which the biotechnology industry is based: fermentation, bioreactors, process analysis and automation, genome sequencing, GM (genetic modification) technology, monoclonal antibodies. The unit then explores some important case studies:

1. Insulin manufacture in bioreactors using GM microorganisms.
2. Monoclonal antibodies, the foundation of the diagnostics industry, and their interaction with antibodies.

3. Green biotechnology. The use of biotechnology for developing alternative environmentally-friendly processes and products.
4. Bioremediation. The use of biotechnology for waste processing.
5. Gene therapy, with insights from the retrovirus, the transposon, and the plasmid.
6. RNAi (RNA-interference). How suppression of messenger RNA is opening up new research and commercial directions in biomedical engineering.
7. DNA sequencing and personalised medicine.
8. Bioethics. Human genetic screening, community perceptions of GM products, and patenting of genetic information.

Note: Biotechnology is an industrial discipline. It has areas of commonality with the related disciplines of Chemical Engineering, Molecular Biology, and Bioinformatics. AMME1961 is not a study of Bioinformatics, nor is it a study of Molecular Biology. For Molecular Biology, biomedical engineering students are referred to the recommended elective MBLG1001. For Bioinformatics, biomedical engineering students are referred to the recommended elective COMP5424.

AMME2000
Engineering Analysis

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prerequisites:** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) AND (ENGG1801 OR INFO1103 OR INFO1903 OR INFO1110 OR DATA1002) **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course is designed to provide students with the necessary tools for mathematically modelling and solving problems in engineering. Engineering methods will be considered for a range of canonical problems including; Conduction heat transfer in one and two dimensions, vibration, stress and deflection analysis, convection and stability problems. The focus will be on real problems, deriving analytical solutions via separation of variables; Fourier series and Fourier transforms; Laplace transforms; scaling and solving numerically using finite differences, finite element and finite volume approaches.

AMME2200
Introductory Thermofluids

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories **Prohibitions:** AMME2261 OR AMME2262 **Assumed knowledge:** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933). Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **Assessment:** Through semester assessment (30%) and Final Exam (70%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This Unit of Study is a shorter version of content in AMME2261 + AMME2262 and suits Biomedical (Mechanical Major) and Mechatronics students.

Students will get a practical, introductory course in Fluid Mechanics, Heat Transfer and Thermodynamics. Basic principles and applications in these areas are covered. The emphasis is on learning how to tackle the variety of problems which engineers encounter in these fields.

Fluid Mechanics

Properties: viscosity, surface tension, cavitation, capillarity. Hydrostatics: manometers, forces and moments on submerged surfaces, centre of pressure, buoyancy, vessel stability. Flow: Streamlines, turbulence, continuity, Bernoulli, venturi meter, pitot tube, head, loss coefficients, pumps, turbines, power, efficiency. Fluid momentum, drag, thrust, propulsive efficiency, wind turbines, turbomachinery, torque, power, head, Francis, Pelton, Kaplan turbines. Dimensional analysis, similarity, scale modelling, Reynolds No. , pipe flow, pressure drop, Moody chart.

Heat Transfer

Conduction: thermal circuits, plane, cylindrical, conduction equation, fins. Heat Exchangers: LMTD and NTU methods. Unsteady Conduction: lumped capacity, Bi, Fo, Heissler charts. Convection (forced), analytical Nu, Pr correlations. Convection (natural) Ra, Gr. Radiation spectrum, blackbody, emissivity, absorptivity, transmissivity, Stefan-Boltzmann, Kirchhoff Laws, selective surfaces, environmental radiation.

Thermodynamics:

1st Law of Thermodynamics, Properties, State postulate. Ideal gases, 2-phase properties, steam quality. Turbines, compressors. thermal efficiency and COP for refrigerators. 2nd Law of Thermodynamics, Kelvin-Planck, Clausius statements. Carnot engine. Entropy; increase of entropy principle, entropy and irreversibility. Isentropic processes, T-s diagrams, isentropic efficiency. Some power and refrigeration cycle analysis, characteristics of main power cycles. Psychrometry, air-conditioning, thermal comfort basics.

AMME2261
Fluid Mechanics 1

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Laboratories **Prerequisites:** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) **Prohibitions:** AMME2200 **Assumed knowledge:** Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **Assessment:** Through semester assessment (40%) and 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:** Lectures, Tutorials, Laboratories **Prerequisites:** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) **Prohibitions:** AMME2200 **Assumed knowledge:** Students are expected to be familiar with basic, first year, integral calculus, differential calculus and linear algebra. **Assessment:** Through semester assessment (50%) and 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.

AMME2301
Mechanics of Solids

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Prerequisites:** ENGG1802 AND (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) **Prohibitions:** CIVL2201 **Assessment:** Through semester assessment (35%) and 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:** Lectures, Tutorials, Laboratories **Prerequisites:** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921 OR MATH1906 OR MATH1931) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923 OR MATH1907 OR MATH1933) AND ENGG1802 **Assumed knowledge:** Familiarity with the MATLAB programming environment **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study will focus on the principles governing the state of motion or rest of bodies under the influence of applied force and torque, according to classical mechanics. The course aims to teach students the fundamental principles of the kinematics and kinetics of systems of particles, rigid bodies, planar mechanisms and three-dimensional mechanisms, covering topics including kinematics in various coordinate systems, Newton's laws of motion, work and energy principles, impulse and momentum (linear and angular), gyroscopic motion and vibration. Students will develop skills in analysing and modelling dynamical systems, using both analytical methods and computer-based solutions using MATLAB. Students will develop skills in approximating the dynamic behaviour of real systems in engineering applications and an appreciation and understanding of the effect of approximations in the development and design of systems in real-world engineering tasks.

AMME2700
Instrumentation

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Laboratories **Prerequisites:** AERO1560 OR MECH1560 OR MTRX1701 OR ENGG1800 **Assumed knowledge:** Programming skills, 1st year maths skills, familiarity with fundamental Engineering concepts. **Assessment:** Through semester assessment (60%) and 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.

AMME2960
Biomedical Engineering 2

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prerequisites:** (MATH1001 OR MATH1021 OR MATH1901 OR MATH1921) AND (MATH1002 OR MATH1902) AND (MATH1003 OR MATH1023 OR MATH1903 OR MATH1923) **Assumed knowledge:** AMME1960 AND AMME1961 **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

AMME2960 Biomedical Engineering 2 is the third of the four Biomedical Engineering foundational units. The first (AMME1960 Biomedical Engineering 1A) introduces students to the discipline of biomedical engineering, introducing the key concepts of biomedical technology, design, biomechanics, and the key systems of the human body from a biomedical engineering perspective. The second (AMME1961 Biomedical Engineering 1B) is an introduction to Biotechnology. The fourth (MECH2901 Anatomy and Physiology for Engineers) provides a hands-on anatomy and physiology study of the key systems of the human body from a biomedical engineering perspective, and includes cadaver laboratories. This unit (AMME2960 Biomedical Engineering 2) is designed to provide students with the necessary tools for mathematically modelling and solving problems in engineering. Engineering methods will be considered for a range of canonical problems, including conduction heat transfer in one and two dimensions, vibration, stress and deflection analysis, convection and stability problems. The lectures will address real problems: deriving analytical solutions via separation of variables, Fourier series and Fourier transforms, Laplace transforms, scaling and solving numerically using finite differences, finite element and finite volume approaches. The emphasis in the tutorials will be on applying these mathematical methods to Biomedical Engineering problems involving electrical, mechanical, thermal and chemical mechanisms in the human body. Specific examples include heat regulation, vibrations in biological systems, and the analysis of physiological signals such as ECG and EEG.

