## Semester and vacation dates 1997*

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**Notes:**
- U3.xxx: Course Codes
- CE: Civil Engineering
- ME: Mechanical Engineering
- AE: Aerospace Engineering
- ChE: Chemical Engineering
- EE/ISE: Electrical and Information Systems Engineering
- Gen: General
- PEM: Professional Environmental Management
- M.: Master's Degree
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</table>
Welcome to the Faculty of Engineering of the University of Sydney, which is also known as the P.N. Russell School of Engineering in commemoration of its munificent industrial benefactor, Sir Peter Russell. Over the past one hundred and ten years about ten thousand students have preceded you along the path you have chosen to follow towards professional engineering.

An aim of this faculty is to provide the best possible education for its students, both undergraduate and postgraduate. Undergraduate teaching is one of the highest expressions of education; for us, undergraduate teaching is a great social responsibility as well as an opportunity to produce engineers of the future who are both technically competent and socially aware.

In whichever of the five engineering branches you may choose to enrol, you will find that the engineer is concerned with applying scientific knowledge and exercising social skills. To do so with competence and assurance, we believe he or she should have a strong basis in science: Consequently, during the first two years of your course this scientific basis is laid down. This vital foundation, the soundness of which is the hallmark of the Peter Nicol Russell School, provides you with the ability you will depend on during your future professional career to appreciate the significance of new and developing technologies, and to work with them.

The engineer must operate in the real world of economic forces and social priorities. Engineering is a creative occupation: based on science applied with art and skill, and with the economic and social dimensions added.

You may have chosen to take engineering because you enjoy proficiency at mathematics and in the sciences, disciplines you probably find interesting and challenging. You perhaps have a liking for solving problems and making things. These are all characteristics of the engineer. Engineering is about meeting people too, and managing. Many engineers travel extensively; they tend to have high starring salaries and high career mobility; and they are greatly needed by the nation.

The course in engineering includes more classes and laboratory hours than most. It calls for steady and concentrated effort. Above all it is stimulating and exciting. Engineering students are a cohesive group who play hard, win more than their share of sporting trophies, and have a reputation for flair and initiative. This, too, is the essence of engineering. I congratulate you for joining us and I wish you well in your university life and professional career.

John Glastonbury
Dean
This is the Faculty of Engineering Handbook. In it we hope you will find most of what you need to know about the faculty. In particular, it will help you to know who the people in the faculty are; the requirements for degrees and diplomas in the faculty and the ways that these can be satisfied; what courses are offered, and the books required for them; and where to turn for more information, advice and help.

When making up your mind about your courses of study, look first at chapter 2 dealing with the various branches of engineering, and then at chapter 3, which sets out the requirements for the BE degree and explains how to go about selecting the courses of study.

To obtain more detail on any course refer to chapter 4, where the course details are presented in course number order.

You may need help in deciding on the best courses for you to take—advice is available at the Faculty Office, Room 226, Engineering Faculty Building, or from Year Advisers.

Chapter 5 is a collection of other information about the faculty, such as special enrolment instructions, scholarships and prizes available, and professional societies.

Access
Potential students, students and their parents, industry and members of the public are invited to contact the Faculty of Engineering as follows:

**The Faculty of Engineering**
Faculty Building J13
The University of Sydney, N.S.W. 2006

**Student Enquiry Office**
Room 226, Faculty Building J13, tel. 9351 2534

**Engineering Library**
Level 1, PNR Bdg J02, tel. 9351 2138

**Dean's Office**, tel. 9351 4739/4757
General correspondence, contract research

**Advancement Office**
Room 323B, PNR Bdg J02, tel. 9351 4613
Enquiries about industry links, faculty foundations, Women for Engineering Bursaries, careers markets, gifts and donations, public relations, engineering alumni, etc.

**CSE Office**
Room 323A, PNR Bdg J02, tel. 9351 2834
Chancellor's Scholarships in Engineering

**Foundations and Centres**
- Chemical Engineering Foundation
  Room 454, ChE Bdg J01, tel. 9351 3959
- Civil and Mining Engineering Foundation
  Room 335, CE Bdg J05, tel. 9351 2127
- Electrical Engineering Foundation
  Room 606, EE Bdg J03, tel. 9351 3659
- Warren Centre for Advanced Engineering
  Level 2, Faculty Building J13, tel. 9351 3752
- ASIIC (Australian Centre for Innovation and International Competitiveness)
  Level 2, Faculty Building J13, tel. 9351 3934
- AGSEI (Australian Graduate School of Engineering Innovation) tel. 9209 4111

**Timetables**
The timetable of classes for Junior and Intermediate courses is available in the Engineering Faculty Office. Students should consult individual Engineering departments for the times and places of Senior and Senior Advanced courses.
FACULTY AND DEPARTMENTS/SCHOOLS

Dean
Professor John R. Glastonbury, BE MEngSc PhD, FIChemE
FATE MAusIMM FIEAust

Pro Dean
Professor John Robert Booker, BSc PhD DEng, FAA

Associate Dean (Research and Development)
Professor Y.-W. Mai, Bsc(Eng) PhD U.K., MASME FIEAust

Associate Dean (Undergraduate)
Associate Professor Robin J. King, BEng Sheff. PhD Lond., MIEE FIEAust FIEE

Advisers to Undergraduate Students
Aeronautical—all years—Professor G.P. Steven
Chemical—
  Undergraduate Adviser—Associate Professor G.W. Barton
  Junior—Intermediate—Dr V.G. Gomes
  Senior—Associate Professor D.F. Bagster
  Senior Advanced—Dr L.A. Furzer
Civil—
  Junior and Intermediate—Mr N.L. Ings
  Senior—Dr M.J. Clarke
  Senior Advanced—Associate Professor A. Abel
Electrical—
  Junior and Intermediate—Dr M. Johnson
  Senior—Dr J. Rathmell
  Senior Advanced—Associate Professor D. Wong
Mechanical—
  Undergraduate Adviser—Dr Assaad Masri
  Postgraduate Adviser—Prof. Nhan Phan-Thien
  Junior—Dr L. Bilston
  Intermediate—Mr P. McHugh
  Senior—Dr Zhong
  Senior Advanced—Dr J.D. Atkinson

Faculty Manager and Secretary to Faculty
Ms Jenny Beatson

Student Administration Staff
Postgraduate Adviser—Ms Julie Barry, BA
Undergraduate Adviser—Ms Anne Kwan, BA DipEd Chinese H.K.
Office Manager—Mrs Anna Maria Brancato
Office Assistant—vacant

Administrative Assistant (Secretary to the Dean)
Ms Josephine Harty, BA Macq.

Executive Officer, Engineering Advancement Office
Mr Jeremy M. Steele, BA Keele

Chancellor's Scholarships in Engineering Program
Executive Officer—Mrs Lee Jobling, MA

Administrative Assistant
Ms Jane Busquets

Computer Engineer
Mr Kevin R. Rosolen, MSc Macq.

Computer Programmers
Mr Bernard Gardiner, BSc
Mrs Lila Yassini

Professional Officer Grade II
Didier Debuf, BE U.N.S. W.

Faculty Librarian
Mrs Joan Morrison, BA MSLS Case Western Reserve

Aeronautical Engineering
Head
Professor Grant P. Steven
Administrative Officer
Ms Yvonne Witting

Chemical Engineering
Head
Associate Professor Brian S. Haynes
Administrative Assistant
Mrs Kylie Wootton

Civil and Mining Engineering
Head
Professor John Philip Carter
Executive Assistant to Head of School
Ms Tmme Blair, BA U.N.S. W.

Electrical Engineering
Head
Professor David J. Hill
Administrative Officer
Ms Kim L. Murphy, BA N'cle(N.S.W.) MEdAdmin N.E. GradDipSecStudies C.C.AE.

Mechanical Engineering
Head
Associate Professor John Kent
Administrative Officer
Ms Carol Prasad BA Auck.

DEPARTMENTS

Aeronautical Engineering

Lawrence Hargrave Professor
Grant P. Steven, BSc Glas. DPhil Oxf.
Appointed 1991

Senior Lecturers
Douglass J. Auld, BSc BE MEngSc PhD
Karkenahalli Srinivas, ME PhD I.I.Sc.

Lecturers
Peter Gibbens, BE(Aero) PhD N'cle
Daniel M. Newman, BE MEngSc
Kee-Choon Wong, BE PhD
Liyong Tone, BSc MEngSc Dalian PhD B.U.A.A., MIEAust

'As at October 1996.
Part-time Lecturer
John Bladder, BE

Associate Lecturer
Osvaldo Querin, BE ME(Res)

Professional Officers
Nikos Pitsis, DipEng Athens Polytechnic BE MEngSc
Radu Turcanu, BE(Aero) Bucharest

Chemical Engineering

Professor
Rolf G.H. Prince, BE BSc N.Z. PhD, FIChemE HonFIEAust FTSE FEng
Appointed 1969

ICI Australia/University of Sydney Professor of Process Systems Engineering
Jose Romagnoli, BE N.delSur.Arg. PhD Minn.
Appointed 1991

ANSTO/University of Sydney Professor of Risk Engineering
H. Mark Tweeddale, BE MEng Melb., FIChemE FIMechE FIEAust FTSE CEng
Appointed 1988

Shell Professor of Environmental Engineering

Professorial Fellow
Ric Charlton, BE MESc, FTS

Associate Professors
David F. Bagster, BScApp BSc BE Qld PhD Camb., FIEAust FIChemE CEng
John P. Barford, BE PhD U.N.S. W., FIChemE FIEAust CEng (Director of Research)
Geoffrey W. Barton, BE PhD
Brian S. Haynes, BE PhD U.N.S. W.

Senior Lecturers
Ian A. Furzer, DSc(Eng) PhD Lond., MChemE CEng MAIChemE
Timothy A.G. Langrish, BE N.Z. DPhil Oxf., MChemE
Barry W. Walsh, BE PhD, MChemE CEng SPE

Lecturers
Parisa A. Bahri, BSc, MSc Tehr. PhD
Vincent G. Gomes, BTech MEng PhD Montr.
Marc Shellkoff, BS Venn. PhD M.I.T.

Technical Manager
Robert Staker, PhD Adel.

Professional Officer Grade IV
Denis M. Nobbs, BE U.N.S. W.

Honorary Appointments

Honorary Research Associates
G. DeLeon, PhD, MAIMM GSA
Neville A. Gibson, MSc PhD, MRSChem ARACI FAusIMM CChem
Kenneth C. Hughes, BSc PhD U.N.S.W. ASTC S.T.C.
Peter B. Linkson, BE PhD, FIEChemE FAusIMM FGAA CEng

Honorary Professional Associate
Wayne A. Davies, BSc PhD, MIEAust

Civil and Mining Engineering

Challis Professor of Civil Engineering
Nicholas Snowden Trahair, BSc BE MEngSc PhD DEng, FIEAust
Appointed 1979

Professors
Harry GeorgePoulos, AM, BEPhDDScEng,FIEAustFASCE FIA
Appointed 1982
John P. Carter, BE PhD, MICE FIEAust
Appointed 1990

Professor of Engineering Mechanics
John Robert Booker, BSc PhD DEng, FIEAust FAA
Appointed 1985

BHP Steel Professor of Steel Structures
Gregory J. Hancock, BE BSc PhD, FIEAust
Appointed 1990

Associate Professors
Andrew Abel, DipIIng T. U. Bud. MSc McM. PhD U.N.S.W., CEngFIM
Peter Ansourian, BSc BE PhD PhD, FIEAust
Ali Ja'afari, BSc ME Tehr. MSc PhD Sur.
Kenny C.S. Kwok, BE PhD Monash, FIEAust
Stuart G. Reid, ME Can. PhD McG.
John C. Small, BSc(Eng) Lond. PhD, MIEAust MASCE
Robert J. Wheen, BSc BE MEngSc, FIEAust MASCE

Senior Lecturers
David W. Arey, BA MPhil PhD Camb.
Logan W. Apperley, BE PhD Auck.
Murray J. Clarke, BSc BE PhD
Kim J.R. Rasmussen, MEngSc T.U. Donemark PhD

Lecturers
Noel L. Ings, MEngSc U.N.S.W. BE, MASCE MIEAust
Lloyd J. Pilgrim, BSurv PhD N'cle(U.N.S.W.)

Tutor in Surveying
John Curdie, ME DipT&CP, FIS

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Nigel P. Balaam, BE PhD
John P. Papangelis, BE PhD

Professional Assistant
David Wang, BE Tong-ji MBldgSc U.N.S.W.

Computer Systems Officer
Danny D.Q. Kim, BSc Ho Chi Minh United

Honorary Appointments

Emeritus Professor
A.E. Jenkins, BMetE MEngSc PhD Melb., FIM FIEAust MAIMM MAIM

Honorary Research Associates
Russel Q. Bridge
Peter T. Brown, BE PhD
Roger J. Enright, BE PhD U.N.S.W. MSc W.Virginia
Howard B. Harrison, BE PhD, MIEAust
Ian S.F. Jones, BE U.N.S.W. PhD Wat., MIEAust
Harold Roper, BSc PhD Witw. MEngSc, MAIMM
Richard D. Watkins, BE Qld PhD Aberd.,- MIEAust

Honorary Teaching Associate
Ian G. Bowie, MSc Mane, MCSCE MIEAust

Electrical Engineering

P.N. Russell Professor
Appointed 1980

Professors
David Hill, BE BSc Qld PhD N'cle(U.N.S.W), FIEAust FIEEE
Marwan A. Jabri, Maitrise de physique Paris PhD
Associate Professors
Robin W. King, BEngScPhD Lond., MIEE FIEAust HREE
Robert A. Minasian, BE PhD Melb. MSc(Eng) Dist) DipMicrowave Eng(Dist) Lond., MIEEE SMIREE HE Aust
Stephen W. Simpson, BSc PhD, FIE Aust
Anthony D. Stokes, BSc BE PhD, FIE Aust
Branka S. Vucetic, MSc PhD Belgrade
David G. Wong, BSc BE MEngSc PhD, FIE Aust

Readers
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Shu Yuen Ron Hui, BSc Birm. PhD DIC Lond., MIEEE MIEE

Senior Lecturers
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David Levy, BSc, MSc (Engl), Natal, MIEEE Ph D Natal
James G. Rathmell, BSc BE PhD, SMIREE
Jonathan B. Scott, BSc BE MEngSc
Graham E. Town, BE N.S.W.I.T. PhD, MIEEE MIEEE
Hansen Yee, BSc BE PhD, IEEE

Professors
Hugh Francis Durrant-Whyte, BSc(Eng) Lond. MIEEE Ph D Penn.
Appointed 1995
Yiu-Wing Mai, BSc(Eng) PhD H.K., MASME HE Aust
Appointed 1987
Nhan Phan-Thien, BE PhD
Appointed 1991

Associate Professors
John H. Kent, BE MEngSc PhD

Senior Lecturers
John D. Atkinson, PhD Cal. Tech. BSc BE
M. W. M. G. Dissanyake, BSc(Eng) Peradeniya MSc PhD Birm.
Andrei Lozzi, BSc U.N.S. W. MEngSc PhD
Assaad R. Masri, BE PhD
Paul J. McHugh, BSc BE
Eduardo M. Nebot, BS Bahia Blanca MS PhD Colorado

Lecturers
Lynne E. Bilston, MSc PhD Penn. BE
David C. Rye, BE Adel. PhD
Lin Ye, BS Harbin MS PhD BIAA
Liangchi Zhang, BSc MEng Zhejiang PhD Beijing

Professional Officers
Jonathan P. Woolmington, BE

Research Fellow
Sten H. Stamer, BE PhD

Visiting Professor
Michael V. Swain, BSc PhD U.N.S.W.

Adjunct Associate Professor
Robin J. Higgs, St Bartholomew’s Hospital Medical School, London

Honorary Appointments
Emeritus Professors
W. N. Christiansen, DSc Melb., FlnstP FAIP FIEE FIEAust
F AA FIRE( Aust)
Hugo K. Messerle, MEngSc DSc Melb. PhD, FTS HEE HE Aust
FIRE FIEEEE FAIP

Research Associate
Peter M. Nickolls, MB BS BSc BE PhD

Research Affiliate
J. J. Lowke, BSc PhD DipEd Adel.

Mechanical and Mechatronic Engineering
P.N. Russell Professor
Roger Ian Tanner, BSc Brist. MS Calif. PhD Mane, FAAA FTS
FIEAust MASME MAIChE
Appointed 1975

Professors
Robert William Bilger, BSc BE N.Z. DPhil Oxf. FTS FIEAust
Appointed 1976
A short history

A hundred years of engineering education
In 1983 the Faculty of Engineering celebrated one hundred years of engineering education at the University of Sydney.

At the beginning of March 1883 the first classes in engineering were held in the Main Building. Engineering then formed part of the newly created Faculty of Science (1882). The classes were attended at the opening by three matriculated students who were candidates for the engineering certificate and by seven non-matriculated students.

The lecturer in engineering was Mr W.H. Warren, who had been appointed in December 1882 following a decision by the University Senate to carry out significant revisions to the teaching of the University. These revisions, which provided for the establishment of Schools of Medicine, Science and Engineering, were unable to be implemented in 1881 for lack of staff, accommodation, and facilities.

In 1883, when the new engineering curriculum was introduced, the Senate reported that 'great inconvenience [had] been felt during the year, both by the lecturers and the students, through the deficiency in accommodation for lecturing purpose ... the room occupied by the Lecturer in Engineering [was] much too small to contain the apparatus required for the illustration of his lectures...'. A temporary structure was erected at the rear of the Main Building, and in 1885 classes moved to a fairly commodious low white building with a verandah facing Parramatta Road, on a site now partly occupied by the Holme Building.

In 1909 the new building for the P.N. Russell School of Engineering was sufficiently completed early in the year for the work of the school to be conducted within its walls. This building—an outcome of the P.N. Russell benefactions described on the pages following—was formally opened by the Governor on 20 September 1909 at the same time as he opened the new Fisher Library building (now MacLaurin Hall). During the course of the next few decades extensions were made to the PNR Building until, with the expansion in student numbers in the 1950s and early 1960s, new facilities were constructed in the Darlington extension area across City Road. Since the mid seventies all departments have been accommodated in this area, although a wind tunnel in the Woolley Building is still in use by Aeronautical Engineering.

Curriculum development
It was the Senate's intention in establishing engineering education at the University in 1882 to award Certificates in Engineering—in Civil Engineering and Architecture, Mechanical, and Mining Engineering. In 1883, however, the Senate adopted revised by-laws to establish two degrees in engineering, those of Bachelor of Engineering and Master of Engineering.

In so doing the Senate specified three branches of engineering: Civil Engineering and Architecture; Mechanical Engineering and Machine Construction; and Mining Engineering, Metallurgy, Assaying and Mining Law.

In 1891 Civil and Mechanical were combined. By 1893 Mining had become Mining and Metallurgy and a separate curriculum in Electrical Engineering had been introduced. In 1900 Mechanical and Electrical were combined, and in the same year the degree course in Civil Engineering was extended to four years.

In 1920, in an act of major academic restructuring, the University created six new faculties including Engineering, so separating it off from the Faculty of Science after nearly forty years of association. To this day the two faculties remain closely allied in teaching and outlook. The other faculties created at that time were Agriculture, Architecture, Dentistry, Economics and Veterinary Science.

Administrative arrangements in Engineering remained unchanged until 1926 when Engineering Technology was added as a fourth branch. With the decision of the Senate to introduce teaching in Aeronautical Engineering in 1939, Aeronautical Engineering became the fifth branch. In 1948, on the appointment of Professor T.G. Hunter as the first Professor of Chemical Engineering in Australia, the Department of Engineering Technology was replaced by the Department of Chemical Engineering. In 1957 separate curricula in Mechanical Engineering and Electrical Engineering were developed and implemented.

In 1982 the departments of Civil Engineering and of Materials and Mining Engineering were amalgamated to form the School of Civil and Mining Engineering. This amalgamation recognised the close association that has developed in Australia between civil engineering and the mineral extractive industries; moreover, by providing for wider contacts with the various branches of the industry, it was intended to strengthen the teaching and research activities in the two areas.

The Faculty continued to award separate bachelor's degrees in the five areas of engineering:
- Aeronautical
- Civil
- Mechanical
- Chemical
- Electrical

Professor William Henry Warren
At its meeting on 6 December 1882 the Senate appointed Mr W.H. Warren, CE, as Lecturer in Engineering from 1 March 1883.

Warren was born in Bristol in 1852 and obtained his technical and scientific training in the London and Northwestern Railway Works and as a student at the Royal College of Science in Dublin and Owen's College, Manchester. He sailed for Sydney in 1881 and,
following nearly two years as an employee of the Public Works Department, took up his university post. He was to hold this, first as lecturer and then, from 1884, as Professor of Engineering, until his retirement at the end of 1925, a record term of 42 years. During his occupancy of his Chair he was also Chairman of the Professorial Board, Dean of the Faculty of Science, and first Dean of the Faculty of Engineering. Professor Warren retired on 31 December 1925 and was made emeritus professor from 1 January 1926.

To his peers Warren was the acknowledged leader of his profession in Australia. His services to the community on royal commissions, on scientific and technical councils, and his work in the Department of Engineering, were widely recognised and respected. His students loved and respected him.

Peter Nicol Russell

With the transfer of the Faculty of Engineering to the new engineering precinct in Darlington between 1961 and 1974, the Peter Nicol Russell School of Engineering moved from the building in Science Road where it had been housed for over 50 years. That building had been erected primarily through the generosity of a man whose engineering works thrived in Sydney a century ago.

Peter Nicol Russell was born in Scotland in 1816. He came to Australia in 1832 where, with his brothers Robert and John, he helped his father establish a general engineering and foundry business in Hobart Town. In 1838 they moved to Sydney and, just before their father died, commenced a new business, Russell Bros, in Queens Place on the banks of the Tank Stream, later moving to larger premises in Macquarie Place.

Peter Russell left the firm in 1842 when he rented the foundry and ironmongery premises which were part of the estate of James Blanch, located next to the Royal Hotel in George Street, and commenced operations under the name 'The Sydney Foundry and Engineering Works'. This business quickly flourished and in its second year received contracts for all the iron work required for the Military Barracks at Paddington, and for the Darlinghurst, Maitland and Newcastle Gaols.

Peter was later joined by his brothers, when the firm of Russell Bros was wound up, and in 1855 the partnership of P.N. Russell and Company was formed, comprising the brothers Peter, John and George (the youngest whose business 'George Russell and Company, Engineers' was absorbed in the new partnership) and the works foreman J.W. Dunlop. During the next twenty years the firm grew to such size that the works extended over a large area at Darling Harbour with a big warehouse in George Street.

It soon became the most complete organisation of its kind in Australia and undertook extensive contracts for road and railway bridges, railway rolling stock, steam dredges, gun boats for the Maori War, and crushing and flour milling machinery. Many of the beautiful cast-iron columns and ornamental architectural iron work executed by P.N. Russell & Co.'s foundry could be seen at the entrances and around the balconies of many old Sydney buildings. Bridges over the Macquarie River at Bathurst and over the Yass River at Yass, the latter with a wrought iron superstructure spanning 55m, were constructed by P.N. Russell & Co. in 1870-71.

Peter Nicol Russell returned to London in 1864 and retired as an active member of the firm, but for many years continued to act as overseas representative. He showed sound judgement and foresight by his anticipation of possible future labour troubles in the colony. He repeatedly suggested to P.N! Russell & Co. that they should devote more attention to the importing side of the business rather than continue manufacturing engineering equipment in keen competition with overseas trade, for in those days there was little protection to aid the local manufacturer.

On 30 October 1873 the workmen at the Sydney foundry made a demand for ten hours' pay for eight hours' work, and went on strike. No satisfactory arrangements for the settlement of the strike were reached and the engineering works and warehouses were closed in June 1875, never to be opened again. Thus P.N. Russell & Co. with a capital of £250 000 and employing over 1000 men went out of existence. When Peter Russell revisited Sydney after the closing of the firm which had been his life's work, it is said that he was so distressed that he immediately returned to London; there he lived in retirement until his death in 1905 at the age of 89, having been knighted in 1904. He was buried at St Marylebone cemetery in London, where his grave dominates, marked by a massive monument.

It was in 1895, while on leave in London, that Professor W.H. Warren, the first Professor of Engineering at the University of Sydney, had a fortunate meeting with Peter Russell, which led ultimately to the magnificent endowments totalling £100 000 for Engineering at this University. In 1896 Russell endowed the Department of Engineering by a gift of £50 000, including in the deed of gift a provision that the department should thereafter be styled "The Peter Nicol Russell School of Engineering'. In 1904 this gift was followed by a second benefaction of £50 000 as an extension of the first amount, when Sir Peter Russell stipulated that the Government of New South Wales should undertake to hand to the University, within three years, a sum of £25 000 to provide an extension of the buildings of the School of Engineering or to erect new buildings. This the Government agreed to do and a building was erected from designs prepared by the Government Architect.

Thus was founded the Peter Nicol Russell School of Engineering, the new building for which was opened in 1909. It is fitting that the present faculty building in the Darlington engineering precinct should retain the name of this great benefactor, thus preserving for future generations the P.N.R. tradition.

At the ground floor entrance of the Peter Nicol Russell Building may be seen one of the hardwood lintels from the Darling Harbour foundry. An elaborate Royal Coat of Arms, which was cast in the foundry for
an exhibition in London in 1851, is on display in the foyer. In the courtyard stands one of the many cast iron building columns made in the P.N. Russell & Co.'s foundry, and nearby is the monument in granite and bronze—a duplicate of Russell's St Marylebone Cemetery memorial—presented to the University by Lady Russell in honour of her husband. A portrait in oilsof Charlotte Russell hangs above the mainstairway leading from the foyer to the first floor drawing office.

The Warren Centre for Advanced Engineering

Origin
The Warren Centre for Advanced Engineering is an independent, industry-linked institute committed to fostering excellence and innovation in advanced engineering throughout Australia. Set up in 1983 to mark the centenary of engineering education at The University of Sydney, The Warren Centre is a self-funding, non-profit organisation.

The Warren Centre has four objectives:
• stimulating innovation in advanced engineering technologies important to Australia’s industrial development;
• encouraging effective deployment and use of new engineering technologies;
• promoting the integration of technology, management, design and enterprise among Australian businesses; and
• providing independent advice and comment on the above issues and their impact on national policies and industrial development and enterprise.

In its brief history, The Warren Centre has gained wide recognition for its unique approach and achievements in diverse fields of engineering technology and industry development.

The Centre’s core services include major projects, seminars and lectures, and a range of programs being developed in recent years for high-tech enterprises.

Operation
The Warren Centre is governed by a Board of Directors which consists of a majority of members from industry as well as the Dean of Engineering and representatives from the Engineering Faculty and The University.

The Centre’s fundamental aim is to engage in activities which are likely to justify strong participation and financial support by industry and the engineering profession.

The Centre underwrites the initial setup costs and risks for each activity from its investment income, which also covers core operating and administrative costs.

The investment base comprises donations, bequests and reserves. The reserves are adjusted regularly from investment income to preserve the original capital value of donations and bequests in current dollars.

Standing currently at just over $3 million, the investment base plays an important role in determining the scope and growth of The Warren Centre’s activities.

Activities

Conferences and seminars
Seminars are held during each Major Project. The Centre also sets up conferences and seminars to explore contemporary issues such as engineering risk, intellectual property, financing innovation, engineering mathematics and adding value.

SME networking
The Warren Centre promotes activities targeting small to medium size enterprises (SMEs), including the AusIndustry Business Networks Program and Round Tables where SMEs in suburban and regional centres exchange ideas, discuss issues and explore opportunities of mutual interest.

Opening other frontiers
The Warren Centre played a key role in the establishment of the Australian Graduate School of Engineering Innovation (AGSEI) and the Asia Pacific Smart Card Forum.

Publications
The Centre’s publications on the findings of its activities have received world-wide respect for their value and objectivity.

Major Projects
The Warren Centre brings together leading people in selected fields of engineering technology to work on Major Project teams to:
• develop new insights and knowledge in the technology; and
• accelerate the technology’s application in Australian industry.

These Major Projects invariably result in important breakthroughs in the technology itself and impact on Australian engineering practice and business enterprise. Major Projects have included:

Underground Space in the Urban Environment (1996)—which established the status quo for development and use of underground space and provided strategies, supported by engineering technology, for integrating the use of underground space into the fabric of the urban environment.

Utilisation of Supercomputers in Science and Engineering (1992)—which demonstrated how high performance computing can provide a new approach to solving practical problems for industry and government through extensive use of case studies, giving hands-on experience to the project team.

Energy Management in the Process Industries (1990)—which demonstrated that commercially practical applications of modern energy management techniques and technology offer annual savings exceeding $1 billion nationally, and indicated how this might be achieved.

Economic Recycling and Conservation of Structures (1989)—which combined philosophy with practical technology to achieve cost-effective conservation and re-use buildings.

Fire Safety and Engineering (1989)—which established the basis for a new systematic engineering approach to achieve fire safety, with the prospect of large savings in building construction costs without any reduction in safety.
Preparing Australians for a Future with Technology (1988)—which examined cultural and educational tasks involved and provided guidelines for initiatives in technological awareness.

Winning by Design (1987)—which explored the key role that design plays in creating successful value-added products for export markets; it also played an important role in the establishment of the Australian Academy of Design.

Advanced Process Control (1987)—which identified potential benefits from the use of advanced process control in Australian industry and offered courses in technology.

Chairman, Board of Directors
Peter J North, BE, MBA Harv., FAIM FAICD

Executive Director
Professor Trevor W. Cole, BE W.Aust. PhD Camb., FTSEFIEAustCPEngFRSAFAIDC(Dip) .

General Manager
Angus M Robinson, BSc Melb., FAIM FAusIMM

Administration Manager
Cheonhee Sohn, BA H.U.F.S. S.Korea MEd U.N.S.W.

Administrative Assistant

Australian Centre for Innovation and International Competitiveness (ACIIC)

ACIIC was established as a non-profit company in April 1992 and has the status of a department of the Faculty of Engineering. It is dedicated to building bridges between Australia’s intellectual capability and the world of business and government. Its mission is to:

- work closely with Australian industry to build international competitiveness;
- support economic and social development using the leverage of technological innovation;
- integrate innovation to capture the benefits of the national investment in science and technology; and
- assist the engineering community to understand the forces which are reshaping the requirements of engineering employment and engineering education.

ACIIC delivers a number of services to the Faculty. These include:
- teaching undergraduate and postgraduate courses in engineering management, innovation and environmental engineering and public policy;
- supervision of undergraduate final year theses and PhD students; and
- assistance with strategic planning, marketing, the development of new teaching initiatives, and linkages with government and industry.

ACIIC is also engaged in grant and contract-supported research on issues of science, technology, engineering and innovation planning and management. Recent projects include:
- development of appropriate models for innovation and competitiveness in the knowledge economy;
- models of social and organisational innovation appropriate to the learning organisation;
- application of foresight techniques to strategic planning and priority-setting;
- strategic planning for public sector organisations such as universities, schools, local governments and public libraries in the context of the information economy and technologies;
- evaluation of research funding programs, university industry linkages, and the distribution of basic research capability across Australian universities; and
- application of new learning theories and technologies in schools and adult education and in involving industry.

ACIIC provides a non-engineering capability to the Faculty which will assist it to pursue relevant objectives of the strategic plan. Its contribution will be assessed against the quality of the student intake, the visibility and image of the Faculty, the quality and impact of non-engineering education and the strength of and revenue raised for research.

Australian Graduate School of Engineering Innovation (AGSEI)

AGSEI is a national Advanced Engineering Centre promoting an engineering culture which brings together technology, management and marketing, with an overall focus on wealth creation and the introduction of a more effective process of engineering innovation to Australian industry.

AGSEI has been formed jointly by the Engineering Faculties of the University of Sydney and the University of Technology, Sydney, and is located separately from both of them. Its objectives are:
- to ensure that today’s engineers, as well as those of tomorrow, are better equipped to take leadership roles in assuring the success of industrial enterprises;
- to educate engineers and others to think and contribute across disciplines in a corporate environment;
- to demonstrate the central role of innovation in achieving competitive advantage;
- to provide industry with convenient access to national and international best practice in engineering management and the application of technology;
- to enhance the capability to commercialise new technology and the results of research and development;
- to foster the creation of new industry through technology transfer and the introduction of appropriate management systems;
- to raise understanding in the professions and society of the role of industry, technology and engineering in the creation of national wealth; and
- to educate engineers to understand and contribute to enterprise management, and to educate executive managers to understand and utilise their engineering capability more effectively.

Students

Initially programs are being structured for engineers and other professionals who have been in industry for two to three years after completing their bachelor’s degree. Later programs will be developed for undergraduate courses.
AGSEI offers an array of courses centring on:

- Engineering Management
- Engineering Innovation
- Industrial Systems Engineering

The programs cover topics in:
- quality
- innovation
- technology
- systems engineering
- information technology and management
- computer-aided engineering and logistic support
- human resources and change management
- professional and business ethics
- design and documentation
- manufacturing
- government
- economics
- marketing
- finance
- law

The approach taken is distinctly different from that of an MBA. The MBA programs teach generic management, regardless of what is being managed. AGSEI focuses specifically on the capability of engineers, and is wholly about organisation and application of engineering effort to innovation and business performance—total engineering, not total management.

Modules
The basic program element is the module, typically offered over one week and involving intensive material presentation plus workshop and project sessions. Modules may be aggregated, by those who wish to do so, to lead to formal awards at several levels such as graduate certificate or master's degree. Modules will have the following characteristics:

- All modules will be available in stand-alone form, designed expressly to meet the needs of engineers and engineering enterprises.
- All programs require the course content to be trialed in industry, with advice from AGSEI staff, and (where possible) the results to be reported and discussed in workshop sessions.
- Heavy use is made of industry-based project work.
- Wherever possible, modules involve group interaction, normally multi-disciplinary. AGSEI acts as a framework in which participants (engineers and other professionals who deal with engineers) learn from each other and from inter-organisation contacts.

More detailed information may be obtained from AGSEI (tel. 9209 4111).

Chemical Engineering Foundation
The Chemical Engineering Foundation within the University of Sydney was established in 1981 with the following objectives:

- to foster good communications between industry and commerce and the Department of Chemical Engineering;
- to advise on courses of instruction in Chemical Engineering;
- to encourage students of high calibre to work in the Department;
- to assist graduates in Chemical Engineering to make appropriate contributions to industry; and
- to facilitate and develop research in Chemical Engineering with particular reference to industry oriented projects.

The Chemical Engineering Foundation provides an opportunity for executives in Australian industry to assess and discuss what is taught in the undergraduate course in chemical engineering.

Activities include financial support to the undergraduate program and to research by both postgraduates and staff. Continuing education courses for practising engineers are regularly arranged, publication of updates on the Department's research activities is undertaken twice yearly, and emphasis is placed on expanding industry-university collaboration.

Australian Centre of Advanced Risk and Reliability Engineering
The Australian Centre of Advanced Risk and Reliability Engineering Ltd (ACARRE) is a joint venture of the University and the Australian Nuclear Science and Technology Organisation (ANSTO). It is a company limited by guarantee, and has the objective of promoting appropriate application of risk and reliability engineering and management principles in Australia and the near region. It operates in three fields: education, through undergraduate, postgraduate and external courses; research; and industry and government consultancy throughout Australia ranging from the chemical industry and oil refining to transport, storage and distribution. In undertaking these activities, ACARRE draws on specialist skills from the University, ANSTO and elsewhere. The Executive Director is the ANSTO Professor of Risk Engineering.