AMME3060
Engineering Methods

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Prerequisites:** AMME2000 OR MATH2067 OR (MATH2061 AND MATH2065) OR MATH2021 **Assessment:** Through semester assessment (50%) and 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.

AMME3110
Project A

Credit points: 6 **Session:** Semester 1, Semester 2 **Assessment:** Project (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment.

Supervised project on a relevant engineering discipline.

AMME3500
System Dynamics and Control

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prerequisites:** (AMME2000 OR MATH2067 OR (MATH2061 AND MATH2065) OR MATH2021) AND AMME2500 **Assessment:** Through semester assessment (40%) and 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 Mechanical, Mechatronic, Biomedical, and Aerospace Engineering. Control systems are found in a broad range of applications within these disciplines, from aircraft and spacecraft to robots, automobiles, manufacturing processes, and medical diagnostic 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 derivation of differential equations and use of frequency domain (Laplace transform) methods for their solution and analysis.

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. Techniques including Root Locus, Bode Plots, and State Space for analysis and design of feedback control systems.

4. Case studies inspired by real-world problems in control engineering.

AMME3660
Biomanufacturing

Credit points: 6 **Session:** Semester 1 **Prerequisites:** MECH2400 OR ENGG1960 OR AMME1960 OR MECH1560 **Prohibitions:** MECH3660 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit aims to teach the fundamentals of biomedical manufacturing processes, including traditional and advanced manufacturing technologies. This unit aims to develop the following attributes: to understand the fundamental principles of biomedical manufacturing approaches; to gain the ability to understand and select appropriate manufacturing processes and systems for biomedical applications; to develop ability to create innovative new manufacturing technologies for medical bionics and other applications in biomedical engineering; to develop ability to invent new manufacturing systems suitable for biomedical engineering implementation. At the end of this unit students will have a good understanding of the following: merits and advantages of individual manufacturing processes and systems used in the fabrication of medical devices and products that support human health and well-being; principles of developing new technologies for biomedical engineering applications; comprehensive applications and strategic selection of manufacturing processes and systems within the regulatory landscape of biomedical manufacturing. Unit content will include: Machining: An introduction into the use of machining, CAD and manual CNC coding. Rapid Prototyping: An introduction into the most current prototyping methods currently in use. Manufacturing Processes: Common processes and their science (machining, moulding, sintering, materials processing, joining processes) and their relative merits and limitations.

AMME4010
Major Industrial Project

Credit points: 24 **Session:** Semester 1, Semester 2 **Classes:** Practical Experience **Prerequisites:** 36 credits of at least 3rd year units of study with 65% average **Prohibitions:** AMME4111 OR AMME4112 OR AMME4121 OR AMME4122 OR ENGG4000 OR MECH4601 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment.

Students spend 6 months at an industrial placement working on a major engineering project relevant to their engineering stream. This is a 24 credit point unit, which may be undertaken as an alternative to AMME4100 Practical Experience, AMME4111/4112 Thesis A and B, MECH4601 Professional Engineering 2 and a recommended elective.

This unit of study gives students 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, with the student essentially being engaged fulltime on the project at the industrial site.

AMME4110
Project B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Project Work - own time **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment.

Supervised project on a relevant engineering discipline.

AMME4111
Thesis A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research **Prerequisites:** 36 credit points of at least third year units of study **Prohibitions:** AMME4010 or AMME4122 or AMME4121 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Prospective students in 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 ability to plan, systematically conduct and report on a major project, involving both research and design, is an important skill for professional engineers. The final year thesis units (Thesis A and Thesis B) aim to provide students with the opportunity to carry out a defined piece of independent research and design that fosters the development of engineering skills. These skills include: the capacity to define a problem; carry out systematic research in exploring how it relates to existing knowledge; identifying the tools needed to address the problem; designing a solution, product or prototype; analysing the results obtained; and presenting the outcomes in a report that is clear, coherent and logically structured.

The thesis is undertaken across two semesters of enrolment. Taken together, Thesis A covers initial research into the background of the problem being considered (formulated as a literature review), development of a detailed proposal incorporating project objectives, planning, and risk assessment, preliminary design, modelling and/or experimental work, followed by the detailed work in designing a solution, performing experiments, evaluating outcomes, analysing results, and writing up and presenting the outcomes. The final grade is based on the work done in both Thesis A and B, and will be awarded upon successful completion of Thesis B.

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. For student who are completing a Major within their BE degree, the thesis topic must be within the area of the Major. The theses to be undertaken by students will very often be related to some aspect of a staff member's research interests. Some projects will be experimental in nature, others may involve computer-based simulation and analysis, feasibility studies or the design, construction and testing of equipment. All however will require students to undertake research and design relevant to the topic of their thesis. The 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 thesis must be the student's individual work although it may be conducted as a component of a wider group project. Students undertaking research on this basis will need to take care in ensuring the quality of their own research and design work and their individual 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 they have been in assessing their work and that of others. Students will also be required to present the results of their thesis to their peers and supervisors as part of a seminar program. Whilst thesis topics will be constrained by the available time and resources, the aim is to contribute to the creation of new engineering knowledge, techniques and/or solutions. Students should explore topics that arouse intellectual curiosity and represent an appropriate range and diversity of technical and conceptual research and design challenges.

AMME4112
Thesis B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research **Prerequisites:** 36 credit points of at least third year units of study **Prohibitions:** AMME4121 or AMME4010 or AMME4122 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

The ability to plan, systematically conduct and report on a major project, involving both research and design, is an important skill for professional engineers. The final year thesis units (Thesis A and Thesis B) aim to provide students with the opportunity to carry out a defined piece of independent research and design that fosters the development of engineering skills. These skills include: the capacity to define a problem; carry out systematic research in exploring how it relates to existing knowledge; identifying the tools needed to address the problem; designing a solution, product or prototype; analysing the results obtained; and presenting the outcomes in a report that is clear, coherent and logically structured.

The thesis is undertaken across two semesters of enrolment. Taken together, Thesis A covers initial research into the background of the problem being considered (formulated as a literature review), development of a detailed proposal incorporating project objectives, planning, and risk assessment, preliminary design, modelling and/or experimental work, followed by the detailed work in designing a solution, performing experiments, evaluating outcomes, analysing results, and writing up and presenting the outcomes. The final grade is based on the work done in both Thesis A and B, and will be awarded upon successful completion of Thesis B.

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. For student who are completing a Major within their BE degree, the thesis topic must be within the area of the Major. The theses to be undertaken by students will very often be related to some aspect of a staff member's research interests. Some projects will be experimental in nature, others may involve computer-based simulation and analysis, feasibility studies or the design, construction and testing of equipment. All however will require students to undertake research and design relevant to the topic of their thesis. The 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 thesis must be the student's individual work although it may be conducted as a component of a wider group project. Students undertaking research on this basis will need to take care in ensuring the quality of their own research and design work and their individual 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 they have been in assessing their work and that of others. Students will also be required to present the results of their thesis to their peers and supervisors as part of a seminar program. Whilst thesis topics will be constrained by the available time and resources, the aim is to contribute to the creation of new engineering knowledge, techniques and/or solutions. Students should explore topics that arouse intellectual curiosity and represent an appropriate range and diversity of technical and conceptual research and design challenges.