The Civil and Mining Engineering Foundation
The objectives of the Foundation are to assist the University of Sydney on matters associated with education and research in civil and mining engineering. By securing resources the Foundation enables the School to be the leading provider of civil engineering education and research in Australia.

In particular the Foundation aims to identify the needs and to provide the resources to:

- assist the School to achieve and maintain pre-eminence in selected disciplines in civil and mining engineering;
- establish the School as the leader in the provision of postgraduate and continuing education;
- enhance cooperation between industry and the School in education, research and technical services; and
- facilitate communication at all levels between the civil and mining engineering community and the School.

The Foundation actively fosters collaboration between the school, the engineering profession and the industry it serves.
This is achieved by:

- promoting engineering consultation, research, training, lectures, short courses and technical reporting;
- providing direction to undergraduate and post-graduate education programs;
- sponsoring research projects in the School and encouraging research links with industry;
- forming working parties of top engineers from government, consulting practices, the civil and mining industry and the University to study topical issues arising in the engineering profession; and
- reporting the important results of all these activities to Members and the Public through reports and engineering publications.

The Foundation is supported by annual subscriptions from its Benefactors, Governors, Members and Personal Members, functions and by special donors. The annual subscriptions, as determined by the Foundation Council are: $5000 for special donors. The annual subscriptions, as determined by the Foundation Council are: $5000 for special donors. The annual subscriptions, as determined by the Foundation Council are: $5000 for special donors. The annual subscriptions, as determined by the Foundation Council are: $5000 for special donors. The annual subscriptions, as determined by the Foundation Council are: $5000 for special donors. Details of other grades of membership are obtainable from the Foundation. Tel (02) 93512127.

Management of the Foundation is vested in a Council of not less than five representatives of Governor and Member organisations and up to five representatives of Members appointed by the Senate. Ex-Officio members of the Council include the Chancellor, Deputy Chancellor, Vice-Chancellor, the Professor in the School of Civil and Mining Engineering, the Head of the School, the Presidents of the Civil Engineering Graduates’ Association, the Directors of the School’s Centres, and representatives of the Students.

**Electrical Engineering Foundation**

The mission of the Electrical Engineering Foundation is to build a successful partnership between Sydney University Electrical Engineering, industry and the profession which facilitates, in Australia, the achievement of world-class performance through education, research and development.

The Foundation is managed by a Board made up of representatives from industry, University staff, students and graduates.

The Foundation pursues its mission through activities in the following areas:

- Alumni Relations
- Business Development
- Conference Management
- Continuing Education
- Departmental Development
- Information Services
- Membership Development
- Quality Management
- Student Development

The current President of the Foundation is Mr Allan Gillespie, Chief Executive Officer of AUSTA Electric. The Director is Professor Trevor Cole. The Foundation’s Office is located in Room 606 of the Electrical Engineering Building.

**Centre for Advanced Structural Engineering**

The Centre for Advanced Structural Engineering was established within the University of Sydney to promote the advancement of structural engineering within and beyond the University. The Centre is housed within, and involves University staff and facilities of, the School of Civil and Mining Engineering.

The Centre provides a focus for researchers, industry, government and practising structural engineers for research and the teaching of contemporary structural technology.

The Centre undertakes specialised research, investigation, consulting and testing work for government, consulting engineering, and industry, and disseminates technical information on structural engineering to the profession and industry.

**Mechanical Engineering Foundation**

The Mechanical Engineering Foundation was established in November 1988 to assist the Senate of the University of Sydney and the Vice-Chancellor on matters associated with education, study and research in mechanical engineering within the University of Sydney and, without restricting the generality of the foregoing, in particular to:

- fostering good communications between industry and commerce and the Department of Mechanical and Mechatronic Engineering;
- assist in devising courses of instruction in mechanical engineering;
- encourage students of high calibre to join the Department;
- assist graduates in mechanical engineering to make appropriate contributions to industry; and
- facilitate and develop research in mechanical engineering with particular reference to industry-oriented projects.

**Centre for Advanced Materials Technology**

The Centre was established within the University of Sydney in 1989 and is located in the Department of Mechanical and Mechatronic Engineering with the main objective of promoting industry-university cooperation in furthering knowledge in the theory and application of geotechnics and geomechanics.

It comprises staff and laboratories from the following schools, departments and groups: Civil and Mining Engineering, Geology and Geophysics, Geography, Soil Science, Ocean Sciences, Ocean Sciences Institute and the Coastal Studies Unit.

The objectives of the Centre are:

- to serve as a focus for research in geotechnics and geomechanics within the University of Sydney;
- to undertake specialised research, investigation, consulting, and testing work for industry and government organisations;
- to foster inter-disciplinary research and teaching in geotechnics and geomechanics;
- to develop techniques and equipment for geotechnical testing; and
- to disseminate technical information on geotechnics and geomechanics to industry.

**Centre for Geotechnical Research**

The Centre was set up within the University of Sydney in August 1987 with the primary aim of promoting
collaborative research on the design, engineering, development and manufacturing technology of advanced materials. The Centre also undertakes specialised research and development projects, consulting and testing activities for industry and government organisations in advanced materials. It comprises staff and research facilities in the Departments of Mechanical Engineering, Civil and Mining Engineering, Aeronautical Engineering, Applied Physics, Operative Dentistry and the Electron Microscope Unit.

Cooperative Research Centre in Aerospace Structures

In 1992 the Cooperative Research Centre in Aerospace Structures started on its program of research in composite aircraft structures. This is aimed at providing a research base for manufacturing in Australia. Cooperating in the Centre are the University of Sydney, Monash University, the University of New South Wales, the Royal Melbourne Institute of Technology, Aeronautical Research Laboratories, Hawker de Havilland and Aerospace Technologies of Australia. When at full operation it is expected that nearly 30 researchers will be active on the Centre’s projects.

Optical Fibre Technology Centre (OFTC)

The OFTC at the University was established in 1989 as an initiative of the telecommunications industry with the primary aim to undertake research and development in the design, fabrication and application of Application Specific Optical Fibres. The key researchers are Dr Ian Bassett (Physics), Dr Simon Poole (Technical Director), Dr Mark SCEATS (Chairman, Chemistry), and Associate Professor Tony Stokes (Electrical Engineering). The excellence of the interdisciplinary OFTC research team, which now numbers 15 full-time staff and a similar number of higher degree students, is recognised world-wide. The Centre also provides training courses in optical fibre technology to industry.

Chancellor's Industrial Scholarships in Engineering (CISE)

Chancellor’s Scholarships in Engineering are open to final year high school students who expect to achieve a TER of at least 96.00 in the HSC or interstate equivalent. They are highly competitive and many applications are received each year for the limited number of places available.

The Scholarships are worth $11,000 in 1996. This is paid in fortnightly instalments for the four year duration of the normal undergraduate course, subject to continued satisfactory academic performance. Chancellor’s Scholars attend site visits to the sponsoring companies as well as functions at the University designed to promote good relations and personal interaction between the students and the organisations supporting the CSE program.

During the long vacations between first, second and third year, each Scholar is allotted to a sponsoring organisation for industrial education placement (IEP). Unlike other engineering undergraduates who have only one industrial placement during their time at the University, Chancellor's Scholars have the opportunity to gain experience working in various aspects of industry. Every Scholar works for three different companies and every sponsor sees three different students over the four years of the undergraduate course.

Most scholars expect to, and do join one of the sponsors on graduation, but there is no formal obligation either way.

The CSE Program is controlled by a Steering Committee and administered by the Faculty of Engineering.

Chairman, Steering Committee
Mr P. Moyle (Shell Australia)

Director
Professor R.G.H. Prince

Executive Officer
Mrs Lee Jobling

Administrative Assistant

Sponsoring organisations

ABB Asea Brown Bovery
AGL Sydney Ltd
Alcan Australia Limited
Ansett Airlines
Babcock Australia Limited
Baulderstone Hornibrook
BHP Engineering Pty Ltd
BHP Rod and Bar Products
BHP Slab and Plate Products
Boral Limited
Bull HN Information Systems
Caltex Refining
CIG
Civil Aviation Authority
CMPS&F Pty Ltd
Comalco Rolled Products
Council of the City of Sydney
CRA Adv. Tech. Development
CSR Humes
CSR Refined Sugars
Dow Chemical
DSTO Surveillance Research Laboratories
EPT Limited
Esso Australia
Federal Airports Corporation
Hawker De Havilland
ICI
James Hardie Building Projects
Master Foods of Australia
Metal Manufactures Limited
Optus Pty Ltd
Pacific Power
Pioneer Concrete
Qantas Airways
Randell Australia Water Heater Div.
Roads and Traffic Authority
Rheem Australia Water Heater Div.
Schlumberger Seaco Inc.
Shell Company of Australia Ltd
Shell Refining (Australia) Pty Ltd

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The branches of engineering

From the 18th century onwards all types of engineers, other than military engineers, were known as civil engineers. This definition was still valid in the early years of the Institution of Civil Engineers in Britain, whose royal charter granted in 1828 described civil engineering as ‘...being the art of conducting the great sources of power in Nature for the use and convenience of Man’. Professor Warren was trained as a civil engineer in the modern sense, but was able to conduct courses in Mining Engineering and in Mechanical Engineering, in addition to his own area of expertise. The increase in specialisation has reduced the scope of the title civil engineer, although it is still the largest branch of the profession in Australia.

Aeronautical Engineering

The number of aeronautical engineers in Australia is small and the employment situation can be drastically affected by changes in internal policies or external conditions. The flow of projects to the manufacturing industry is intermittent at present and this is being reflected in a steady, though restricted, demand for new graduates.

The operations field also provides opportunities since, as aircraft become more complex, the requirements of the operators for professional engineers tend to increase. Openings exist with Ansett Airlines, QANTAS et al and the RAAF. The work includes performance analysis of engine and airframe, structural analysis and the forecasting of future requirements. Many challenging problems arise on the operational side and, as some of these are peculiar to Australia, original thinking is required.

Opportunities are not confined to the operators; in particular, the Civil Aviation Safety Authority employs many aeronautical engineers to investigate the airworthiness and performance of all aircraft operating in Australia.

Research and development work has been centred on the Aeronautical and Maritime Research Laboratories and the Defence Scientific and Technology Organisation (DSTO). There is some recruitment of new staff. In addition, the extensive basic training which aeronautical engineers receive in fluid, and solid mechanics along with computer skills places them in a position to take advantage of the research and development openings that occur in many fields outside of aeronautics.

Chemical Engineering

Chemical engineering is concerned with industrial processes in which material in bulk undergoes changes in its physical or chemical nature. Chemical engineers design, construct, operate and manage these processes and in this they are guided by economic and environmental considerations.

Industries employing chemical engineers are generally referred to as the process industries: examples of these are the large complexes at Botany in New South Wales and Altona in Victoria, and the petroleum refineries in all mainland States; other examples are the minerals processing industries that refine Australian ores such as bauxite, nickel sulphides and rutile to produce aluminium, nickel and titanium. In addition there are the traditional metallurgical industries, steel, copper, zinc, lead, etc., as well as general processing industries producing paper, cement, plastics, paints, glass, pharmaceuticals, alcohol and foodstuffs. Allied process operations are those involving waste disposal, pollution abatement, power production and nuclear technology.

Chemical engineering studies are based on chemistry, mathematics and physics and the first two are taken to some depth. The chemical engineer must learn something of the language and principles of mechanical, electrical, and civil engineering, and of administration, and industrial relations.

Each student completes a common core of courses, fundamental to the study of chemical engineering, and also takes a number of elective courses, chosen according to his or her particular field of interest from course options listed later. Three of these introduce students to some important industries in the process field.

Minerals Engineering. For students who are interested in gaining some familiarity with the minerals processing industries.

Biochemical Engineering. For those interested in biochemical methods of pollution control or in any of the biochemical industries such as pharmaceuticals, fermentation or food and dairy processing.

Reservoir Engineering. These courses deal with the properties and behaviour of petroleum and natural gas reservoirs, and the strategies used in their development.
Regardless of the option chosen, the graduate will be a fully qualified chemical engineer, well prepared for a career in any of the process industries.

The Department has a number of active overseas exchange programs. The exchanges, with the Royal Institute of Technology, Stockholm, and the Ecole Nationale Superieure D'Ingenieurs de Genie Chimique in Toulouse, see five or six of our final year students completing their degrees at one of these Institutions each year, with similar numbers of their students finishing their courses in Sydney. There is also an exchange program with Iowa State University which allows one or two of our students to spend their third year there. Each of these exchange schemes includes Industrial Experience in the host country. Some financial assistance is available to approved students.

The majority of chemical engineering graduates enter industry, taking up positions in plant operation, supervision, and eventually management. Others will be engaged in plant design, construction, and commissioning work either for a large process company or one of the specialist construction firms. There is also scope for research and development work with industry or government organisations.

Chemical engineers are also recruited by many of the larger companies for technical service and sales. Graduates may also be able to obtain positions overseas either directly or through Australian companies with overseas associations.

Civil Engineering
The title Civil Engineer is given to one who invents, contrives, designs and constructs for the benefit of the community. Civil engineering covers a wide range including the conception, design, construction and maintenance of those more permanent structures and services such as roads, railways, bridges, buildings, tunnels, airfields, water supply and sewerage systems, dams, pipelines, river improvements, harbours and irrigation systems. In the broader sense civil engineers are charged with the task of producing structures and systems that give the greatest amenity for the funds expended. They have therefore to optimise their schemes in terms of technological performance, impact upon the environment and the financial resources available.

Civil engineers find employment: in government authorities whose concern is the design, construction and maintenance of public services; with consultants whose main interest is the design of civil engineering works; with contractors who carry out the construction work; and in civil engineering industries which manufacture and supply materials, plant and equipment.

In the junior and intermediate years of the course, the student is given a grounding in mathematics and the sciences with an introduction to structural theory, design, construction, and the properties of materials.

In the senior year, basic courses are given in structures, soil mechanics, surveying, hydraulics, structural design, construction, materials and practice of civil engineering.

In the senior advanced year, the basic courses of the senior year are continued with an additional course which requires the preparation of a thesis. Honours degree students must select courses at honours level from subjects such as: structures, soil mechanics, surveying, fluids, materials and steel and concrete structures. At honours level a more extensive thesis is required. A major segment of final year studies for pass degree students are options in structures, fluid mechanics, engineering management and geomechanics.

As civil engineering is a practical profession, attention is given to this aspect throughout the course. Full use is made of the laboratories with students carrying out experiments to obtain a better understanding of behaviour under practical conditions. There is extensive use of computers in design and other exercises. During the vacation between the senior and senior advanced years, every student must obtain practical experience in a civil engineering field and must submit a satisfactory report on this experience. During the senior advanced year, students attend a two-week camp for practical surveying experience and to apply surveying methods to a project. Seminars are also held and visits to works in progress are made as opportunities arise. Students are encouraged to take a close interest in current research and investigations.

Quality Assurance: For most subjects originating in the School of Civil and Mining Engineering, independent Quality Assurance Auditors have been appointed. These auditors have no direct teaching involvement with the subjects for which they act and are responsible for maintaining an overview of each of these subjects through to the monitoring of results. As the auditors are changed more frequently than subject content, the names of current auditors, together with those of staff responsible for coordinating and running the subjects, are available from the School's Office.

Electrical Engineering
Electrical engineers are primarily concerned with development and manufacture of components and systems which utilise electrical, magnetic and optical phenomena. This wide and expanding discipline of electrical engineering may be conveniently divided in several ways. The title 'electronics engineering' is often used to differentiate the areas associated with electronic devices, such as computers and digital systems and communications, from those associated with electrical energy conversion and control systems.

An alternative is to identify communications, computers, digital systems, and signal and image processing as 'information systems engineering'.

With its roots in science, electrical engineering is frequently to be found at the forefront of many new and exciting fields, such as neural computing and superconductivity. Indeed the frontiers of knowledge in all branches of electrical engineering continue to advance very rapidly with new devices, techniques and systems continually appearing. For example, developments in materials technology and solid state physics led to the invention of transistors in the 1940's. The subsequent miniaturisation of transistors into integrated circuits (microelectronics) has led to
computer and electronic communication systems of great reliability and information processing power which underpin the 'information technology revolution' of the 1980s. Transistors are also available as high power semiconductors capable of switching and controlling powers exceeding 1MW.

Their initial education and training must provide electrical engineers with the background and confidence to exploit and contribute to these rapid developments. The undergraduate program concentrates initially on the fundamental mathematics and physics which provide the models for electrical engineering circuits and devices, and information and system concepts. The first two years of the course also include computer science and introduce the main areas of electrical engineering as described earlier. The last two years of the course concentrate on developing the principles and practice of the main areas of electrical engineering. The course has a high laboratory and project content in all years. One important additional theme developed in all years of the course is that of design, communication skills and engineering management.

There are two patterns of study in the final two years. In the 'general' electrical engineering program students study courses in all branches of the discipline: electrical energy conversion, control systems, electronics, digital systems and communications. There is an opportunity to take advanced courses in these areas. Students taking the 'information systems engineering' program in their final two years concentrate on more advanced material in digital systems and computer engineering, and do not take the electrical energy conversion, or more advanced control systems courses. Both programs offer students the chance to take interdisciplinary electives such as biomedical engineering.

A very wide range of professional opportunities is open to graduates of electrical engineering. They may join organisations concerned with telecommunications or electrical power generation and distribution, such as Telstra and Pacific Power. They may join one of the manufacturers of electronics, communications and control devices and systems, such as AW A, Alcatel Australia and Leeds and Northrup. Others may enter the computer industry, join CSIRO or undertake further study. Like electrical engineering itself, the possibilities are almost limitless.

**Mechanical and Mechatronic Engineering**

Mechanical Engineering is a very broad branch of professional engineering and mechanical engineers are found in almost every type of engineering activity. They are involved in power generation, transportation systems for land, sea and air, pollution control, environmental protection and, biomedical engineering. They are found in a wide range of industries which manufacture machinery and consumer goods and offer research and technical services.

Mechanical engineers design machinery, engines, vehicles, agricultural and mining equipment, ships and household appliances. They are managers who run production lines, power stations and steel mills.

They design and maintain coal conveyer systems, building services, oil and gas pipelines and port loading facilities. The great diversity of applications for mechanical engineers means they are much sought after in both commercial and industrial fields.

Students have the opportunity to complete the Bachelor of Mechanical Engineering in one of two different strands—Mechanical and Mechatronics. All students complete a common first year and select either the Mechanical or Mechatronics strand prior to commencing second year.

Mechatronics combines mechanical engineering, electronics and computing. It is the enabling technology of computer-automated manufacturing through the use of robots and automated machine tools. Mechatronics may be concerned with individual machines such as robots, or manufacturing systems automated in their entirety.

Mechatronic engineers use computers and other digital systems to control industrial processes. They bring electronic, materials and mechanical sciences together to create a diverse range of products. These range from everyday products such as cameras, washing machines, photocopiers and anti-lock car brakes, to miniaturised substitutes for human organs and to powerful and precise computer-controlled machine tools used in manufacturing.

The first two years of undergraduate study in mechanical and mechatronic engineering provide students with an introduction to engineering science, design and manufacturing methods, management, computing and electronics, so that by the end of the intermediate year, a broad field has been covered.

In third year, mechanical engineering students study in more depth the hardware, materials and manufacturing processes which are at the heart of mechanical engineering. In addition to this, mechatronics students study topics such as control, digital systems and computer technology, electronics and electrical machines. Three months' practical training in industry follows third year for all students.

The final year of mechanical and mechatronic engineering allows students to develop the professional skills that they will need after graduation. Emphasis is placed on using engineering science, up-to-date technologies and professional tools to solve practical problems. Specialisation in the final year is encouraged. Areas of specialisation include: management, thermofluids, environmental engineering, computational fluid dynamics, design, rheology, advanced materials, orthopaedic/biomedical engineering and mechatronics.

**Project Engineering and Management (Civil)**

*The degree program will be offered when resources to do so become available. As at December 1996 the following description is for information only.*

Recent years have seen the dawn of a new era in both the national and international scene. On the one hand there is a perceptible trend to 'globalisation' of engineering and construction businesses. On the other, engineer-constructors and project managers are required to act as forerunners in the export drive.
The onset of the twenty-first century will demand managers with technical skills to act as entrepreneurs. The competitive market forces in the construction and engineering industries will require engineers and contractors to seek alternative ways to secure business, remain viable and experience sustained growth. This demand translates into a need for a class of engineer who can synthesise projects, analyse their impacts and act as the catalyst in their implementation.

Project engineering and management embraces the 'engineering' of all types of projects, from conception and feasibility studies through to construction and commissioning, albeit at the strategic level and through multidisciplinary teamwork. The project engineer-manager is the specialist in project processes and systems, a significant role in a society becoming increasingly dependent on the creation and management of projects to solve its economic, environmental and social problems.

The degree program responds to the need for technologically competent people with financial, organisational and managerial skills to take the lead in Australia's future engineering and technological projects.

The course is virtually identical to the present Civil Engineering curriculum in the first year. In the second year, courses are introduced in such areas as engineering economics, engineering accounting as well as engineering construction. In the third and fourth years subjects such as network planning, contracts formulation and administration, human and industrial relations, operations research, cost engineering and estimating, project formulation, value analysis and risk analysis are included.

In addition, up to 20% of all the courses taken will be electives. These are to encourage students to follow their own interests and aspirations, and at the same time expose them to as wide a variety of subjects as possible in order to prepare them as team leaders and communicators.

Graduates will be able to conceptualise, analyse and plan a range of technologies for construction and operation of engineering projects. As agents of advanced technology the graduates will be able to appreciate the human side of projects and processes. Their training will give them a better understanding of individual and group behaviour, organisational concepts, state-of-the-art planning, goal setting and other managerial know-how. In addition, they will possess project management skills that will encompass techniques for achieving project goals.

Money is the life blood of industry, and engineering is a subset of business and industrial activities. Project engineering graduates will find it intellectually rewarding to initiate projects and/or take part in the economic and monetary processes under which projects are created and executed. They will appreciate the world of finance and the intricate ways under which projects are initiated by the private and public sectors of the economy. They will also be competent enough to conduct economic appraisal of proposals, evaluate risks, undertake valuation and depreciation analyses, formulate feasible plans for project funding, and generally sell the proposal to others.

Graduates will have the capability to respond to most challenges in a resourceful manner, virtually from the day of graduation. They will be self-starters, communicators, adaptors, performers.

Employment opportunities for such a group is as diverse as the field of project engineering and construction management itself. As an example, the following organisations will typically find the prospective graduate a valuable asset:

- Construction companies
- Project managers/major consulting engineers/planners
- Government and public agencies/municipalities and shires
- Property developers/owners/major clients
- Industrial and mining corporations
- Management consultants/investment analysts
- Development and industrial banks.

Constitution of the faculty

Extract from the Resolutions of the Senate

1. The Faculty of Engineering shall comprise the following persons:

(a) the Professors, Readers, Associate Professors, Senior Lecturers, Lecturers and Associate Lecturers in the Departments in the Faculty of Engineering, being full-time permanent or full-time temporary members of the teaching staff;

(b) the Heads of the Schools of Mathematics and Statistics, Physics and Chemistry;

(c) the Heads of the Departments of Geology and Geophysics and Computer Science;

(d) one full-time member of the academic staff of each of the Schools and Departments mentioned in subsections (b) and (c), nominated by the respective Head from time to time;

(e) two persons being full-time members of the academic staff in the Faculty of Architecture, nominated by the Faculty of Architecture;

(f) such Fellows of the Senate as are graduates in Engineering;

(g) not more than three persons distinguished in the field of Engineering appointed by the Senate on the nomination of the Dean with the approval of the Faculty;

(h) not more than five students elected in the manner prescribed by resolution of the Senate;

(i) such other persons, if any, being full-time members of the senior administrative or senior research staff in the Faculty as may be appointed from time to time by the Senate on the nomination of the Faculty;

(j) the Executive Director of the Australian Centre for Innovation and International Competitiveness.
(a) The persons nominated under section 1(e) shall hold office for a period of two years from 1 January in the year following their nomination and shall be eligible for renomination;

(b) The persons appointed under section 1(g) shall be appointed for a period of three years and shall be eligible for reappointment for one further period of three years;

(c) The persons, if any, appointed under section 1(i) shall be members of the Faculty for so long as they remain full-time members of the senior administrative or senior research staff in the Faculty.
Bachelor of Engineering

There are separate quota arrangements for:

(a) Chemical Engineering;
(b) Electrical Engineering; and
(c) Aeronautical, Civil and Mechanical Engineering.

The requirements for the degree of Bachelor of Engineering are set out in Senate, Academic Board and Faculty resolutions. The Faculty resolutions and extracts from the Senate resolutions are set out later in this chapter. It is important for candidates to become familiar with these rules and regulations.

A summary of the degree requirements and of many of the rules and regulations is set out below. This is intended to assist students in understanding the rules but is not intended to replace them in any way.

Summary of degree requirements
To become eligible for the award of the degree of Bachelor of Engineering, you must

— complete the core courses of your chosen branch of engineering,
— gain credit for a minimum of 200 units,
— complete a period of practical experience in engineering and
— that the minimum time for completion of the BE degree shall be two years and the maximum shall be eight years.

Core courses and elective courses
For each of the branches of engineering in which a degree is awarded there is a list of prescribed core courses and recommended elective courses. Many of these are common to more than one branch.

A core course is one that must be passed to fulfil the requirements for the degree. In some cases the Faculty has specified courses that are acceptable alternatives to the core courses, completion of which satisfies the core course requirement. An elective course is one that is acceptable as part of the requirements but is not a compulsory course.

The core courses and the elective courses for each branch of engineering are listed in the tables at the end of this chapter. The first part of the tables summarises the Junior and Intermediate courses; the second, the Senior, Senior Advanced and Honours courses.

Descriptions of each course, in numerical order, are provided in Chapter 4.

Unit value of courses
Each course has a unit value, which is an approximate measure of the time required for lectures, tutorials and practical classes, e.g. four units may mean approximately 4 hours of classes each week for one semester or, alternatively, 2 hours of classes each week throughout the year.

When you pass a course you are credited with the unit value of the course, except where

— it is mutually exclusive with a course you have already passed, or
— you are attempting the course a second time, having gained a terminating pass the first time.

Completion of courses
In order to complete a course you must: attend the lectures, tutorials and laboratory and practical classes prescribed for the course; complete the exercises, practical work and assignments prescribed; and pass the examination(s) set for the course.

If you have been absent without leave from more than ten percent of the classes in any one semester in a particular course, you may be asked to show cause why you should not be deemed to have failed to complete that course. Should you fail to show cause, you shall be deemed not to have completed that course.

Absence from lectures and other classes
If you are unable to attend lectures and/or practical classes because of illness, accident or for any other reason, you must submit an 'Application for Special Consideration' form. When applicable, a medical certificate or other supporting evidence should be attached. Notification forms for this purpose are available at the Engineering Faculty Office. Please see Chapter 5 for further information on applications for special consideration based on illness and misadventure.

Minimum number of units and rates of progress
To satisfy the requirements for a pass degree you are required to gain not less than 200 units, which must include all the core courses for at least one branch of engineering.

The total of 200 units is the minimum, but many students gain more than this. Some students choose to take extra elective courses and other students change their chosen branch of engineering and therefore have to pick up outstanding core courses for the new branch.

The minimum time in which you can qualify for the degree is four years. If you want to qualify in the minimum four years, you should plan to gain not less than 48 to 52 units each year. Some students take five years to complete the degree requirements. This is usually because of failure in some of the courses attempted, with the consequent need to repeat the courses. Some candidates, however, plan to progress at a slower rate, sometimes so that they can take a number of elective courses.

The BE degree is available on a full-time basis only and students cannot complete the degree requirements on a part-time basis or externally.
Classification into years

Students are classified as being in Junior (First), Intermediate (Second), Senior (Third) or Senior Advanced (Fourth) year according to the year from which the majority of their units are being taken.

Selection of courses

The following advice is intended to help you select your courses. You should become familiar with the courses that are available for the degree and particularly with those that have been prescribed as core courses for the branch or branches of engineering in which you are interested.

The full list of Junior and Intermediate courses for which you may gain units toward the degree in any branch of engineering is to be found in Tables 1(a) and (b) of the Tables of Courses accompanying the Senate resolutions at the end of this chapter.

Tables 2 to 8 set out the core courses prescribed for each of the branches of engineering. Next to each of these courses is a summary of the Faculty and Department/School resolutions relating to that branch of engineering, showing, e.g., acceptable alternative courses to the core courses listed in the tables. Information about which elective courses are recommended for which branch of engineering and other relevant information is also set out on the pages next to the Tables of Courses.

For detailed descriptions of each course refer to Chapter 4, Courses of Study. If, for special reasons, you want to take a course which is not included in the lists of prescribed courses you may apply to the Faculty for permission.

Junior year enrolment

In your first year of attendance you are normally required to enrol in 48, 50 or 52 units.

Depending on the choice of elective courses you make in your first year of attendance, you may be able to proceed to the degree in any of the branches of engineering (subject to the separate electrical and chemical engineering quota arrangements).

Students in all branches of engineering study introductory courses in the branch of engineering which they are designed and they will lead to sensible second year enrolments.

At enrolment time students are given information about a variety of enrolment menus, which are combinations of courses designed for each of the branches of engineering. Enrolment menus comprise courses which are considered to provide the best possible introduction to the branch of engineering for which they are designed and they will lead to sensible second year enrolments.

For some branches of engineering there is only one Junior (First) year menu, which comprises all the Junior core courses prescribed for that particular branch. In other branches, there is a choice of menus which comprise some or all of the Junior core courses together with a choice of recommended elective courses.

While first year students in the quota for Aeronautical, Civil and Mechanical Engineering must choose an enrolment menu designed for one of these particular branches of engineering, there is sufficient flexibility for students to be able to change their branch of engineering at the beginning of second year and still be able to complete the degree requirements within the minimum of four years in most cases. Students who wish to change branches at a later stage may do so but it would probably take them longer than the minimum of four years to complete the degree requirements.

Similarly, students who wish to do so may change from Chemical or Electrical Engineering into one of the other branches. The number of years that it would take them to complete the degree requirements would depend on the stage at which they wish to change and also on which branch of engineering they wish to enter.

Students who wish to transfer from Aeronautical, Civil or Mechanical branches into Chemical or Electrical Engineering must apply through the Universities Admissions Centre.

If you wish to take the opportunity of transferring to the Faculty of Science at the end of your Intermediate (or Senior) BE year, you should study the rules relating to the double degree under Resolution 13. (These rules are set out below.) You will need to fulfil a number of conditions to be eligible to transfer to the Faculty of Science, one of which is the completion of two 16-unit Science courses in your Intermediate BE year. You should therefore ensure that the menu/courses you take in your first year will enable you to take the appropriate Science courses in your second year.

It is strongly recommended that you enrol in a menu and not in a one-off combination of courses if you wish to complete the degree requirements in the minimum of four years.

Each menu shows the branch of engineering for which it is suitable and also the consequential minimum number of units necessary for Intermediate year to complete all Junior and Intermediate core courses for each branch if all courses on the menu are completed at a satisfactory standard. There is also an indication where the consequential Intermediate enrolment would be very heavy, where it would be excessive and where there would be serious timetabling problems.

A ‘one-off enrolment in courses outside the menus can have a number of pitfalls:
— the courses might not timetable,
— the consequential Intermediate Year BE enrolment might have prerequisite/corequisite problems and/or serious timetabling problems,
— it might result in you needing to spend five years completing the degree requirements.

Intermediate and later year enrolments

The minimum enrolment for re-enrolling students is normally 36 units and the maximum is normally 64 units (unless the Faculty has imposed any special conditions on your re-enrolment because of unsatisfactory progress in the previous year).
Enrolments outside the 36 to 64 units limit require special Faculty permission. You should note, however, that an enrolment of more than 48 to 52 units is demanding, and only an exceptionally strong student should contemplate an enrolment in the region of 56 to 64 units. Experience has shown that a student who fails a number of units and who then tries to 'catchup' by taking more than 48 to 52 units will perform far worse than if he or she had attempted a more realistic number of units.

Intermediate year students must include in their enrolment any outstanding Junior core courses for their chosen branch of engineering. (Outstanding core courses are courses which a student either did not attempt in the previous year, or attempted but did not complete satisfactorily.) Similarly, Senior students must include in their enrolment any outstanding Junior and Intermediate core courses, etc.

If you received a Terminating Pass for a course in the previous year and if that course is an '(a)' level prerequisite for a higher year core course in your chosen branch, then you would normally be required to repeat that course in your next year of enrolment (unless you were granted permission otherwise).

Your enrolment in outstanding core courses must generally take priority over your enrolment in higher year courses and you must not enrol in courses with timetable clashes.

If you are enrolling, for example, in the Intermediate year and if you are not able to add sufficient Intermediate core courses to your outstanding Junior courses to total the normal minimum enrolment of 36 units, then you should add elective units (from courses that do not cause timetable clashes) or you may apply to the Faculty for special permission to enrol in less than 36 units. Senior and Senior Advanced students should proceed in the same way.

You should note that, generally speaking, timetabling problems with outstanding core courses and current year core courses only occur when students have failed to complete courses at a satisfactory standard and have to repeat courses or when students change their branch of engineering.

If you are thinking about proceeding towards the 'double degree' of BSc BE, then you should include two 16 unit Science courses in your Intermediate year enrolment. If this would result in an excessive number of units, then you should discuss with advisers at enrolment time the feasibility of leaving one or two 4 to 8 unit Intermediate Engineering courses out of your enrolment. There is provision for the Faculty to grant you special permission to 'carry' these 4 to 8 units in a part-time BE enrolment concurrently with your Resolution 13 BSc degree enrolment. There is also provision for the Faculty of Science to allow you to take as part of the BSc enrolment one of the Engineering Science courses (e.g. Mechanical and Aeronautical Engineering Science). (This permission is normally only given if one of your Intermediate Science courses is not prescribed as a core course for the branch of engineering in which you are proceeding.) On completion of the Engineering Science course you could then apply to the Faculty of Engineering for exemption from the Engineering courses which comprise the Engineering Science course.

Advice for students
Advisers are available for all the branches of engineering during the official enrolment periods in February each year. This is generally the appropriate time for students to seek advice and discuss their plans of courses.

If you require further guidance in the selection of your courses, however, or advice on any other matter concerning your studies, do not hesitate to consult a member of staff.

The Dean or Undergraduate Adviser is available throughout the year at the Engineering Faculty Office in the Faculty Building for consultation with Junior and Intermediate year students.

Senior and Senior Advanced students seeking advice on courses should consult the member of staff shown in the list of Advisers to Undergraduate Students at the beginning of Chapter 1.

Result grades
The Board of Examiners of the Faculty of Engineering is the body which determines BSc students' examination results. The Board meets in December each year when it considers the results recommended by the examiners of each course for each student. Official examination result notices are then sent to students.

Some teaching departments may release informal results at the end of First Semester, but these are not official, final results.

Satisfactory performance in a course is recognised by the award of the grade of Pass (P). Performance at levels higher than this is recognised by the award of a Credit (Cr), Distinction (D) or High Distinction (HD). If the requirements for a course are not completed then a grade of Fail (XX) may be awarded.