AMME4121
Engineering Project A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Project Work - own time **Prerequisites:** 30 credit points of at least third year units of study **Prohibitions:** AMME4111 or AMME4010 or AMME4112 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: Prospective students in Engineering Project A are expected to have consulted with supervisors and selected a project topic of interest at the end of third year, guided by the advertised list of suggested project 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 undertake a project 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.

To complete the research requirement for their engineering degree, students now have a choice of either completing Thesis A/B (AMME4111/AMME4112) or Project A/B (AMME4121/AMME4122). Project A/B is intended to be more practical in orientation while Thesis A/B demands extensive literature review and critical analysis of outcomes. Thesis is a program for individuals whereas Projects can be done by groups or by an individual. Engineering Project A/B is undertaken across two semesters of enrolment, in two successive Units of Study of 6 credits points each. Engineering Project A covers first steps of project work, starting with development of project proposal. Project B covers the second of stage writing up and presenting the project results.

The fourth year engineering project aims to provide students with the opportunity to carry out a defined piece of independent design work in a setting and in a manner that fosters the development of engineering design skills. These skills include the capacity to define a engineering design problem, showing how it relates to prior art, identifying appropriate tools and methods, carrying out a design in a systematic way and presenting outcomes in a report that is clear, coherent and logically structured.

AMME4122
Engineering Project B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Project Work - own time **Prerequisites:** AMME4121 AND 30 credit points of at least third year units of study **Prohibitions:** AMME4010 AND AMME4111 AND AMME4112 **Assumed knowledge:** Students will be expected to draw on their project plan, proposed outcomes and background research developed during Project A to allow them to complete the requirements for this unit of study. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment.

To complete the research requirement for their engineering degree, students now have a choice of either completing Thesis A/B (AMME 4111/AMME4112) or Engineering Project A/B (AMME 4121/AMME4122). Engineering Project A/B is intended to be more practical in orientation while Thesis A/B demands extensive literature review and critical analysis of outcomes. Thesis is a program for individuals whereas Projects can be done by groups or by an individual. Engineering Project A/B is undertaken across two consecutive semesters of enrolment, in two successive Units of Study of 6 credits points each. Engineering Project A covers first steps of project work, starting with development of project proposal. Engineering Project B covers the second of stage writing up and presenting the project results.

The fourth year engineering project aims to provide students with the opportunity to carry out a defined piece of independent design work in a setting and in a manner that fosters the development of engineering design skills. These skills include the capacity to define a engineering design problem, showing how it relates to prior art, identifying appropriate tools and methods, carrying out a design in a systematic way and presenting outcomes in a report that is clear, coherent and logically structured.

AMME4710
Computer Vision and Image Processing

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories **Prerequisites:** MTRX3700 OR MECH4720 OR MECH5720 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

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.

AMME4971
Tissue Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prerequisites:** MECH2901 AND MECH3921 **Assessment:** Through semester assessment (65%) and Final Exam (35%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

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 engineering and the life sciences have begun to make this possible, and as a consequence, the very new and multidisciplinary field of tissue engineering has been making dramatic progress in the last few years.

This unit will provide an introduction to the principles of tissue engineering, as well as an up to date overview of recent progress and future outlook in the field of tissue engineering. This unit 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: To gain a basic understanding of the major areas of interest in tissue engineering; To learn to apply basic engineering principles to tissue engineering systems; To understand the promises and limitations of tissue engineering; To understand the advances and challenges of stem cell applications; Enable students to access web-based resources in tissue engineering (for example: Harvard-MIT Principles and Practice of Tissue Engineering); Enable students to develop basic skills in tissue engineering research.

AMME4981
Applied Biomedical Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Research, Seminars, Lectures, Tutorials, Meetings, Project Work - own time **Prerequisites:** AMME2301 AND AMME2500 AND (AMME1362 OR AMME2302) **Prohibitions:** AMME9981 **Assumed knowledge:** MECH3361 AND MECH2400 AND MECH2901 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

This UoS will give students an understanding of CT/MRI based solid modelling, finite element methods, constitutive material models, design analysis and optimisation, experimental validation and their use in biomedical engineering. The students are expected to gain skills and experience with finite element software for the solution to sophisticated problems associated with biomedical engineering and experimentation techniques for the validation of these problems. The unit will take a holistic approach to the learning outcomes: an overview of typical biomedical design problems, an overview of finite element analysis software, a detailed look at finite element methods in biomedical applications, and a project-based learning approach to the development of a biomedical prosthesis. By the end of the unit, the students are expected to have familiarised themselves with design analysis, optimisation, and validation for biomedical engineering problems.

AMME4990
Biomedical Product Development

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prerequisites:** MECH2901 AND MECH3921 **Assumed knowledge:** 1000-level chemistry, 2000-level biology, and specific knowledge of cell biology at least at the 1000-level, and preferably at the 2000-level. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

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 unit 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 unit assumes prior knowledge of cell biology and chemistry and builds on that foundation to elaborate on the important aspects of biomedical product development.

AMME5010
Major Industrial Project

Credit points: 24 **Session:** Semester 1 **Classes:** Project Work in Industry **Prohibitions:** AMME5020 OR AMME5021 OR AMME5022 OR AMME5222 OR AMME5223 OR ENGG5217 **Assumed knowledge:** Students must have a credit (>65%) average in prior semester enrolment **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

Students spend 6 months at an industrial placement working on a major engineering project relevant to their engineering stream. This is a 24 credit point unit, which may be undertaken as an alternative to ENGG5217 Practical Experience, AMME5020/5021 Capstone Project A and B and 12cp of specialist electives.

This unit of study gives students 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, with the student essentially being engaged full-time on the project at the industrial site.

AMME5020
Capstone Project A

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research **Prerequisites:** 96 cp from MPE degree program or 24 cp from the ME program (including any credit for previous study). **Prohibitions:** AMME5222 OR AMME5223 OR AMME5010 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

The capstone project requires the student to plan and execute a substantial research-based project, using their technical and communication skills to design, evaluate, implement, analyse and theorise about developments that contribute to professional practice thus demonstrating the achievement of AQF Level 9.

Students are required 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. Capstone project is undertaken across two semesters of enrolment, in two successive Units of Study of 6 credits points each. Capstone Project A covers first steps of thesis research starting with development of research proposal. Project 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, however the student is expected to make a significant contribution to the direction of the project, and 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.

A thesis at this level will represent a contribution to professional practice or research, however the timeframe available for the thesis also needs to be considered when developing project scopes. 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. Finally the ability to plan such a project to achieve results within constraints and the identification of promising areas and approaches for future research is a key assessment criterion.

AMME5021
Capstone Project B

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Research **Prerequisites:** 96 credit points from the MPE degree program (incuding any credit for prior study) or 24 credit points from the ME degree program (incuding any credit for prior study). **Prohibitions:** AMME5022 OR AMME5222 OR AMME5223 OR AMME5010 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

The capstone project requires the student to plan and execute a substantial research-based project, using their technical and communication skills to design, evaluate, implement, analyse and theorise about developments that contribute to professional practice thus demonstrating the achievement of AQF Level 9.

Students are required 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. Capstone project is undertaken across two semesters of enrolment, in two successive

Units of Study of 6 credits points each. Capstone Project A covers first steps of thesis research starting with development of research proposal. Project 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, however the student is expected to make a significant contribution to the direction of the project, and 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.

A thesis at this level will represent a contribution to professional practice or research, however the timeframe available for the thesis also needs to considered when developing project scopes. 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. Finally the ability to plan such a project to achieve results within constraints and the identification of promising areas and approaches for future research is a key assessment criterion.

AMME5022
Capstone Project B Extended

Credit points: 12 **Session:** Semester 1, Semester 2 **Classes:** Research **Prerequisites:** 42 credit points in the Master of Engineering and WAM >70, or 66 credit points in the Master of Professional Engineering and WAM >70 or exemption. **Prohibitions:** AMME5021 OR AMME5222 OR AMME5223 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment.

The capstone project requires the student to plan and execute a substantial research-based project, using their technical and communication skills to design, evaluate, implement, analyse and theorise about developments that contribute to professional practice thus demonstrating the achievement of AQF Level 9.

Students are required 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. Capstone project is undertaken across two semesters of enrolment, in two successive Units of Study of 6 credits points each. Capstone Project A covers first steps of thesis research starting with development of research proposal. Project 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, however the student is expected to make a significant contribution to the direction of the project, and 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.

A thesis at this level will represent a contribution to professional practice or research, however the timeframe available for the thesis also needs to considered when developing project scopes. 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. Finally the ability to plan such a project to achieve results within constraints and the identification of promising areas and approaches for future research is a key assessment criterion.

AMME5101
Energy and the Environment

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prerequisites:** MECH3260 OR MECH9260 OR AERO3261 OR AERO9261 **Assumed knowledge:** Students are expected to be familiar with the basic laws of thermodynamics, fluid mechanics and heat transfer **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

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 processes used for the conversion of energy into useful work. This course concentrates on thermal energy conversion. It also assesses and deals with the environmental consequences of energy conversion. At the end of this unit students will be able to critically analyse technical, economic and societal impacts of energy conversion systems.

A series of topics, each containing a series of lectures, will be covered in relation to energy. The course content will include: The Status of Energy Today; Energy for Electricity Generation; Nuclear Energy; Energy for Transportation; Future Energy Usage.

AMME5202
Computational Fluid Dynamics

Credit points: 6 **Session:** Semester 1 **Classes:** Laboratories, Lectures, Tutorials **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

Note: Department permission required for enrolment.

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.

AMME5222
Dissertation A

Credit points: 12 **Session:** Semester 1, Semester 2 **Prohibitions:** AMME5020 OR AMME5021 OR AMME5022 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: In order to enrol in a dissertation project, students must first secure an academic supervisor in an area that they are interested. Students must have acieved a WAM of 75% or greater in their prior year of study. The topic of your project must be determined in discussion with the supervisor.

To complete a substantial research project and successfully analyse a problem, devise appropriate experiments, analyse the results and produce a well-argued, in-depth thesis. The final research project should be completed and reported at a level which meets AQF level 9 outcomes and has original components as would be expected in MPhil.

AMME5223
Dissertation B

Credit points: 12 **Session:** Semester 1, Semester 2 **Prohibitions:** AMME5020 OR AMME5021 OR AMME5022 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Supervision

Note: Department permission required for enrolment. Note: In order to enrol in a dissertation project, students must first secure an academic supervisor in an area that they are interested. Students must have acieved a WAM of 75% or greater in their prior year of study. The topic of your project must be determined in discussion with the supervisor.

To complete a substantial research project and successfully analyse a problem, devise appropriate experiments, analyse the results and produce a well-argued, in-depth thesis. The final research project should be completed and reported at a level which meets AQF level 9 outcomes and has original components as would be expected in MPhil.

AMME5271
Computational Nanotechnology

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Assumed knowledge:** Understanding of basic principles of Newtonian mechanics, physics and chemistry, fluid mechanics and solid mechanics. General knowledge of how to operate a computer and work with different software is also required. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This course introduces atomistic computational techniques used in modern engineering to understand phenomena and predict material properties, behaviour, structure and interactions at nano-scale. The advancement of nanotechnology and manipulation of matter at the molecular level have provided ways for developing new materials with desired properties. The miniaturisation at the nanometre scale requires an understanding of material behaviour which could be much different from that of the bulk. Computational nanotechnology plays a growingly important role in understanding mechanical properties at such a small scale. The aim is to demonstrate how atomistic level simulations can be used to predict the properties of matter under various conditions of load, deformation and flow. The course covers areas mainly related to fluid as well as solid properties, whereas, the methodologies learned can be applied to diverse areas in nanotechnology such as, liquid-solid interfaces, surface engineering, nanorheology, nanotribology and biological systems. This is a course with a modern perspective for engineers who wish to keep abreast with advanced computational tools for material characterisation at the atomic scale.

AMME5310
Engineering Tribology

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratories, Tutorials, Seminars **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

Note: Department permission required for enrolment.

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.

AMME5510
Vibration and Acoustics

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories **Prerequisites:** (AMME2301 OR AMME9301) AND (AMME2200 OR AMME2261 OR AMME9261) AND (AMME2500 OR AMME9500) **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study 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:** Lectures, Tutorials, Research **Prerequisites:** AMME3500 OR AMME5501 OR AMME9501 **Assumed knowledge:** 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%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces engineering design via optimisation, 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 stabilise 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 optimisation 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.

AMME5790
Introduction to Biomechatronics

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories, Project work - own time, Tutorials **Prerequisites:** MECH3921 OR MTRX3700 OR AMME5921 **Prohibitions:** AMME4790 **Assumed knowledge:** A good practical knowledge in mechanical and electronic engineering; adequate maths and applied maths skills; background knowledge of physics, chemistry and biology; Some programming capability, MATLAB, C, C++; able to use common software tools used by engineers including CAD and EDA packages. **Assessment:** through semester assessment (65%) and final exam (35%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: AMME5790 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 specialised 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 and signal processing) that underpin their operation.

AMME5902
Computer Aided Manufacturing

Credit points: 6 **Session:** Semester 2 **Classes:** Project Work - in class, Lectures, Tutorials, Laboratories, Seminar **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

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.

Through integrated project-based learning and hands-on-machine training, you will learn: How to successfully complete a CAD/CAM and CNC mill based project; Manufacturing management and system skills, such as product planning, manufacturing sequence, time and cost; The science in designing and selecting a manufacturing method; How 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: Enhanced learning by real-world problems; Improved comprehensive skill in manufacturing design.

AMME5912
Crash Analysis and Design

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Assumed knowledge:** Computer Aided Drafting, Basic FEA principles and Solid Mechanics **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

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 and the interaction between solids and fluids. 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.

AMME5921
Biomedical Engineering Technology 2

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures **Prohibitions:** MECH3921 **Assumed knowledge:** Junior biology, junior materials science and some engineering design **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study provides an introduction to the field of biomedical engineering, from the point of view of the engineering and the global biomedical industry itself. After completion of this unit, students will have a clear understanding of what biomedical engineering is, both from the engineering perspective and the commercial/industry perspective.