<table>
<thead>
<tr>
<th>Grade</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pass</td>
<td>50-64</td>
</tr>
<tr>
<td>Credit (Cr)</td>
<td>65-74</td>
</tr>
<tr>
<td>Distinction</td>
<td>75-84</td>
</tr>
<tr>
<td>High Distinction</td>
<td>85-100</td>
</tr>
<tr>
<td>Fail below</td>
<td>50</td>
</tr>
</tbody>
</table>

If a student failed a course but the failure was borderline, then the Board of Examiners may award one of the following results instead of a Fail:

Terminating Pass (T)—A Terminating Pass will not permit a student to enrol in further courses in that subject or to use that course as a prerequisite for courses that require a clear pass in their prerequisite courses. (This means that a T Pass does not fulfil '(a)' level prerequisite requirements.)

Terminating Pass, Optional Supplementary (M)—This is a T Pass (see above), with permission to attempt a supplementary examination: if you perform satisfactorily in the supplementary you may be granted a clear pass; if you fail, or do not sit the supplementary, you will be granted a Terminating Pass in the course.

Fail, Supplementary Examination (X)—This means that you have failed the course but have been granted permission to attempt a supplementary examination: if you perform satisfactorily in the supplementary you may be granted a clear pass or you may be
granted a Terminating Pass; if you fail, or if you do not sit the supplementary, you will be awarded a Fail in the course.

The Board also uses a concession system where, if a student failed a course but the student's overall performance in all courses reached a certain standard, the Board may award one of the following results instead of a Fail:

*Pass, Concessional (PCon)*—This means that the Board has conceded you a Pass. A PCon may be treated as a full, clear pass for progression purposes.

*Terminating Pass (Concessional)*—This means that the Board has conceded you a Terminating Pass (see T above).

*Terminating Pass, Optional Supplementary (Concessional) (MC)*—This means that the Board has conceded you a Terminating Pass, with permission to attempt a supplementary examination (see M above). This affords an opportunity for you to gain a full pass.

*Fail, Concessional Supplementary (XC)*—This means that you have failed the course but have been granted permission to attempt a supplementary examination: if you perform satisfactorily in the supplementary you may be granted a Pass; you could also be awarded a Concessional or Terminating Pass (see above); or you could be awarded a Fail. If you do not sit the supplementary, you will be awarded a Fail in the course.

If a student has not been able to complete the requirements for a course because of serious ill-health or misadventure (which has been duly attested), the Board may grant the following result:

*Supplementary Examination to count as an Annual (XTCA)*—This means that you may sit for a supplementary examination, and your result in the supplementary will be treated as though you had obtained it at the annual examination. You may be awarded any of the passing grades (up to and including HD) and if you fail the examination you will be awarded a Fail.

Students who are awarded supplementary examinations for reasons of illness or misadventure and who have already achieved some form of passing grade will have their result achieved indicated, followed by 'SUPP TO CHANGE GRADE'. This gives students the opportunity to attempt a supplementary exam in order to improve their original grade.

Students awarded supplementary examinations should consult the department that teaches the course for information about the form and content of the supplementary examination. Students who have been awarded a result of Incomplete (I or IX) or Result to Come (V) should consult the member of staff responsible for the course.

Supplementary examinations should be regarded as privileges and not as rights.

The Board of Examiners meets again each February to determine the results of students who were granted permission to sit for supplementary examinations. Students who pass their supplementary examinations will not be awarded grades of pass higher than Pass (except where an XTCA or other result of STCA—Supplementary to count as Annual—was awarded).

**Exemption from attendance at classes**

If you enrol in a course which you have previously attempted you may be granted exemption from attendance at laboratory or practical classes. To seek such exemption, apply on the appropriate form before the course starts. Application forms are available at the Engineering Faculty Office.

**Deferment of enrolment**

Deferment of enrolment is only possible from second year onwards. To ensure your place is kept open, you must apply in writing to the Faculty Manager, stating the reasons for your requested deferment. Deferment is normally granted for only one year, although this may be extended in exceptional circumstances which must be detailed in your letter of application.

**Practical experience**

At an appropriate stage of your training you are required to work as an employee of an approved engineering-related organisation and submit a satisfactory written report of your work. This period of experience, usually about 12 weeks, is normally undertaken after you complete some or all of the prescribed Senior courses and before you enrol for your final year of study. It is possible to undertake all of the work experience at the end of Senior Year, or undertake a part at the end of Intermediate Year and complete the work experience at the end of Senior Year. There is a core course prescribed for each of the branches of engineering which comprises this practical experience requirement. Please refer to the course descriptions later in this Handbook for specific conditions applying in each Department in relation to when the work experience can be undertaken and what type of experience is "suitable.

If you are not committed to employment as a cadet or scholarship holder the Careers and Appointments Service of the University is available to help you obtain suitable employment.

Candidates for the degree in chemical engineering obtain this experience in special vacation practice schools, located in industrial plants and supervised by academic staff, whenever this can be arranged.

**Honours degree**

If you have made good progress for three years you may apply for admission as a candidate for the honours degree before commencing on your fourth and final year of study.

When you are accepted as a candidate for honours you may be required to enrol, in the final year, in Honours courses specified by the head of the department in which you are a candidate.

Alternatively, if you satisfy the requirements for the award of the pass degree in four years, you may then apply for admission as a candidate for honours. If accepted, you will be required to enrol for a fifth year of study and the award of the degree is deferred for one year.
In both cases the acceptance of an application rests with the head of the department concerned. Applications from students who have taken longer than three or four years, as the case may be, to reach the necessary standard may be considered, but in such cases it is necessary to obtain special approval of the Faculty.

The various Engineering departments use different formulae for determining students' eligibility for the award of Honours. All enquiries about this should be addressed to the relevant department.

The double degree BE/BCom

The double degree of BE/BCom was introduced in 1993. Engineering graduates often end up in management. This is because they are trained in solving problems, are good with figures, have learnt to work in teams and to deal with people. A background in commerce is a valuable asset in such progression. The engineer with financial skills can be more useful to his or her employer, and is likely to advance more securely and rapidly in a career headed towards management.

The five-year double degree with Commerce begins with a standard first year in Engineering. If accepted into the program you will spend a further four years studying Engineering and Commerce subjects in parallel.

Engineering workload: The normal Engineering degree consists of about 200 units: 50 units per year over four years. For the double degree with Commerce the total Engineering unit count is about 169. Over Years 2 to 5 of the double degree program the average number of Engineering units per year is 30, or 60% of the standard load. This load may be distributed differently in each department.

Commerce workload: The normal Commerce degree consists of 22 semester courses over three years. For the double degree this is 15. The Engineering equivalent of the Commerce courses is about 108 units spread over Years 2 to 5 of the double degree. The average load of Commerce and Engineering units taken together is 57 per year.

Who is eligible: Students enrolling in Intermediate (second) Year Engineering with a Junior (First Year) weighted average mark (WAM) of at least 62% may be eligible for admission to the Bachelor of Engineering/Bachelor of Commerce double degree program. Applicants will be selected in order of decreasing WAM. You will also need to have gained credit for at least 48 units towards the Bachelor of Engineering degree (a minimum unit requirement for first year Engineering), and have completed all courses attempted at full pass level or better at the first examination (i.e. you cannot upgrade through supplementary exams).

Who is not eligible: The double degree with Commerce is not available to those who enrol in Aeronautical Engineering and cannot be taken with:
• Information Systems Engineering
• Mechatronics
• The BE BSc double degree.

How to apply: Apply to the Faculty of Engineering by 30 November of your first year of attendance, on the application form available at the Faculty of Engineering Office.

The double degree BSc BE

Many Engineering students take the opportunity of gaining the 'double degree' of BSc BE.

If you satisfy certain requirements you may be permitted to transfer to the Faculty of Science for one year in order to complete the requirements for the BSc degree. This one year is additional to the four years required to complete the BE degree. Students who proceed towards the 'double degree' usually transfer to the Faculty of Science after they have completed two years of Engineering, but there is provision for students to do so after they have completed the Senior (or Third) year of the BE degree course. There is also provision for students to complete the BSc degree under Resolution 13 over two years part-time instead of one year full-time. Most students do so full-time, however. There is also provision for students to remain in the Faculty of Science for an extra year in order to complete an Honours BSc degree.

After completion of the Science year(s), students then transfer back to the Faculty of Engineering in order to complete their BE degrees.

The rules and regulations relating to the 'double degree' are set out in Resolution 13 of the Resolutions of the Senate relating to the degree of Bachelor of Science and in Resolutions of the Faculty of Science. These rules are set out below and you should study them carefully if you are interested in obtaining the 'double degree' of BSc BE.

A summary of the main points of the rules is also set out below. This summary is intended to assist students to understand the rules but is in no way intended to replace them.

Summary of Resolution 13 rules

In order to be eligible to transfer to the Faculty of Science for the 'double degree', you should normally have:
— completed 96 units at the end of your second year of enrolment in the BE degree course (or 108 units at the end of your third year of enrolment);
— course including at least two 16 unit Intermediate Normal or Intermediate Long Science courses (for example, Chemistry 2, Computer Science 2, Mathematics 2, or Physics 2).

In order to qualify for the BSc degree you are required to complete courses totalling 24 units. The 24 units should normally include at least one 12 unit Senior course (for example, Chemistry 3, Computer Science 3, Pure or Applied Mathematics 3, Physics 3). If only one 12 unit Science course is completed, then at least 8 of the remaining 12 units should be for an Intermediate course. You have the choice of a wide range of subjects in the Faculty of Science, but you must have satisfied the prerequisites laid down in the BSc degree requirements for any course in which you wish to enrol.

If you are interested in proceeding towards the 'double degree' it is essential that you plan your
courses carefully in your Junior (First) year, so that you fulfil prerequisite requirements for the two 16 unit Intermediate Science courses which you must take in your Intermediate (Second) year.

Application to transfer to the Faculty of Science under Resolution 13 should be made at the end of your Intermediate (or Senior) year studies (i.e. by the end of December in the year prior to the one in which you wish to undertake the Science year). Applications will close on the last working day in the University prior to the closing of the University for the Christmas break.

Similarly you will need to lodge an application to transfer back to the Faculty of Engineering from the Faculty of Science.

Applications for transfer to and from the Faculty of Science are available at the Student Centre and the Faculty of Science and Faculty of Engineering Offices.

Resolution 13 Rules

1. Pursuant to Resolution 13 of the Resolutions of the Senate governing the degree of Bachelor of Science, students who are of two or three years' standing in the Faculty of Engineering may be admitted to candidature for the degree.

2. To be eligible for admission, such students:
   (1) must have gained credit in the Faculty of Engineering for not less than 96 units if of two years' standing in that faculty, or not less than 108 units if of three years' standing in that faculty; and
   (2) except with the permission of the Dean of the Faculty of Science, must have completed all courses attempted in the Faculty of Engineering at their first examination, including:
      (i) all courses attempted in the Faculty of Engineering at their first examination;
      (ii) at least two Intermediate Normal or Intermediate Long courses offered by departments of the Faculty of Science. In some circumstances students may be permitted to count as one of the Intermediate courses for this purpose, courses undertaken in the Faculty of Engineering which combined are the equivalent of one of the following courses in the Faculty of Science:
          Chemical Engineering Science 2, Chemical Engineering Science 2 Auxiliary,
          Civil Engineering Science 2,
          Mechanical and Aeronautical Engineering Science 2.

3. To qualify for the award of the pass degree, candidates after admission under Resolution 13 of the Resolutions of the Senate governing the degree of Bachelor of Science shall complete in one year of full-time study or in two consecutive years of part-time study, courses totalling at least 24 units subject to the provisos:
   (1) that at least 12 of the required 24 units shall be for a Senior course and, if only one Senior course is completed, at least 8 of the remaining 12 units shall be for an intermediate course; and
   (2) that, except with the permission of the Dean, the 24 units shall not include any units
   (i) for courses listed under Senate Resolution 10 Groups (d) or (e) relating to the degree of Bachelor of Science,
   (ii) for any courses already attempted either completely or in part, within the Faculty of Engineering, or
   (iii) for all or part of the courses:
       Chemical Engineering Science 2,
       Civil Engineering Science 2,
       Mechanical and Aeronautical Engineering Science 2.

   Such permission will be given only if the candidate has not counted one of these courses as an Intermediate course for the purpose of gaining admission under Resolution 13; up to 8 units, taken in one year to complete one of the above courses, may then be included. Any one of the 8 unit courses above may then be counted as an Intermediate course for the purposes of part (1) of this resolution provided the whole course is completed in one year.

4. Candidates admitted under Resolution 13 shall comply with Resolution 13 of the Resolutions of the Senate governing the degree of Bachelor of Science.

5. To qualify for admission to Honours courses, such candidates shall comply with Resolution 13 of the Resolutions of the Senate.

   There is no provision for students admitted under Resolution 13 to continue in the Faculty of Science after one full-time or two part-time years of study except to complete an Honours course.

   Candidates who fail to complete the required 24 units may only be readmitted to the Faculty of Science if a successful application is made at the appropriate time through UAC. Successful applicants will be given credit for courses completed in accordance with Resolution 11 of the Resolutions of the Senate governing the degree of Bachelor of Science.

Admission of BSc graduates

If you are enrolled in the Bachelor of Science degree course at this University and wish to transfer to the Bachelor of Engineering degree course, you must make application through the Universities Admissions Centre by a closing date which is late in September in the year preceding that in which you wish to enrol in the Faculty of Engineering.

Your application will be considered on the basis of academic merit, to the extent that facilities are available. Consideration will be given to your HSC examination results and to your examination results in the Faculty of Science (and to your results in any other tertiary courses you may have completed). The offer of a place in the Faculty of Engineering is NOT automatic and the competition for entry is keen.

If you are a graduand/graduate in the Faculty of Science and if you are offered a place in the Faculty of Engineering, you may be able to complete the BE degree requirements in two further years of full-time study. You would need to have completed appropriate courses in the Faculty of Science so that you could be given credit for/exemption from all or most of the
Junior and Intermediate core courses prescribed for that branch of Engineering in which you wish to proceed.

The departments in the Faculty of Engineering have indicated that they would recommend that a Science graduand/graduate be given sufficient credit/exemption to enable him or her to complete the BE degree requirements in two years if he or she has completed the courses set out below.

The BSc degree requirements would need to have been completed in the minimum time and in some Engineering departments minimum standards of performance in science courses are required.

For Aeronautical Engineering
Chemistry 1
Computer Science 1
Mathematics 2 (Pure or Applied)
Physics 2
Mechanical and Aeronautical Engineering Science 2

For Chemical Engineering
Mathematics 2 (Pure or Applied)
Chemistry 2 Auxiliary
Chemical Engineering Science 2

For Civil and Mining Engineering
Chemistry 1
Physics 1 or Computer Science 1
Mathematics 2 (Pure or Applied)
Civil Engineering Science 2

For Electrical Engineering
Mathematics 2 (Pure or Applied)
Computer Science 2
Physics 3D (passed at Credit level or better)

For Mechanical and Mechatronic Engineering
Chemistry 1
Computer Science 1
Mathematics 2 (Pure or Applied)
Physics 2
Mechanical and Aeronautical Engineering Science 2

For Mechanical and Mechatronic Engineering, students need to have achieved good grades in the courses listed above. When entering Mechanical Engineering, students will be required to enrol in Mechatronic Design.

If you have completed courses other than those listed above then the Faculty would need to give individual consideration to what credit/exemption you could be given.

The Commonwealth Department of Education may approve the extension of benefits under AUSTUDY for a period of two years for students in the final year of the science degree who proceed to studies in the Faculty of Engineering.

Engineering Talented Students Scheme

The Faculty makes special provision for first year students who have achieved outstanding academic results before coming to the Faculty. Examples of such results would include a TER of 99+, or successful competition in a Maths or Physics Olympiad. The Engineering Scheme links in with the corresponding program in the Faculty of Science since all students undertake a high proportion of Science subjects in their Junior year. Students who are admitted to the scheme undertake flexible course programs which are individually tailored to their needs; talented students can take additional subjects to broaden their knowledge, undertake courses at a more advanced level and accelerate their progress towards the degree. Students can apply to enter the scheme at the time of enrolment in first year.

Discontinuation and variation of enrolment

Your enrolment is your responsibility. It is in your best interests to ensure that the formal record of your course enrolment is correct.

If you wish to cease attending a course (or all your courses), you are discontinuing your enrolment in those courses. You must notify the University of your intention to discontinue by submitting the appropriate form to the Engineering Faculty Office. If you fail to do so, you may be recorded as being Absent Fail in the course(s) at the end of the year and may be sent a warning letter or asked to 'Show Cause' why you have not made satisfactory progress.

There are three categories of discontinuation results used to record discontinuations in the Faculty of Engineering: 'Withdrawn', 'Discontinued with Permission', and 'Discontinued'. These results are dependent upon the time of year you choose to discontinue (see below).

If your enrolment is 'Withdrawn' (W), then your enrolment is cancelled as though you had never enrolled. This enrolment does not appear on an official transcript of your academic record.

If your enrolment is 'Discontinued with Permission', it means that you commenced the course(s) and were given permission to discontinue without any academic penalty or implication of failure whatsoever. However, HECS or fees are still liable for these subjects. The enrolment and the result of 'Discontinued with Permission' (DP) appear on an official transcript of your academic record.

If your enrolment is 'Discontinued' (Disc), then it means that the discontinuation counts as a failure. HECS or fees are still liable for these subjects. On an official transcript of your academic record, your enrolment appears with the result of 'Discontinued'. As this result implies failure, you will be allocated a 0% unit value for this subject in the calculation of your weighted average mark. The Faculty takes student WAMs into consideration when determining whether or not students have made satisfactory progress.