AMME5931
Nanomaterials in Medicine

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Assumed knowledge:** 1000-level Biology and Chemistry; 3000-level or higher Engineering Design Practice and Biomedical Engineering; AMME1362 or 6cp 1000-level Materials Science; MECH2901 or 6cp 2000-level Anatomy and Physiology. **Assessment:** through semester assessment (60%) and final exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The application of science and technology at the nanoscale for biomedical problems promises to revolutionise medicine. Recent years have witnessed unprecedented advances in the diagnosis and treatment of diseases by applying nanotechnology to medicine. This course focuses on explaining the fundamentals of nanomedicine, and highlighting the special properties and application of nanomaterials in medicine. This course also reviews the most significant biomedical applications of nanomaterials including the recent breakthroughs in drug delivery, medical imaging, gene therapy, biosensors and cancer treatment.

The aims and objectives of this unit of study are:

to introduce the student to the application of nanotechnology in medicine and diverse range of nanomaterials used in this field; to give the student an overview of basic principles on synthesis and characterisation of nanomaterials in medicine; to enable students to understand the current challenges and difficulties in nanomedicine and give them ideas to engineer and design new materials to address the current challenges; to introduce students to the future impact of nanomedicine on healthcare practice.

AMME5958
Nanotechnology in Biomedical Engineering

Credit points: 6 **Session:** Semester 2 **Prerequisites:** (AMME1362 OR AMME9302) AND (MECH3921 OR AMME5921) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Nanotechnology in Biomedical Engineering will have a broad nanotechnology focus and a particular focus on the biophysics and electrical aspects of nanotechnology, as it relates to nanobiosensors and nanobioelectronics which represents a rapidly growing field in Biomedical Engineering that combines nanotechnology, electronics and biology with promising applications in bionics and biosensors. Nanodimensionality and biomimetics holds the potential for significant improvements in the sensitivity and biocompatibility and thereby open up new routes in clinical diagnostics, personalized health monitoring and therapeutic biomedical devices.

AMME5962
Introduction to Mechanobiology

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Assumed knowledge:** 6 credit points of 1000-level biology, 6 credit points of 1000-level chemistry and 6 credit points of 2000-level physiology or equivalent **Assessment:** through semester assessment (60%) and final exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Mechanobiology has emerged as a new field of science that integrates biology and engineering and is now considered to have significant influence on the development of technologies for regenerative medicine and tissue engineering. It is well known that tissues and cells are sensitive to their mechanical environment and changes to this environment can affect the physiological and pathophysiological processes. Understanding the mechanisms by which biological cells sense and respond to mechanical signals can lead to the development of novel treatments and therapies for a variety of diseases.

The objectives are:

a) To understand the basic principles of cell biology.

b) Learn to apply and integrate engineering principles to biological processes.

c) To understand the basic principles of mechanobiology and its importance in the field of tissue engineering and regenerative medicine

d) Understand the challenges and difficulties involved in the field of mechanobiology

e) Develop basic research skills in mechanobiology.

AMME5992
Regulatory Affairs in the Medical Industry

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures **Prerequisites:** (AMME9901 OR MECH2901) AND (MECH3921 OR AMME5921) **Prohibitions:** AMME4992 **Assumed knowledge:** 6cp of 1000-level Chemistry, and 6cp of Biology units **Assessment:** through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

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 unit 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.

AMME5995
Advanced Bionics

Credit points: 6 **Session:** Semester 1 **Prerequisites:** AMME5921 OR MECH3921 **Mode of delivery:** Normal (lecture/lab/tutorial) day

The field of 'bionics' is one of the primary embodiments of biomedical engineering. In the context of this unit, bionics is defined as a collection of therapeutic devices implanted into the body to restore or enhance functions lost through disease, developmental anomaly, or injury. Most typically, bionic devices intervene with the nervous system and aim to control neural activity through the delivery of electrical impulses. An example of this is a cochlear implant which delivers electrical impulses to physiologically excite surviving neurons of the auditory system, providing the capacity to elicit the psychological perception of sound.

This unit primarily focuses upon the replacement of human senses, the nature and transduction of signals acquired, and how these ultimately effect neural activity.

Mechanical Engineering unit of study descriptions

MECH – Mechanical Engineering unit of study descriptions

MECH1400
Mechanical Construction

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

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

MECH1560
Introduction to Mechanical Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Workshops **Prohibitions:** ENGG1800 or CIVL1900 or CHNG1108 or AERO1560 or AMME1960 or MTRX1701 or ENGG1960 **Assessment:** Through semester assessment (90%) and Final Exam (10%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

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 (60%): 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.

Manufacturing Technology (40%): An overview of a range of processes related to the design and manufacture of aerospace components is provided through hands-on experience. Manufacturing Technology practical work is undertaken in: (a) Hand tools, Machining, and Welding - an introduction to basic manufacturing processes used to fabricate mechanical engineering hardware. Safety requirements: All students are required to provide their own personal protective equipment (PPE) and comply with the workshop safety rules provided in class. 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. (b) Solid Modelling - the use of computer aided design (CAD) tools to model geometry and create engineering drawings of engineering components. (c) Microcontrollers - ubiquitous in modern engineered products - will be introduced through experiential learning with development kits.

MECH2400
Mechanical Design 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories **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 to AS1100; 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) Appreciation and analysis of standard components; 7) An understanding of power transmission elements.

MECH2401
Human-Centred Engineering Design

Credit points: 6 **Session:** Semester 2 **Classes:** e-learning, tutorials, studios **Assumed knowledge:** MECH1560 AND MECH1400 **Assessment:** through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

MECH2401 aims to integrate various less technical aspects of industrial design, with a focus on designing for humans.

Elements of human ergonomics, industrial design, creativity, problem solving, critical thinking, team project work, marketing and product development form the basis for the unit of study.

The unit is predominantly delivered in a studio learning environment, with involvement of industry practitioners and a major team project based on the creative design of products for human use.

Group based problem solving and a project based studio learning environment form the core basis for student learning.

MECH2901
Anatomy and Physiology for Engineers

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories **Prerequisites:** (AMME1960 OR ENGG1960 OR AMME1961 OR BIOL1xxx) AND (6CP 1000-level Chemistry) **Assessment:** Through semester assessment (40%) and Final Exam (60%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study provides the underpinning knowledge needed in biomedical engineering designs. 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.

MECH3260
Thermal Engineering 2

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories **Prerequisites:** AMME2200 OR AMME2262. **Assumed knowledge:** Fundamentals of thermodynamics and fluid mechanics are needed to begin this more advanced course **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit aims to develop an understanding of: 1) The principles of thermodynamics- energy, entropy and exergy balances- applied to pure substances, mixtures and combustion and the application of these principles to engineering processes, power and refrigeration systems. 2) The principles of heat transfer- conductive, convective, radiative heat transfer- in the context of a variety of physical situations and the application of these principles in order to design and size engineering equipment and analyse engineering processes.

Course content includes: 1) Thermodynamics- properties of matter, energy, entropy and exergy balances for closed and steady state flow systems, mixtures, mixing and separation, psychrometry and air-conditioning and combustion- stoichiometry, first and second law analysis of reacting systems. 2) Heat Transfer- conduction, thermal circuits, general conduction equation, conduction through cylindrical bodies and fins, heat exchangers, transient conduction including analytic solutions, forced convection and natural convection, boiling and radiation- spectrum, intensity, surface radiative properties, environmental radiation, solar radiation.

At the end of this unit students will be able to: 1) Thermodynamics- apply the principles of thermodynamics and heat transfer to engineering situations; have the ability to tackle and solve a range of problems involving thermodynamic cycles, devices such as compressors and turbines, mixtures, air conditioning, combustion. 2) Heat Transfer- have the ability to tackle and solve a range of heat transfer problems including heat exchangers, cooling by fluids, quenching, insulation and solar radiation.

MECH3261
Fluid Mechanics 2

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Laboratories **Prerequisites:** AMME2200 OR (AMME2261 AND AMME2262) **Assessment:** Through semester assessment (50%) and 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:** Lectures, Tutorials, Laboratories **Prerequisites:** AMME2301 AND (AMME1362 OR AMME2302 OR CIVL2110) **Assessment:** Through semester assessment (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The unit of study 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:** Lectures, Tutorials, Laboratories **Prerequisites:** AMME2301 AND (AMME2302 OR AMME1362 OR CIVL2110) **Assumed knowledge:** (1) A good understanding of basic knowledge and principles of material science and engineering from Materials I and mechanics of solids for simple structural elements (in tension, bending, torsion); (2) Reasonable mathematical skills in calculation of stresses and strains in simple structural elements. **Assessment:** Through semester assessment (45%) and 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:** Lectures, Tutorials **Prerequisites:** MECH2400 and AMME2301 **Assumed knowledge:** Properties of engineering materials including fatigue failure theories. Statics and dynamics properties of machines. **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 utilise 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:** Laboratories, Lectures, Tutorials **Prerequisites:** MECH2400 OR ENGG1960 OR AMME1960 **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:

CAD / CAM: An introduction into the use of CAD and manual CNC coding as separate tools combined with an introduction into the kinematics and structural requirements in the construction of a CNC machine.

Rapid Engineering: An introduction into the most current Rapid Engineering methods currently in use.

Manufacturing Processes: Common processes and their science (machining, casting, powder metallurgy, metal working, welding) and their relative merits and limitations.

MECH3921
Biomedical Design and Technology

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Presentation **Prerequisites:** (AMME2302 OR AMME1362) AND MECH2901 AND (MECH2400 OR ENGG1960 OR AMME1960) **Prohibitions:** AMME5921 **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.

MECH4460
Mechanical Design 3

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **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.

MECH4601
Professional Engineering 2

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prohibitions:** AMME4010 **Assumed knowledge:** 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.

MECH4660
Engineering Management

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures **Prohibitions:** MECH3661 OR AERO3660 OR MECH2660 **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 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.

MECH4961
Biomechanics and Biomaterials

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures **Prerequisites:** (ENGG1960 OR ENGG1802 OR PHYS1001) AND (AMME2302 OR AMME1362) AND MECH2901 AND MECH3921 **Assessment:** Through semester assessment (60%) and Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This course is divided into two parts: biomechanics and biomaterials.

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).

MECH5255
Air Conditioning and Refrigeration

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Prerequisites:** MECH3260 OR MECH9260 OR MECH5262 **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%) and 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
Combustion

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **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%) and Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study 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 unit 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.

MECH5275
Renewable Energy

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Prerequisites:** (MECH3260 AND MECH3261) OR (AERO3260 AND AERO3261) OR (MECH5262 AND MECH5261) OR (MECH9260 AND MECH9261) OR (AERO9260 AND AERO9261). Students claiming to have prerequisite knowledge based on study at other institutions must contact the unit of study coordinator before enrolling in this unit and may be required to sit a pre-exam to demonstrate that they have the necessary knowledge and skills to undertake this advanced level unit. **Assumed knowledge:** The student will need a sound background in advanced level fluid mechanics, thermodynamics and heat transfer. In particular, students should be able to analyse fluid flow in turbomachinery; perform first and second law thermodynamic analysis of energy conversion systems, including chemically reacting systems; and perform advanced level calculations of conductive and convective and radiative heat transfer, including radiative spectral analysis. **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.

MECH5304
Materials Failure

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories, Presentation **Prerequisites:** (AMME9301 OR AMME2301) AND (AMME9302 OR AMME2302 OR AMME1362) AND (MECH9361 OR MECH3361) AND (MECH9362 OR MECH5362 OR MECH3362) **Assumed knowledge:** Fundamental knowledge in materials science and engineering: 1) atomic and crystal structures 2) metallurgy 3) structure-property relationship 4) mechanics of engineering materials 5) solid mechanics **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Develop advanced knowledge and skills in diagnostic analyses of materials failure using advanced techniques; enhance students' ability in handling complex engineering cases using interdisciplinary technologies; and provide students an opportunity to understand project research.

MECH5305
Smart Materials

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories **Prerequisites:** (AMME9301 OR AMME5301 OR AMME2301) AND (AMME9302 OR AMME5302 OR AMME2302 OR AMME1362) **Assumed knowledge:** Fundamental knowledge in materials science and engineering: 1) atomic and crystal structures 2) metallurgy 3) structure-property relationship 4) mechanics of engineering materials 5) solid mechanics **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Develop an essential understanding of structure-property relationship of smart materials, as well as their applications in practical applications; develop student's capability to design functional structures using smart materials; and provide students an opportunity to learn the new knowledge through project approaches.

MECH5310
Advanced Engineering Materials

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Laboratories **Prerequisites:** (AMME2301 OR AMME9301) AND (AMME2302 OR AMME1362 OR AMME9302) AND (MECH3362 OR MECH9362) **Prohibitions:** MECH4310 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

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.

MECH5416
Advanced Design and Analysis

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prerequisites:** (AMME2301 OR AMME9301) AND (AMME2500 OR AMME9500) AND (MECH2400 OR MECH9400) **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

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.

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.

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:** Lectures, Project Work - own time, Laboratories, Tutorials **Prerequisites:** MTRX3700 **Prohibitions:** MECH4720 **Assumed knowledge:** Strong MATLAB skills **Assessment:** Through semester assessment (65%) and Final Exam (35%) **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 and Image Intensifiers

c) ACTIVE SENSORS THE BASICS: Operational Principles, Time of flight (TOF) Measurement and 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.

MECH5907
Orthopaedic and Surgical Engineering

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures **Prerequisites:** (AMME2302 OR AMME9302 OR AMME1362) AND (MECH2901 OR AMME9901) AND (MECH3921 OR AMME5921) **Prohibitions:** MECH4902 **Assumed knowledge:** 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 unit 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.

Mechatronic Engineering unit of study descriptions

MTRX – Mechatronic Engineering unit of study descriptions

MTRX1701
Introduction to Mechatronic Engineering

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, Workshops **Prohibitions:** MECH1560 OR ENGG1800 OR AERO1560 OR CIVL1900 OR CHNG1108 OR AMME1960 OR ENGG1960 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

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 (60%): (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.

Manufacturing Technology (40%): An overview of a range of processes related to the design and manufacture of aerospace components is provided through hands-on experience. Manufacturing Technology practical work is undertaken in: (a) Hand tools, Machining, and Soldering - an introduction to basic manufacturing processes used to fabricate mechatronic engineering hardware. Safety requirements: All students are required to provide their own personal protective equipment (PPE) and comply with the workshop safety rules provided in class. 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. (b) Solid Modelling - the use of computer aided design (CAD) tools to model geometry and create engineering drawings of engineering components. (c) Microcontrollers - ubiquitous in modern engineered products - will be introduced through experiential learning with development kits.