Total discontinuation

If you wish to discontinue all your courses, then you must notify the University of this intention by completing and submitting your 'Confirmation of Enrolment' form (together with your student card) to the Engineering Faculty Office. You should note your reasons for discontinuing on this form. If your 'Confirmation of Enrolment' form is not available, then you should obtain an 'On-line variation form' from the Student Centre or Faculty Office and use that instead.
If your enrolment is recorded as 'Discontinued', which means that the discontinuation counts as a failure, then you have failed to make satisfactory progress with your studies and the Faculty may determine that you should be sent a 'Warning Letter' or that you should be asked to 'Show Cause'.

Variation of enrolment
Any change to your enrolment, including total withdrawal from the degree, can only be done through the Engineering Faculty Office. This includes courses taken outside this Faculty. Collect a 'Variation of Enrolment' form from the Faculty Office, have the changes approved by your Year Adviser/Supervisor and hand the completed form back to the Faculty Office. Note: Some Science undergraduate courses offering 'Normal' and 'Advanced' options are exempt from the following rules and you may move freely between the options throughout the year. If you're not sure if your course is one of these, please check with the Faculty Office. Again, you must lodge the changes through the Faculty Office.

Before March 31 (Sent 1 HECS deadline)
You may enrol in or withdraw from any course—semester or year-long—without academic or financial penalty. Your discontinuation result will be 'Withdrawn'.

After March 31
You may only enrol in or withdraw from Semester 2 courses without academic or financial penalty.
—You cannot enrol in Semester 1 or full-year courses;
—If you drop a Semester 1 or full-year course between March 31 and the seventh teaching week of Semester 1, you will automatically receive a 'Discontinue with Permission' result;
—If you drop any course after the seventh teaching week, you will receive a result of 'Discontinue'. If, however, you believe you have good reason for discontinuing at this late stage, discuss this with your Year Adviser, who may recommend a result of 'Discontinue with Permission'.

After August 31 (Sem 2 HECS deadline)
—You cannot enrol in any course this year;
—You cannot drop any course this year without penalty;
—If you drop a Semester 2 course between August 31 and the seventh week of teaching of Semester 2, you will automatically receive a 'Discontinue with Permission' result;
—If you drop any course after the seventh teaching week, you will receive a result of 'Discontinued'. If, however, you believe you have good reason for discontinuing at this late stage, discuss this with your Year Adviser, who may recommend a result of 'Discontinue with Permission'.

There is no way these rules can be bent or broken, so it is in your best interests to ensure that your enrolment is correct. If you haven't lodged every change through the Faculty Office and in accordance with the HECS deadlines, we will not be able to help you if you discover something wrong.

Other rules relating to variation of enrolment
You should note that variations of enrolment are subject to all the other rules relating to enrolment in the BE degree course. First year students are normally required to be enrolled in 48 to 52 units, and re-enrolling students are normally required to be enrolled in 36 to 64 units (unless special conditions have been imposed on their re-enrolment). Students are normally required to fulfil prerequisite and corequisite requirements and they are not permitted to enrol in courses with timetable clashes. Students must enrol in outstanding core courses and must give priority to their enrolment in these courses over higher year courses.

Weighted Average Mark (WAM)
The Faculty uses students' weighted average marks (or WAMs) when considering a number of aspects of students' candidatures: Engineering departments use WAM calculations when determining students' eligibility for the award of Honours degrees. The Faculty uses WAM calculations when ranking applicants for scholarships for postgraduate study and for undergraduate prizes and scholarships. The Faculty also takes account of students' WAMs when determining whether or not students have made satisfactory progress with their studies. A WAM is calculated for every student for every year of enrolment by adding together the products of the marks achieved with the unit value of each course attempted (including courses which have been failed or 'Discontinued') and dividing by the total number of units attempted. Courses which have been 'Withdrawn' or 'Discontinued with Permission' are not included in the WAM calculation.

Application procedure to re-enrol in the BE degree course after total discontinuation

New first year students
If you are a new first year student who totally discontinues his/her enrolment and if you wish to re-enrol in the BE degree course, then generally speaking you will need to apply for re-enrolment through the Universities Admissions Centre (unless you were recorded as 'Discontinued with Permission' and were given 'Repeat status'). ('Repeat status' means that you may enrol in the BE degree course in the next calendar year by completing an internal University 'General application for enrolment' form and that you will not need to compete for a place through UAC for that one calendar year only. If you do not take up that option and then wish to re-enrol in the BE degree course in a future year, you will need to apply for re-admission through UAC.)

UAC applications must be lodged by the closing date late in September/early in October in the year prior to that in which you wish to re-enrol.

Re-enrolling students
If you are a re-enrolling student in the BE degree course who totally discontinues his/her enrolment and wish to re-enrol in the BE degree course, then generally speaking you should apply for re-enrolment by completing an internal University 'General application for enrolment' form by 1 October in the year prior to that in which you wish to re-enrol.
Failure to make satisfactory progress and exclusion

If the Faculty considers that you have failed to make satisfactory progress with your studies, the Faculty may exclude you from re-enrolment in the Faculty of Engineering. This process of excluding students is designed to ensure that the resources available in the Faculty are used to teach those students who make the best use of them. Failure to make satisfactory progress cannot be defined precisely in all cases in advance, but generally you will be considered not to have made satisfactory progress if:

— your weighted average mark (WAM) for the year is poor; and/or
— you do not gain at least half of the units for which you are enrolled; and/or
— you fail a major course more than once; and/or
— you had special conditions imposed on your re-enrolment (usually because of lack of satisfactory progress in the previous year of enrolment) and you fail to meet these conditions.

If the Faculty considers that your annual progress has not been satisfactory, it may decide that you should be sent a ‘Warning Letter’, in which you are advised of this and also of certain conditions that you would need to meet in your next year of enrolment in the Faculty. These conditions would normally specify the number of units and particular courses that you would need to pass in the next year of enrolment in the Faculty. Failure to meet such conditions would normally result in you being asked to show good cause why you should be allowed to re-enrol in the Faculty of Engineering.

If the Faculty considers that your progress has been most unsatisfactory it may decide that you should be asked to show good cause why you should be allowed to re-enrol in the Faculty of Engineering. This means that you are being asked for an explanation for your failure to make satisfactory progress in your studies. When the Faculty considers students’ statements purporting to show good cause, it takes account of illness, accident and/or personal problems.

If the Faculty determines that you have shown good cause (i.e. it accepts your explanation), then it will allow you to re-enrol. In doing so, the Faculty will probably impose certain conditions on your re-enrolment (such as specifying the number of units and particular courses that you must pass in your next year of enrolment). Should you fail to meet these conditions you may be called upon again to show good cause why you should be allowed to re-enrol in the Faculty of Engineering.

If the Faculty considers that you have failed to show good cause (or if no statement is received from you), then the Faculty may exclude you from enrolment. If you are excluded, you have the right of appeal to the Senate. The Senate may either uphold the Faculty’s decision or allow you to re-enrol in the Faculty of Engineering or it may disallow your appeal and confirm your exclusion.

A student who is excluded from re-enrolment in the Faculty may apply for re-admission to the Faculty after two academic years have elapsed. When considering an application for re-admission, the Faculty takes account of the following: the circumstances that led to the student’s failure to make satisfactory progress; how these circumstances have changed; and the student’s activities since being excluded. The Faculty would normally expect a student to have undertaken relevant tertiary studies successfully during this period. (You should note, however, that students who are excluded from one Faculty or degree course at this University are finding it increasingly difficult to gain selection into another course at this University and at other tertiary institutions.)

Outcomes of degree programs in the Faculty of Engineering

This section provides a statement of expected outcomes from the undergraduate degree programs in the Faculty of Engineering.

Outcomes

Outcomes of the undergraduate degree programs can be specified in terms of the attributes of graduates from the Faculty, with two qualifications:

(a) There is a minimum common set of attributes that all Engineering graduates will possess. However, in recognition of the differences between students, the Faculty provides a wide range of learning opportunities so that students can achieve optimum outcomes consistent with their own interests.

(b) The more advanced objectives of teaching in the Faculty can probably only be specified in very general terms. This is appropriate for university-level teaching.

The attributes of our graduates can be divided into three classes:

(1) Knowledge and understanding: Course curriculum descriptions in this Handbook summarise the fields covered, which embrace broad areas of engineering and adjoining disciplines. The courses emphasise understanding of underlying principles and conceptual frameworks rather than rote learning of facts. It is this type of understanding that graduates can carry with them into their future careers.

(2) Abilities: These encompass generic capabilities, such as management and communication skills, as well as specific engineering abilities, such as proficiency in engineering problem-solving and analysis; testing and measurement; and planning and design. Graduates will possess the ability to effectively apply knowledge acquired during the course and, equally importantly, be able to adapt to new environments in engineering with confidence. A range of practically-orientated capabilities are developed in the Faculty’s programs. These include: the ability to extract key aspects from information; the ability to evaluate the reliability of data; skills in estimation and approximation; the ability to recognise when additional expertise or information is required; and the ability to take the broad view of an engineering task including the non-engineering aspects. To help develop these capabilities, laboratory work is a key element in the Faculty’s undergraduate programs.
Through laboratory design and project work, students not only acquire up-to-date technical skills (including computer-based skills), but develop attitudes important to the practice of engineering.

(3) **Attitudes:** Personal characteristics of the graduates include: an understanding of the function of engineers in society; an understanding of the roles of scholarship, research, and innovation; a recognition of the importance of continued study to remain up-to-date; an appreciation of professional ethics; and a cognisance of environmental issues.

The Engineering degree is accredited by the Institution of Engineers with Continued Full Recognition. The rigorous periodic accreditation process includes a full review of course structure and content, inspection of Faculty facilities, perusal of examination papers and meetings with students and staff. The Faculty is developing uniform procedures for quality assessment of courses, including a common scheme for course evaluation by students and review of examination material.

**Statutes**

**Bachelor of Engineering**

**Resolutions of the Senate**

1. (1) The degree of Bachelor of Engineering shall be awarded in:
   (a) Civil Engineering
   (b) Mining Engineering
   (c) Mechanical Engineering
   (d) Mechanical Engineering (Mechatronics)
   (e) Electrical Engineering
   (f) Electrical Engineering (Information Systems Engineering)
   (g) Chemical Engineering
   (h) Aeronautical Engineering
   (i) Project Engineering and Management (Civil).

2. The certificates for the degree shall specify the department or departments of Engineering for which they are awarded.

3. (i) Graduates in Engineering in any department may be admitted to the degree examination in any other department or departments on conditions to be prescribed by the Faculty.

   (ii) Upon passing the examination such candidates shall receive a certificate for such additional department or departments.

IA. For the purpose of these resolutions—

   (i) a 'course' shall comprise such lectures, tutorial instruction, essays, exercises and practical work as the Faculty may provide.
   (ii) to complete a course' means—
      (a) to attend the lectures and the meetings, if any, for tutorial instruction;
      (b) to complete satisfactorily the essays, exercises and practical work, if any; and
   (c) to pass the Annual Examination of the course, and derivative expressions shall have a corresponding meaning.

   (iii) 'core course' means a course which must be completed by a candidate in order to qualify for the award of a degree, unless the candidate is granted exemption by the Faculty.

   (iv) 'elective course' means a course other than a core course.

   (v) 'prerequisite' means a course which a candidate must complete before the candidate is permitted to enrol in any course for which that course has been declared a prerequisite.

   (vi) 'corequisite' means a course in which, unless previously completed, a candidate must enrol concurrently with any course for which that course has been declared a corequisite.

   (a) The courses which may be taken for the degree are—
      (i) the Junior and Intermediate courses set out in Table 1 of the Tables appended to these resolutions.
      (ii) the Senior and Senior Advanced courses set out in Tables 2 to 8.
      (iii) elective courses, being Senior, Senior Advanced and Honours courses from time to time prescribed by the Faculty; such courses may not be provided in every year.
      (iv) such other course or courses as may be approved by the Faculty in special cases.

   (b) (i) The core courses for the degree and their corequisite and prerequisite courses are set out in the Tables as follows:
      In Civil Engineering—Table 2.
      In Mining Engineering—Table 3.
      In Mechanical Engineering—Table 4.
      In Mechanical Engineering (Mechatronics)—Table 4A.
      In Electrical Engineering—Table 5.
      In Electrical Engineering (Information Systems Engineering)—Table 5A.
      In Chemical Engineering—Table 6.
      In Aeronautical Engineering—Table 6.
      In Project Engineering and Management (Civil)—Table 8.

   (ii) The Faculty may prescribe courses alternative to one or more of the core courses set out in the tables, completion of which shall satisfy the requirement to complete the core course concerned.

   (iii) The Head of the Department or School concerned may accept other work completed by a candidate as the equivalent of a
4. (a) An examination called an 'Annual Examination' shall be held for each course.
(b) The Annual Examination may consist of written or oral examinations, exercises, essays or practical work or any combination of these.
(c) A candidate who has been prevented by duly certified illness or misadventure from sitting for the whole or part of the Annual Examination may be tested at such times and in such a way as the Faculty shall determine and this shall not count as a re-examination.

3. The courses for the degree shall have a unit value; elective courses prescribed by the Faculty shall have the unit value given them at the time of prescription and all other courses shall have the unit values shown in the Tables.

4. (a) An examination called an 'Annual Examination' shall be held for each course.
(b) The Annual Examination may consist of written or oral examinations, exercises, essays or practical work or any combination of these.
(c) A candidate who has been prevented by duly certified illness or misadventure from sitting for the whole or part of the Annual Examination may be tested at such times and in such a way as the Faculty shall determine and this shall not count as a re-examination.

5. (a) A candidate who has completed a course shall have credited to the candidate's degree the unit value of that course except that:
(i) no course may be counted more than once as a qualifying course for the degree;
(ii) a candidate may not have credited for the degree units derived from more than one of such courses as the Faculty may deem to be mutually exclusive; and
(iii) a candidate may not receive credit for an option within a course which is similar in content to part of a course concurrently being taken or previously completed.

(b) (i) In any course at the Annual Examination the Faculty may award a Terminating Pass which entitles the candidate to be credited with the full number of units for that course.
(ii) A candidate who has been awarded a Terminating Pass in a course shall be held to have completed such course except that the Tables prescribe for core courses certain prerequisites in which a terminating pass is not acceptable, and the Faculty may prescribe the same restriction as to prerequisites for an elective course.
(iii) A candidate who is awarded a Terminating Pass in any course may take that course again but on completion of the course the units thereof may not be counted again.

6. (a) To qualify for the award of a Pass degree a candidate shall unless granted exemption by the Faculty under part (b) of this resolution:
(i) complete all the core courses listed in the Table pertaining to the Department in which the candidate is pursuing the degree, and
(ii) complete additional elective courses as may be necessary to gain credit for a total of not less than 200 units.
(b) In special circumstances the Faculty may grant an exemption from completion of any core course to a candidate. No credit will be allowed for any core course for which an exemption from completion has been granted.
(c) A candidate who, with the prior permission of the Faculty, completes a course or courses at another university or an appropriate institution may be given credit for such of the courses set out in the Tables attached to these Resolutions as the Faculty may determine.

7. Except with the permission of the Faculty, a candidate, in the first year of attendance, shall enrol in Junior courses with a total unit value of not less than 48 units and not more than 52 units.

8. (a) In each subsequent year of attendance after the first, a candidate may enrol in any of the courses for which there is no prerequisite or for which the candidate has completed the prerequisites provided that:
(i) in the second year of attendance the candidate may enrol in Junior and/or Intermediate courses only.
(ii) the candidate shall include amongst the courses in which the candidate enrols such of the core courses for the degree for which the candidate was qualified to enrol in the previous year of attendance and for which the candidate has not yet gained credit, and for Which the candidate has not been granted exemption under section 6(b).
(iii) the candidate shall in no case enrol for courses having a total unit value of more than 64, nor enrol for courses having a total unit value of less than 36 unless the candidate already has a credit for 158 or more units.
universities who desire to proceed to the degree
University of Sydney or graduates of other
for the course.
which the candidate has previously failed to
may determine.
regards that course be governed by the require­
Faculty to be equivalent, provided they have
permission, may be given credit for any of the
permission to enrol as candidates for the degree
Such candidates shall then be required to
considered by the Faculty to be equivalent.
provided they have completed for their previous
set out in the Tables as the Faculty may
connection with such examination.
for any prize or scholarship awarded in
attend all lectures and other classes and
complete shall, unless exempted by the Faculty,
the requisite number of courses not already
taken to meet the requirements of section 11.
(a) Graduates in other Faculties' of the
University of Sydney or graduates of other
universities who desire to proceed to the degree
Bachelor of Engineering, may be admitted to
candidature with credit for such of the courses
set out in the Tables as the Faculty may
determine, up to a maximum of 100 units,
provided they have completed for their previous
degree those courses or a course or courses
considered by the Faculty to be equivalent.
Such candidates shall then be required to
complete, in accordance with these resolutions,
the requisite number of courses not already
taken to meet the requirements of section 6.
(b) Students who have completed a course
or courses in another Faculty or other Faculties
of the University of Sydney may apply for
permission to enrol as candidates for the degree
of Bachelor of Engineering and if granted such
permission may be given credit for such of the courses set out in the Tables as the Faculty may determine.
(d) In each of the circumstances of the
foregoing subsections, where an applicant for
candidature has completed courses which are
not comparable with any of the courses set out
in the Tables, the Faculty may, either instead of
or in addition to giving credit for any course
that is so set out, give credit for such number of
units, to be designated by the Faculty as Junior,
Intermediate, Senior or Senior Advanced, as
the Faculty may determine, and all units so
credited shall, notwithstanding anything
contained in these resolutions, count
accordingly towards the satisfaction of the
requirements of the degree.
10A, (1) Students who have completed one year
of candidature toward the degree of Bachelor
of Engineering may be admitted by the Faculty
of Economics, on the recommendation of the
Dean of the Faculty of Engineering, to
candidature for the combined degrees of
Bachelor of Engineering and Bachelor of
Commerce. Students who have completed two
years of candidature toward the degree of
Bachelor of Engineering will only be considered
for admission to the combined degrees in
exceptional circumstances.
(2) Such students shall comply with such
requirements for the combined degrees as may
be prescribed in the resolutions of the Senate
relating to the two degrees and consequential
resolutions of the Faculties.
11. (a) To qualify for admission to candidature
for the Honours degree, a candidate shall—
(i) be considered by the Head of the
Department concerned to have the
requisite knowledge and aptitude, and
(ii) except with the permission of the Faculty,
be either of not more than three years' standing in the Faculty and have gained
credit for not less than 48 units from
Senior and Senior Advanced courses or
of not more than four years' standing in the Faculty and have completed the
requirements of the Pass degree.
(b) In the case of a candidate who transfers
to the Faculty of Science in accordance with the
provisions of section 13 of the Senate resolutions
which govern candidature for the degree of
Bachelor of Science, the time spent as a candidate
in the Faculty of Science shall not be counted in
determining the candidate's years of standing in the Faculty of Engineering.
(a) To qualify for the award of an Honours
degree a candidate shall—
(i) complete the requirements of section 6,
and
(ii) complete such Honours courses as are
determined by the Head of the Depart-
ment in which the candidate is pursuing
the degree.
(b) The Faculty may prescribe any Senior or Senior Advanced course as a course which may be taken as an Honours course.

(c) Where an Honours course and a core course are deemed by the Faculty to be mutually exclusive, completion of the Honours course will be taken as satisfying the core course.

(d) Except with the permission of the Faculty, a candidate shall not be eligible for the award of an Honours degree unless the candidate has completed all the requirements within one year from admission to candidacy.

(e) A candidate for an Honours degree who has failed to be placed in any Honours classification may be awarded a Pass degree.

13. If a candidate graduates with First Class Honours and the Faculty is of the opinion that the candidate's work is of outstanding merit, that candidate shall receive a bronze medal.

14. The provisions of these resolutions came into force on 1 January 1989. All candidates who commenced candidature prior to this date shall complete the degree requirements under such conditions as the Faculty may determine.

Resolutions of the Faculty

Bachelor of Engineering/Bachelor of Commerce

1. (1) Candidates admitted to candidacy for the combined degrees of Bachelor of Engineering and Bachelor of Commerce shall qualify for admission to the pass degree of Bachelor of Engineering on completion of 168 units including the core courses listed in the branch or specialisation in which the candidate is pursuing the degree and the completion of the requirements for the degree of Bachelor of Commerce as set out in the resolutions of the Faculty of Economics.

(2) Except with special permission of the Dean of Science on advice from the Dean of Engineering, a candidate for the combined degrees of Bachelor of Engineering and Bachelor of Commerce who is admitted to the degree of Bachelor of Science in accordance with the provision of section 13 of the Senate Resolutions which govern candidature for the degree of Bachelor of Science, shall cease to be a candidate for the combined degrees and may only be eligible to be readmitted to the degree of Bachelor of Engineering.

(3) A candidate who ceases to be a candidate for the degree of Bachelor of Commerce and who has not been awarded that degree shall be eligible for the award of the degree of Bachelor of Engineering on completing such additional requirements as the Faculty of Engineering may determine.

Alternative core courses

2. Pursuant to section 2(b)(ii) of the Senate resolutions the Faculty has prescribed the following variations to the core courses required for candidates proceeding to the combined degrees of Bachelor of Engineering and Bachelor of Commerce.

Bachelor of Engineering in Chemical Engineering with Bachelor of Commerce

A candidate admitted to candidacy for the combined degrees of Bachelor of Engineering in Chemical Engineering and Bachelor of Commerce shall not be required to complete the following core courses:

- U2.502 Electrical Technology 4 units
- U2.701 Mechanics of Solids 1 4 units
- U3.645 Project Economics 4 units
- U3.650 Materials and Corrosion 2 4 units
- U3.670 Chemical Engineering Laboratory 10 units

but must complete the following alternative core course:

- U3.670A Chemical Engineering Laboratory 6 units

Bachelor of Engineering in Mechanical Engineering with Bachelor of Commerce

A candidate admitted to candidacy for the combined degrees of Bachelor of Engineering in Mechanical Engineering and Bachelor of Commerce shall not be required to complete the following core course:

- U3.460 Manufacturing Engineering and Management 10 units

but must complete the following alternative core course:

- U3.461 Manufacturing Engineering 5 units

Bachelor of Engineering in Civil Engineering with Bachelor of Commerce

A candidate admitted to candidacy for the combined degrees of Bachelor of Engineering in Civil Engineering and Bachelor of Commerce shall not be required to complete the following core course:

- U3.283 Applied Statistics 4 units

but shall be required to complete 10 units from the following core courses:

- U4.212 Materials 3 4 units
- U4.222 Structural Analysis 2 4 units
- U4.223 Finite Element Methods 4 units
- U4.231 Structural Behaviour 2 4 units
- U4.241 Soil Engineering 4 units
- U4.251 Surveying 2 4 units
- U4.262 Fluids 2 4 units

Bachelor of Engineering in Electrical Engineering with Bachelor of Commerce

A candidate admitted to candidacy for the combined degrees of Bachelor of Engineering in Electrical Engineering and Bachelor of Commerce shall not be required to complete the following core courses:

- U3.571 Management for Engineers 3 units
- U4.589 Thesis 12 units

nor be required to complete 36 units from additional approved Senior Advanced courses as described in Table 5 in the sentence commencing 'A further core requirement is to gain credit', but must complete the following course:

- U4.588 Thesis A 8 units

An additional requirement is to gain credit for 12 units from the following set of Senior Advanced courses:
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>U4.529</td>
<td>Electrical Systems Analysis</td>
<td>4 units</td>
</tr>
<tr>
<td>U4.539</td>
<td>Control 2</td>
<td>4 units</td>
</tr>
<tr>
<td>U4.549</td>
<td>Electronic Design</td>
<td>4 units</td>
</tr>
<tr>
<td>U4.558</td>
<td>Digital Communication Systems</td>
<td>4 units</td>
</tr>
<tr>
<td>U4.559</td>
<td>Data Communication Networks</td>
<td>4 units</td>
</tr>
<tr>
<td>U4.568</td>
<td>Real Time Computing</td>
<td>4 units</td>
</tr>
<tr>
<td>U4.569</td>
<td>Digital Systems 2</td>
<td>4 units</td>
</tr>
</tbody>
</table>

Other Senior Advanced courses may be approved by the Head of the Department of Electrical Engineering from time to time.
### Table 1 — Junior and Intermediate courses [See Resolution 2]

#### Table 1 (a) — Junior courses

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Assumed standard of knowledge at the HSC examination</th>
<th>Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1.001</td>
<td>Mathematics 101F</td>
<td>6</td>
<td>Mathematics 3 unit course and either 2 unit Physics or the Physics core of 3/4 unit Science</td>
<td></td>
</tr>
<tr>
<td>U1.002</td>
<td>Mathematics 102S</td>
<td>6</td>
<td>Mathematics 3 unit course and either 2 unit Physics or the Physics core of 3/4 unit Science</td>
<td></td>
</tr>
<tr>
<td>U1.010</td>
<td>Mechanics IE</td>
<td>6</td>
<td>Mathematics 3 unit course and either 2 unit Physics or the Physics core of 3/4 unit Science</td>
<td>12 units of First Year Maths</td>
</tr>
<tr>
<td>U1.021</td>
<td>Physics IE</td>
<td>6</td>
<td>Mathematics 3 unit course and either 2 unit Physics or the Physics core of 3/4 unit Science</td>
<td></td>
</tr>
<tr>
<td>U1.022</td>
<td>Physics 101F</td>
<td>6</td>
<td>Mathematics 3 unit course and either 2 unit Physics or the Physics core of 3/4 unit Science</td>
<td></td>
</tr>
<tr>
<td>U1.023</td>
<td>Physics 103S</td>
<td>6</td>
<td>Mathematics 3 unit course and either 2 unit Physics or the Physics core of 3/4 unit Science</td>
<td></td>
</tr>
<tr>
<td>U1.031</td>
<td>Chemistry IE</td>
<td>6</td>
<td>Mathematics 2 unit course and either 2 unit Chemistry or the Chemistry core of 3/4 unit Science</td>
<td></td>
</tr>
<tr>
<td>U1.032</td>
<td>Chemistry IE Supplementary</td>
<td>6</td>
<td>Mathematics 2 unit course and either 2 unit Chemistry or the Chemistry core of 3/4 unit Science</td>
<td></td>
</tr>
<tr>
<td>U1.033A</td>
<td>Chemistry 111F</td>
<td>6</td>
<td>Mathematics 2 unit course and either 2 unit Chemistry or the Chemistry core of 3/4 unit Science</td>
<td></td>
</tr>
<tr>
<td>U1.033B</td>
<td>Chemistry 112S</td>
<td>6</td>
<td>Mathematics 2 unit course and either 2 unit Chemistry or the Chemistry core of 3/4 unit Science</td>
<td></td>
</tr>
<tr>
<td>U1.0402</td>
<td>Computer Science 101F</td>
<td>6</td>
<td>Mathematics 3 unit course</td>
<td></td>
</tr>
<tr>
<td>U1.0402</td>
<td>Computer Science 102S</td>
<td>6</td>
<td>Mathematics 3 unit course</td>
<td></td>
</tr>
<tr>
<td>U1.050A</td>
<td>Geology 101F</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U1.050B</td>
<td>Geology 102S</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U1.051</td>
<td>Engineering Geology 1</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U1.060A</td>
<td>Biology 101F</td>
<td>6</td>
<td>2 unit Biology or 3 unit Biology or 4 unit Science</td>
<td></td>
</tr>
<tr>
<td>U1.060B</td>
<td>Biology 192S</td>
<td>6</td>
<td>2 unit Biology or 3 unit Biology or 4 unit Science</td>
<td></td>
</tr>
<tr>
<td>U1.060C</td>
<td>Biology 103S</td>
<td>6</td>
<td>2 unit Biology or 3 unit Biology or 4 unit Science</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** See prerequisites for 2nd Year Physics

For other 12 unit First Year courses offered by the Faculties of Arts, Economics and Science consult the relevant Faculty Handbook for the rules relating to assumed knowledge and mutual exclusiveness.

U1.100 Manufacturing Technology 4

U1.200 Civil Engineering 1 4

For courses U1.100 to U1.710 inclusive:

Mathematics 3 unit course and either the Science 4 unit course or the Chemistry 2 unit course and the Physics 2 unit course.
### Table (1)(b) — Intermediate courses

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Assumed standard of knowledge at the HSC examination</th>
<th>Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>U2.002</td>
<td>Maths 201F</td>
<td>4</td>
<td>12 units of First Year Maths</td>
<td>U1.001</td>
</tr>
<tr>
<td>U2.003</td>
<td>Maths 202F</td>
<td>4</td>
<td>12 units of First Year Maths</td>
<td>U1.001</td>
</tr>
<tr>
<td>U2.004</td>
<td>Maths 205S</td>
<td>4</td>
<td>12 units of First Year Maths</td>
<td>U1.001</td>
</tr>
<tr>
<td>U2.005</td>
<td>Maths 251S</td>
<td>2</td>
<td>12 units of First Year Maths</td>
<td></td>
</tr>
<tr>
<td>U2.006</td>
<td>Maths 252S</td>
<td>2</td>
<td>12 units of First Year Maths</td>
<td></td>
</tr>
<tr>
<td>U2.022</td>
<td>Physics 201F</td>
<td>8</td>
<td>U1.022 and/or U1.023</td>
<td>U1.001 and; (U1.002 or U1.003) and; (U1.010 or U1.400)</td>
</tr>
<tr>
<td>U2.023</td>
<td>Physics 202S</td>
<td>8</td>
<td>U1.022 and/or U1.023</td>
<td>U1.001 and; (U1.002 or U1.003) and; (U1.010 or U1.400)</td>
</tr>
<tr>
<td>U2.022E</td>
<td>Physics 201F (Elec Eng)</td>
<td>6</td>
<td>U1.022 and/or U1.023</td>
<td>U1.001 and U1.003</td>
</tr>
<tr>
<td>U2.023E</td>
<td>Physics 202S (Elec Eng)</td>
<td>6</td>
<td>U1.022 and/or U1.023</td>
<td>U1.001 and U1.003</td>
</tr>
<tr>
<td>U2.030A</td>
<td>Chemistry 201F</td>
<td>8</td>
<td>U1.033A and U1.033B, or U1.031 and U1.032</td>
<td></td>
</tr>
<tr>
<td>U2.030B</td>
<td>Chemistry 211F</td>
<td>8</td>
<td>U1.033A and U1.033B, or U1.031 and U1.032</td>
<td></td>
</tr>
<tr>
<td>U2.030C</td>
<td>Chemistry 221F</td>
<td>8</td>
<td>U1.033A and U1.033B, or U1.031 and U1.032</td>
<td></td>
</tr>
<tr>
<td>U2.0401</td>
<td>Computer Science 201F</td>
<td>4</td>
<td></td>
<td>U1.0402</td>
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<tr>
<td>U2.0402</td>
<td>Computer Science 202F</td>
<td>4</td>
<td></td>
<td>U1.0402</td>
</tr>
<tr>
<td>U2.0403</td>
<td>Computer Science 203S</td>
<td>4</td>
<td></td>
<td>U1.0402</td>
</tr>
<tr>
<td>U2.0404</td>
<td>Computer Science 204S</td>
<td>4</td>
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<td>U1.0402</td>
</tr>
<tr>
<td>U2.0405</td>
<td>Computer Science 205S</td>
<td>3</td>
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<td>U1.0402</td>
</tr>
<tr>
<td>U2.0406</td>
<td>Computer Science 206S</td>
<td>3</td>
<td></td>
<td>U1.0402</td>
</tr>
<tr>
<td>U2.050A</td>
<td>Geology 201F</td>
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<td></td>
<td>U1.050B</td>
</tr>
<tr>
<td>Course No.</td>
<td>Title</td>
<td>Unit value</td>
<td>Prerequisites* (a)</td>
<td>(b)</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------------------------------------</td>
<td>------------</td>
<td>--------------------</td>
<td>-----</td>
</tr>
<tr>
<td>U2.050B</td>
<td>Geology 202S</td>
<td>4</td>
<td>U2.050A</td>
<td></td>
</tr>
<tr>
<td>U2.050C</td>
<td>Geology 203S</td>
<td>4</td>
<td>U2.050A</td>
<td></td>
</tr>
<tr>
<td>U2.052</td>
<td>Engineering Geology 2</td>
<td>5</td>
<td>U1.051; or U1.050</td>
<td></td>
</tr>
<tr>
<td>U2.065A</td>
<td>Biochemistry 201F</td>
<td>8</td>
<td>(U1.033A and U1.033B) or (U1.031 and U1.032)</td>
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<tr>
<td>U2.065B</td>
<td>Biochemistry 202S</td>
<td>8</td>
<td>to be advised</td>
<td></td>
</tr>
<tr>
<td>U2.066A</td>
<td>Biochemistry 211F</td>
<td>4</td>
<td>to be advised</td>
<td></td>
</tr>
<tr>
<td>U2.066B</td>
<td>Biochemistry 212S</td>
<td>4</td>
<td>to be advised</td>
<td></td>
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<tr>
<td>U2.090</td>
<td>Asian Studies 1</td>
<td>8</td>
<td>to be advised</td>
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<tr>
<td>U2.210</td>
<td>Introduction to Materials</td>
<td>4</td>
<td>U1.220 and U1.000 and U1.010</td>
<td></td>
</tr>
<tr>
<td>U2.221</td>
<td>Structural Mechanics</td>
<td>5</td>
<td>U1.220 and U1.000 and U1.010</td>
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</tr>
<tr>
<td>U2.261</td>
<td>Fluids 1</td>
<td>5</td>
<td>U1.000</td>
<td></td>
</tr>
<tr>
<td>U2.272</td>
<td>Engineering Communications 1</td>
<td>2</td>
<td>U1.000</td>
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<tr>
<td>U2.290</td>
<td>Structural Design</td>
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<td>U1.220 and U1.000 and U1.010</td>
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<tr>
<td>U2.410</td>
<td>Mechanical Engineering 2</td>
<td>10</td>
<td>U1.000 and U1.411 or U1.710</td>
<td></td>
</tr>
<tr>
<td>U2.411</td>
<td>Introductory Thermodynamics</td>
<td>4</td>
<td>U1.000</td>
<td></td>
</tr>
<tr>
<td>U2.412</td>
<td>Engineering Dynamics</td>
<td>4</td>
<td>U1.000 and U1.410 or U1.710</td>
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</tr>
<tr>
<td>U2.417</td>
<td>Introductory Mechanics and Materials</td>
<td>8</td>
<td>U1.000</td>
<td></td>
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<tr>
<td>U2.440</td>
<td>Mechanical Design 1</td>
<td>8</td>
<td>U1.411 or U1.710</td>
<td></td>
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<tr>
<td>U2.441</td>
<td>Mechanical Design 1A</td>
<td>6</td>
<td>U1.411 or U1.710</td>
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</tr>
<tr>
<td>U2.443</td>
<td>Mechatronic Design 1</td>
<td>2</td>
<td>U1.000</td>
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<tr>
<td>U2.471</td>
<td>Introductory Mechatronics</td>
<td>6</td>
<td>U1.500</td>
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<tr>
<td>U2.504</td>
<td>Electrical and Electronic Engineering</td>
<td>6</td>
<td>U1.500</td>
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<td>U2.511</td>
<td>Electrical Engineering 2A</td>
<td>8</td>
<td>U1.511</td>
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<td>U2.512</td>
<td>Electrical Engineering 2B</td>
<td>8</td>
<td>U1.511</td>
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<tr>
<td>U2.610</td>
<td>Chemical Engineering 2</td>
<td>8</td>
<td>U1.000</td>
<td></td>
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<tr>
<td>U2.611</td>
<td>Fundamentals of Environmental Chemical Engineering</td>
<td>4</td>
<td>U1.000 and U1.630</td>
<td>U1.610</td>
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<td>U2.612</td>
<td>Chemical Engineering Computations</td>
<td>4</td>
<td>U1.000</td>
<td></td>
</tr>
<tr>
<td>U2.700</td>
<td>Mechanics and Properties of Solids 1</td>
<td>6</td>
<td>U1.000</td>
<td></td>
</tr>
<tr>
<td>U2.701</td>
<td>Mechanics of Solids 1</td>
<td>4</td>
<td>U1.000</td>
<td></td>
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<tr>
<td>U2.710</td>
<td>Fluid Mechanics</td>
<td>4</td>
<td>U1.000</td>
<td></td>
</tr>
<tr>
<td>U2.770</td>
<td>Engineering Computation</td>
<td>4</td>
<td>U1.000 and U1.280 and U1.281</td>
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<tr>
<td>U2.800</td>
<td>Engineering Construction 1</td>
<td>4</td>
<td>U1.000</td>
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</tr>
<tr>
<td>U2.820</td>
<td>Engineering Economics</td>
<td>4</td>
<td>U1.000</td>
<td></td>
</tr>
<tr>
<td>U2.821</td>
<td>Engineering Accounting</td>
<td>4</td>
<td>U1.000</td>
<td></td>
</tr>
</tbody>
</table>

*For prerequisites in Column (a) a Terminating Pass is not acceptable.
### Table 2 — Civil Engineering

Candidates for the degree of Bachelor of Engineering in Civil Engineering are required to gain credit for the core courses set out below. Any additional credit necessary to satisfy the requirements of Resolution 6 shall be gained by completing other courses from Table 1 and/or from the Senior and Senior Advanced elective courses prescribed by the Faculty from time to time.