MTRX1702
Mechatronics 1

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Prohibitions:** ELEC1101 or ELEC2602 or COSC1902 or COSC1002 **Assumed knowledge:** MTRX1701 **Assessment:** Through semester assessment (60%) and Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit of study aims to provide a foundation for the study of systems and embedded programming for the degree in Mechatronic Engineering.

It is based around a systems engineering approach to requirements capture, software design, implementation, debugging and testing in the context of the 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. Programming in teams; documentation and version control.

The C language: 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 allocation; functions and parameter passing; derived storage classes: structures and unions; file I/O.

MTRX1705
Introduction to Mechatronic Design

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials, Laboratories **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 basic hardware elements of mechatronic systems.

Basic electrical theory: Ohms law, Kirchoff's voltage and current laws, passive component characteristics (resistors, capacitors and inductors).

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.

Brushed DC Motors: Introduction to characteristics and control, motor specifications, torque-speed characteristics, power and efficiency, thermal considerations.

Introduction to BJTs and FETs as switches. PWM control of DC motors; half- and full-bridge configurations; Feedback and operational amplifiers; selected op-amp applications circuits with an emphasis on sensor and actuator interfacing.

The unit of study will include a practical component where students design and implement logic and linear circuits. Purchase of a basic laboratory tool kit as described in classes will be required.

MTRX2700
Mechatronics 2

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Laboratories **Prerequisites:** MTRX1702 AND MTRX1705 **Prohibitions:** ELEC2601 or 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%) and 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, emphasising 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, MTRX1705. 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).

MTRX3700
Mechatronics 3

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories **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%) and 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 organisation, and the organisation 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; real-time operating systems for microcontrollers; 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.

MTRX3760
Mechatronic Systems Design

Credit points: 6 **Session:** Semester 2 **Classes:** lectures, tutorials **Prerequisites:** MTRX2700 **Assessment:** Through semester assessment (60%), Final Exam (40%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit of study follows a systems engineering approach to the integration of hardware and software components to form mechatronic systems.

Sensors: dead reckoning and inertial sensors; external sensors including ultrasonic, laser, radar and GPS; sensor interfaces, serialisation and data streams.

Methodologies for object-oriented design; the C++ language: classes and class design; overloading; inheritance and polymorphism; iostreams.

Operating system: introduction to structure and principles; facilities for interprocess communication and synchronisation; device drivers and applications programming; Gnu software tools; make and related utilities; communications middleware for distributed software.

Students will complete a six-week project working in groups to design and implement a distributed mechatronic system.

MTRX5700
Experimental Robotics

Credit points: 6 **Session:** Semester 1 **Classes:** Laboratories, Lectures **Prerequisites:** (AMME3500 OR AMME5501 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%) and 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.

Project Management unit of study descriptions

PMGT – Project Management unit of study descriptions

PMGT1852
Communications and Stakeholder Management

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Tutorials **Assumed knowledge:** ENGG1850 **Assessment:** through semester assessment (50%) and final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Effective stakeholder management and communication play a vital role in the success of projects. Project managers and leaders often express that stakeholder management, leadership and communication are often the most sought-after competencies. This unit of study focuses on the process of stakeholder identification; defining their roles and responsibilities; understanding their organisation mission, vision and overall strategic objectives; alignment and prioritisation of specific project needs and requirements; with emphasis on stakeholder engagement/analytic methodologies such as analysing stakeholder influence, reliance, collaboration and communication networks. The unit of study will also cover aspects of psychology, emotional intelligence, communication techniques and leadership qualities required for effective performance in project management roles.

PMGT2800
Project Placement A

Credit points: 6 **Session:** Semester 1 **Classes:** practical experience, workshops, meetings **Assumed knowledge:** ENGG1850 AND MATH1005 AND BUSS1040 AND PMGT1852. This unit of study is only available to students who have a credit average or above and who have obtained approval from the program director. **Assessment:** through semester assessment (100%) **Mode of delivery:** Field experience

Note: Department permission required for enrolment.

This unit of study provides student with internship and/or work placement opportunities in the field of project management. It allows student to translate their learning from their junior and intermediate units of study within Bachelor of Project Management degree into experiential learning in a real world context. Students will be required to work with the supporting/host organisation for a minimum of 120 hours or 20 working days and this arrangement needs to be endorsed by both the academic director of the program or equivalent and the supervisor of the host organisation prior to the beginning of the placement. Students will gain valuable industry and professional experience from this unit of study including communication and key aspects of project management skills such as planning, scheduling, costing, coordinating, resourcing, budgeting, monitoring and reporting. It is anticipated that this unit of study would enrich the learning experience as well as enhance future business development or job employment opportunities in the project management context.

PMGT2801
Project Placement B

Credit points: 6 **Session:** Semester 1 **Classes:** practical experience, workshops, meetings **Assumed knowledge:** ENGG1850 AND MATH1005 AND BUSS1040 AND PMGT1852 **Assessment:** through semester assessment (100%) **Mode of delivery:** Field experience

Note: Department permission required for enrolment.

This unit of study provides student with internship and/or work placement opportunities in the field of project management. It allows student to translate their learning from their junior and intermediate units of study within Bachelor of Project Management degree into experiential learning in a real world context. Students will be required to work with the supporting/host organisation for a minimum of 120 hours or 20 working days and this arrangement needs to be endorsed by both the academic director of the program or equivalent and the supervisor of the host organisation prior to the beginning of the placement. Students will gain valuable industry and professional experience from this unit of study including communication and key aspects of project management skills such as planning, scheduling, costing, coordinating, resourcing, budgeting, monitoring and reporting. It is anticipated that this unit of study would enrich the learning experience as well as enhance future business development or job employment opportunities in the project management context. This unit of study is only available to students who have a credit average or above and who have obtained approval from the program director.

PMGT2854
Implementing Concurrent Projects

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories, Tutorials **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.

PMGT3850
Project Management Capstone Project A

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Meeting, Project Work - own time **Prerequisites:** 30 credits of 2nd or 3rd 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 and 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 and 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:** Lectures, Practical Work **Prerequisites:** 30 credits of 2nd year units of study, and PMGT3850 **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 and 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 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:** Lectures, Tutorials **Prerequisites:** ENGG2851 **Assessment:** Through semester assessment (50%) and Final Exam (50%) **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 unit 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.

PMGT3856
Sustainable Project Management

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **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 not only in terms of economic capital but 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, whilst considering social and environmental impacts these projects may have. Cases discussed in this unit 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:** Lectures, Laboratories, Tutorials **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit 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.

PMGT3858
Complex Project Coordination

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials **Prerequisites:** ENGG1850 AND ENGG2852. **Assessment:** Through semester assessment (50%) and 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.

PMGT4850
Project Management Honours Project A

Credit points: 12 **Session:** Semester 1, Semester 2 **Classes:** Research, Lectures, Meetings **Prerequisites:** Students are required to achieve a minimum 65% average mark in the 2000-level and 3000-level or higher 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 Director)

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 **Classes:** Lectures, Meeting, Research **Prerequisites:** Students are required to achieve a minimum 65% average mark in the 2000-level and 3000-level or higher 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.

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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.

PMGT5875
Project Innovation Management

Credit points: 6 **Session:** Semester 1 **Classes:** Lectures, Tutorials, E-Learning **Assessment:** Through semester assessment (100%) **Mode of delivery:** Block mode, Online

Innovation is widely-recognised as a major driver of economic growth. Yet innovation projects can be difficult to manage: they typically involve a high level of uncertainty, and many organisations are unsatisfied with the level of innovation they achieve. In this unit of study, we focus on issues in the management of innovation projects at the individual project level, organisational level and across networks of organisations. Since a systematic approach can and does improve our effectiveness in managing innovation, we begin by exploring several different process models of the stages through which innovation projects are managed. We discuss context and challenges which impact such projects, as well as the concepts of creativity and intellectual property management. Using focused case studies, we analyse best practice in the structures and processes that organisations can provide to enable innovation, as well as to support the search, selection, implementation, dissemination, feedback and evaluation stages of their innovative projects. We also examine the impact of networks on innovation (e.g. collaboration networks), national innovation policies and systems, and trends towards open innovation.

PMGT5876
Strategic Delivery of Change

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Seminars, E-Learning **Prohibitions:** WORK6026 **Assessment:** Through semester assessment (100%) **Mode of delivery:** Online, Normal (lecture/lab/tutorial) day

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 and storytelling. You will learn quite a bit about these ideas 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: be they in private, public or third sector.

PMGT5879
Strategic Portfolio and Program Management

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lectures, Tutorials, E-Learning **Assessment:** Through semester assessment (100%) **Mode of delivery:** Block mode, 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:** Lectures, Tutorials **Assessment:** Through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) evening

Note: Department permission required for enrolment.

Students should achieve an understanding of dynamical systems methods applied to complex adaptive systems (CAS). CAS is a new approach to engineering and management that studies and models how relationships between parts give rise to collective and dynamic system-level behaviours, for example, in communication and transport networks, megaprojects, social and eco-systems. Effectively implemented, the methods can dramatically improve a manager's effectiveness in today's complex and interconnected business world, by helping to predict and evaluate indirect effects of actions and policies. This course provides managers with many practical quantitative tools to enhance individual, team, and organisational learning, change, and performance.

PMGT6867
Quantitative Methods: Project Management

Credit points: 6 **Session:** Semester 1, Semester 2 **Classes:** Lectures, Tutorials, E-Learning **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 (50%) and Final Exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) evening, 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 unit will also facilitate the understanding of the mechanics of these methods and their underlying theory.

PMGT6885
Project Placement Special Topic

Credit points: 6 **Session:** Intensive January, Intensive July, Semester 1, Semester 2 **Assessment:** through semester assessment (100%) **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 related to the management of projects; the content of this unit may be varied depending on special opportunities such as a distinguished researcher visiting the University.

PMGT6888
International Project Study Tour

Credit points: 6 **Session:** Intensive February, Intensive July, Semester 1, Semester 2 **Classes:** Project Study Tour, Tutorials, Seminars **Assumed knowledge:** Students must have at least 3 years of relevant industry experience to be eligible to enrol in PMGT6888. **Assessment:** Through semester assessment (100%) **Mode of delivery:** Block mode

Note: Department permission required for enrolment. Note: PMGT6888 is available only to students with appropriate level of previous industry experience. This must be confirmed by department before enrolment in the unit.

The aim of this elective unit of study is to provide students with an opportunity to learn from and compare international approaches to the management of projects, to develop their networks and connections and broaden their view of the field. It will take the form of a study trip to one or more countries where seminars will be arranged with universities allowing collaborative work with local students, academics and researchers and industry and project visits will facilitate enhancement of experience and forge new connections. Individually, students will be required to undertake reading in the field to extend their critical and theoretical perspectives. They will be required to keep a reflective journal throughout the trip documenting their experiences and relationship to their reading. As a group, students will maintain a blog, sharing and reflecting on their learning and experiences with a wider audience. Prior to commencement of the trip, students will submit a proposal for an individual report on a theme aligned with the proposed activities for the trip. This report will require research in terms of a literature review, fact finding and interviews conducted during the trip and will be submitted at the end of the semester. On return to Australia, participating students will host a seminar for fellow students, alumni and industry at which they will share their insights.

Software Development unit of study descriptions

SOFT – Software Development unit of study descriptions

SOFT2201
Software Construction and Design 1
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** lectures, laboratories **Prerequisites:** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 **Prohibitions:** INFO3220 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit introduces the foundations of software design and construction. It covers the topics of modelling software (UML, CRC, use cases), software design principles, object-oriented programming theory (inheritance, polymorphism, dynamic subtyping and generics), and simple design patterns. The unit aims to foster a strong technical understanding of the underlying software design and construction theory (delivered in the lecture) but also has a strong emphasis of the practice, where students apply the theory on practical examples.

SOFT2412
Agile Software Development Practices
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** Lectures, Laboratories, Project Work - own time **Prerequisites:** INFO1113 OR INFO1103 OR INFO1105 OR INFO1905 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit builds students skills to follow defined processes in software development, in particular, working in small teams in an agile approach. Content covers the underlying concepts and principles of software processes, their analysis, measurement and improvement. Students will practice with a variety of professional-strength tool support for the practices that ensure quality outcomes. The unit requires students to enter already skilled in individual programming; instead this unit focuses on the complexities in a team setting.

SOFT3202
Software Construction and Design 2
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 1 **Classes:** lectures, laboratories **Prerequisites:** SOFT2201 **Prohibitions:** INFO3220 **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

This unit is a sequel of Software Construction and Design I (SOFT2301). It introduces advanced concepts which build on the topics of SOFT2301. SOFT3302 covers topics including software validation and verification, the theory of testing, and advanced design patterns. The unit has a strong focus on the theoretical underpinning of software design. I the labs the theory is applied with contemporary tools with concrete examples.

SOFT3410
Concurrency for Software Development
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** lectures, laboratories **Prerequisites:** (INFO1105 OR INFO1905) OR ((INFO1103 OR INFO1113) AND (COMP2123 OR COMP2823)) **Assessment:** through semester assessment (50%), final exam (50%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

The manufacturing industry has experienced a radical shift in the way they design computers, with the integration of multiple processors on the same chip. This hardware shift now requires software developers to acquire the skills that will allow them to write efficient concurrent software. Software developers used to wait for manufacturers to increase the clock frequency of their processors to see increases in the performance of their programs, the challenge is now to exploit, in the same program, more and more processing resources rather than faster processing resources. In this unit, you will learn how to tackle the problems underlying this challenge, including developing and testing concurrent programs, synchronizing resources between concurrent threads, overcoming fairness issues and guaranteeing progress, and ensuring scalability in the level of concurrency.

SOFT3413
Software Development Project
Engineering and Information Technologies

Credit points: 6 **Session:** Semester 2 **Classes:** project work, site visits, meetings **Prerequisites:** 18CP 2000-level or above units from SOFT, COMP or INFO **Assumed knowledge:** SOFT3202 **Assessment:** through semester assessment (100%) **Mode of delivery:** Normal (lecture/lab/tutorial) day

Note: Department permission required for enrolment.

This unit will provide students an opportunity to apply the knowledge and practice 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.

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