#### Junior and Intermediate courses (from Table 1)

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
<th>Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1.001</td>
<td>Mathematics 101F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TJ1.002</td>
<td>Mathematics 102S</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U1.010</td>
<td>Mechanics IE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U1.031</td>
<td>Chemistry IE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U1.051</td>
<td>Engineering Geology 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TJ1.200</td>
<td>Civil Engineering 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U1.220</td>
<td>Statics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U1.280</td>
<td>Engineering Programming</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U1.281</td>
<td>Computer Graphics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U1.500</td>
<td>Introductory Electrical Engineering</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Senior courses

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
<th>Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>U3.212</td>
<td>Properties of Materials</td>
<td>4</td>
<td>U2.210</td>
<td></td>
</tr>
<tr>
<td>U3.222</td>
<td>Structural Analysis</td>
<td>6</td>
<td>U2.221</td>
<td>U2.000</td>
</tr>
<tr>
<td>U3.232</td>
<td>Concrete Structures 1</td>
<td>6</td>
<td>U2.221 and U2.290</td>
<td>U2.000</td>
</tr>
<tr>
<td>U3.235</td>
<td>Steel Structures 1</td>
<td>6</td>
<td>U2.221 and U2.290</td>
<td>U2.000</td>
</tr>
<tr>
<td>U3.244</td>
<td>Soil Mechanics A</td>
<td>4</td>
<td>U2.210 and U2.221</td>
<td>U1.000</td>
</tr>
<tr>
<td>U3.245</td>
<td>Soil Mechanics B</td>
<td>4</td>
<td>U2.210 and U2.221</td>
<td>U1.000</td>
</tr>
<tr>
<td>U3.250</td>
<td>Surveying 1</td>
<td>4</td>
<td>U1.000</td>
<td></td>
</tr>
<tr>
<td>U3.262</td>
<td>Fluids 2</td>
<td>4</td>
<td>U2.261</td>
<td></td>
</tr>
<tr>
<td>U3.271</td>
<td>Transportation Engineering and Planning</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U3.275</td>
<td>Engineering Communications 2</td>
<td>2</td>
<td>U2.272</td>
<td></td>
</tr>
<tr>
<td>U3.284</td>
<td>Risk and Reliability Analysis</td>
<td>2</td>
<td>U2.221 and U2.290</td>
<td>U1.000</td>
</tr>
<tr>
<td>U3.801</td>
<td>Engineering Construction 2</td>
<td>4</td>
<td>U2.800</td>
<td></td>
</tr>
</tbody>
</table>

#### Senior Advanced courses

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
<th>Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>U4.202</td>
<td>Thesis 1</td>
<td>6</td>
<td>A Senior core course in the field of the thesis</td>
<td></td>
</tr>
<tr>
<td>U4.205</td>
<td>Practical Experience</td>
<td>4</td>
<td>28 units of Senior courses</td>
<td></td>
</tr>
<tr>
<td>U4.214</td>
<td>Materials Aspects in Design</td>
<td>4</td>
<td>U3.212</td>
<td></td>
</tr>
<tr>
<td>U4.253</td>
<td>Civil Engineering Camp</td>
<td>4</td>
<td>U3.250</td>
<td></td>
</tr>
<tr>
<td>U4.273</td>
<td>Engineering Management</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.276</td>
<td>Professional Practice</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.292</td>
<td>Civil Engineering Design</td>
<td>4</td>
<td>U3.232 and U3.235</td>
<td></td>
</tr>
</tbody>
</table>

Together with the above core courses you must complete at least 20 units of Senior Advanced courses chosen from the elective courses in Civil Engineering or recommended streams which are available from time to time. One 4-unit course, other than an Honours course, may be replaced by at least 4 units available elsewhere in the Faculty. These are subject to the approval of the Head of School. It is not compulsory to enrol in all the subjects in any one recommended stream, i.e., subjects may be drawn from more than one stream.

For prerequisites in Column (a) a Terminating Pass is not acceptable.
RESOLUTIONS OF THE FACULTY OF ENGINEERING relating to Table 2 — Civil Engineering

Acceptable alternative courses

Pursuant to Resolution 2, the Faculty has prescribed the following acceptable alternatives to the core courses listed in Table 2:

<table>
<thead>
<tr>
<th>Core course</th>
<th>Acceptable alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1.031 Chemistry 1E</td>
<td>U1.033A Chemistry 111F and U1.033B Chemistry 112S</td>
</tr>
<tr>
<td>U1.051 Engineering Geology 1</td>
<td>U1.050A Geology 101F and U1.050B Geology 102S</td>
</tr>
<tr>
<td>U1.280 Engineering Programming</td>
<td>U1.0401 Computer Science 101F and U1.0402 Computer Science 102S</td>
</tr>
<tr>
<td>U1.500 Introductory Electrical Engineering</td>
<td>U1.021 Physics IE or U1.022 Physics 101F and U1.023 Physics 103S or U2.502 Electrical Technology</td>
</tr>
<tr>
<td>TJ2.052 Engineering Geology 2</td>
<td>U2.050A Geology 201F and U2.050B Geology 202S and U2.050C Geology 203S</td>
</tr>
<tr>
<td>U2.800 Engineering Construction 1</td>
<td>U2.0401 Computer Science 201F and U2.0402 Computer Science 202F and U2.0403 Computer Science 203S and U2.0404 Computer Science 204S</td>
</tr>
<tr>
<td>U4.202 Thesis 1</td>
<td>U5.204 Thesis Honours</td>
</tr>
</tbody>
</table>

RESOLUTIONS OF THE SCHOOL OF CIVIL AND MINING ENGINEERING

Recommended elective courses

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
<th>Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1.021</td>
<td>Physics IE</td>
<td>6</td>
<td>See Table 1(a) for the assumed standard of knowledge at the Higher School Certificate Examination for courses U1.021 to U1.100.</td>
<td>One of: U1.010 or U1.410 or U1.710</td>
</tr>
<tr>
<td>U1.0401</td>
<td>Computer Science 101F</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U1.0402</td>
<td>Computer Science 102S</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U1.050A</td>
<td>Geology 101F</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U1.050B</td>
<td>Geology 102S</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U1.050</td>
<td>Geology 1</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U1.100</td>
<td>Manufacturing Technology</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U2.090</td>
<td>Asian Studies 1</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>♦Archaeology (P&amp;H) 101</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>♦Archaeology (P&amp;H) 102</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.071</td>
<td>Human and Industrial Relations</td>
<td>6</td>
<td>Credit for 36 units of Senior courses plus completion of work experience</td>
<td>U4.202</td>
</tr>
<tr>
<td>U4.203</td>
<td>Thesis 2</td>
<td>4</td>
<td></td>
<td>U4.202</td>
</tr>
<tr>
<td>U4.223</td>
<td>Finite Element Methods</td>
<td>4</td>
<td>U3.222</td>
<td></td>
</tr>
<tr>
<td>U4.232</td>
<td>Bridge Engineering</td>
<td>4</td>
<td>U3.222 and U3.232and U3.235</td>
<td></td>
</tr>
<tr>
<td>U4.236</td>
<td>Concrete Structures 2</td>
<td>4</td>
<td>U3.232</td>
<td></td>
</tr>
<tr>
<td>U4.237</td>
<td>Structural Dynamics</td>
<td>4</td>
<td>U3.222</td>
<td></td>
</tr>
<tr>
<td>U4.238</td>
<td>Steel Structures 2</td>
<td>4</td>
<td>U3.235</td>
<td></td>
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</tbody>
</table>
### Recommended elective courses (continued)

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
<th>Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>U4.246</td>
<td>Environmental Geotechnics</td>
<td>4</td>
<td>U3.244 and U3.245</td>
<td></td>
</tr>
<tr>
<td>U4.247</td>
<td>Foundation Engineering</td>
<td>4</td>
<td>U3.244 and U3.245</td>
<td></td>
</tr>
<tr>
<td>U4.251</td>
<td>Surveying 2</td>
<td>4</td>
<td>U3.250</td>
<td></td>
</tr>
<tr>
<td>U4.260</td>
<td>Environmental Fluids 1</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.265</td>
<td>Environmental Fluids 2</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.266</td>
<td>Water Resources Engineering</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.274</td>
<td>Project Procedures</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.293</td>
<td>Project Formulation</td>
<td>4</td>
<td></td>
<td>U4.273</td>
</tr>
<tr>
<td>U4.461</td>
<td>Introduction to Operations Research</td>
<td>2</td>
<td>U2.000</td>
<td></td>
</tr>
<tr>
<td>U4.044</td>
<td>The Building Industry in Australia</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.045</td>
<td>206F Environmental Geology: Hazards</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.046</td>
<td>207S Environmental Geology: Resources</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U5.204</td>
<td>Thesis Honours</td>
<td>10</td>
<td>A Senior Core course in the field of the thesis</td>
<td></td>
</tr>
<tr>
<td>U5.213</td>
<td>Materials Honours</td>
<td>4</td>
<td></td>
<td>U4.214</td>
</tr>
<tr>
<td>U5.224</td>
<td>Steel Structures Honours</td>
<td>4</td>
<td></td>
<td>U4.235</td>
</tr>
<tr>
<td>U5.226</td>
<td>Finite Element Applications Honours</td>
<td>4</td>
<td></td>
<td>U4.223</td>
</tr>
<tr>
<td>U5.234</td>
<td>Structural Dynamics Honours</td>
<td>4</td>
<td></td>
<td>U3.222</td>
</tr>
<tr>
<td>U5.239</td>
<td>Concrete Structures Honours</td>
<td>4</td>
<td></td>
<td>U3.232</td>
</tr>
<tr>
<td>U5.243</td>
<td>Soil Engineering Honours</td>
<td>4</td>
<td>U3.244 and U3.245</td>
<td>U4.247</td>
</tr>
<tr>
<td>U5.253</td>
<td>Surveying Honours</td>
<td>4</td>
<td></td>
<td>U4.251</td>
</tr>
<tr>
<td>U5.267</td>
<td>Environmental Fluids Honours</td>
<td>4</td>
<td></td>
<td>U3.262</td>
</tr>
<tr>
<td>U5.294</td>
<td>Civil Engineering Design Honours</td>
<td>4</td>
<td>U3.232 and U3.235</td>
<td>U4.292</td>
</tr>
</tbody>
</table>

Students must take at least 20 units of elective subjects at Senior Advanced level.

Honours candidates replace core subject U4.202 Thesis 1 by U5.204 Thesis Honours and also enrol in U4.233 Finite Element Methods, 12 units of elective subjects at Honours level and at least 8 units of other elective subjects at Senior Advanced level.

### Elective Streams:

Recommended elective streams are:

- **Construction Engineering and Management Stream**:

- **Environmental Engineering Stream**:
  - U4.246, U4.260, U4.265, U4.266, U4.694 (or U4.490)

- **Structural Engineering Stream**: U4.232, U4.223, U4.236, U4.237, U4.238

- **Geotechnical Engineering Stream**: U4.223, U4.246, U4.247, Environmental Geology 2 Auxiliary (Faculty of Science: 2 units)

*For prerequisites in column (a), a Terminating Pass is not acceptable.

* Faculty of Arts courses—enrol at Faculty Office.
RESOLUTIONS OF THE SENATE

Table 4 — Mechanical Engineering

Candidates for the degree of Bachelor of Engineering in Mechanical Engineering are required to gain credit for the core courses set out below. Any additional credit necessary to satisfy the requirements of Resolution 6’shall be gained by completing other courses from Table 1 and/or from the Senior and Senior Advanced elective courses prescribed by the Faculty from time to time.

**Junior and Intermediate courses** (from Table 1)

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>(a)</td>
</tr>
<tr>
<td>U1.001</td>
<td>Mathematics 101F</td>
<td>6</td>
<td>U2.002 Mathematics 201F 4</td>
</tr>
<tr>
<td>U1.002</td>
<td>Mathematics 102S</td>
<td>6</td>
<td>U2.003 Mathematics 202F 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>U2.004 Mathematics 205S 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>U2.005 Mathematics 251S 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>U2.006 Mathematics 252S 2</td>
</tr>
<tr>
<td>U1.021</td>
<td>Physics IE</td>
<td>6</td>
<td>U2.410 Mechanical Engineering 2 10</td>
</tr>
<tr>
<td>U1.031</td>
<td>Chemistry IE</td>
<td>6</td>
<td>U2.417 Introductory Mechanics and 8 Materials</td>
</tr>
<tr>
<td>U1.411</td>
<td>Mechanical Engineering 1</td>
<td>12</td>
<td>U2.440 Mechanical Design 1 8</td>
</tr>
<tr>
<td>U1.446</td>
<td>Engineering Computing</td>
<td>8</td>
<td>U2.443 Mechatronic Design 1* 2</td>
</tr>
<tr>
<td>U1.500</td>
<td>Introductory Electrical</td>
<td>4</td>
<td>U2.504 Electrical and Electronic Engineering 6</td>
</tr>
<tr>
<td></td>
<td>Engineering</td>
<td></td>
<td>*U2.443 (Mechatronic Design 1): Intermediate core course to be taken by Mechanical/Mechatronic Engineering students undertaking the BE/BSc double degree.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>(b)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Corequisites</td>
</tr>
</tbody>
</table>

|            |                              |            |                |
| U3.420     | Thermo-fluid Engineering     | 10         | U2.410         |
| U3.421     | Thermodynamics               | 4          | U2.410 and U2.411 |
| U3.430     | Mechanics and Properties of Solids 2 | 8          | U2.000 and either U2.416 or U2.417 |
| U3.440     | Mechanical Design 2          | 8          | U2.700 or U2.417 and U2.440 or U2.441 |
| U3.451     | System Dynamics and Control  | 6          | U2.000 and U2.410 or U2.412 |
| U3.460     | Manufacturing Engineering and Management | 10         | U1.411         |
| U3.461     | Manufacturing Engineering*   | 5          | U4.411         |
| U3.465     | Project and Practice         | 6          | U3.420         |
|            |                              |            | U3.430         |
|            |                              |            | U3.450         |
|            |                              |            | U3.460         |

**Senior Advanced courses**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
</tr>
</thead>
<tbody>
<tr>
<td>U4.480</td>
<td>Thesis</td>
<td>12</td>
<td>36 units of Senior courses</td>
</tr>
<tr>
<td>U4.484</td>
<td>Professional Engineering</td>
<td>4</td>
<td>U3.460</td>
</tr>
<tr>
<td>U4.485</td>
<td>Professional Communication</td>
<td>4</td>
<td>Completion of industrial experience</td>
</tr>
<tr>
<td>U4.486</td>
<td>Practical Experience</td>
<td>6</td>
<td>28 units of Senior courses</td>
</tr>
</tbody>
</table>

Together with not less than 28 units of Senior and Senior Advanced level courses chosen from the elective courses available from time to time and subject to restriction upon combinations as the Head of the Department of Mechanical and Mechatronic Engineering may prescribe from time to time.

*For prerequisites in Column (a) a Terminating Pass is not acceptable.

For BE/BCom students only
RESOLUTIONS OF THE FACULTY OF ENGINEERING relating to Table 4 — Mechanical Engineering

Acceptable alternative courses

Pursuant to Resolution 2, the Faculty has prescribed the following acceptable alternatives to the core courses listed in Table 4:

Core course | Acceptable alternative
--- | ---
U1.021 Physics IE | U1.022 Physics 101F and U1.023 Physics 103S
U1.031 Chemistry IE | U1.033A Chemistry 111F and
| U1.033B Chemistry 112S
U2.440 Mechanical Design 1 | Both: U2.441 Mechanical Design IA and
| U2.443 Mechatronic Design 1
U1.445 Engineering Computing | U1.0401 Computer Science 101F and
| U1.0402 Computer Science 102S

RESOLUTIONS OF THE DEPARTMENT OF MECHANICAL AND MECHATRONIC ENGINEERING

Recommended elective courses

Students are required to complete 28 units of Senior and Senior Advanced elective courses. At least 24 units of these must be chosen from the mainstream electives (starred in the list below):

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
<th>Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>U2.090</td>
<td>Asian Studies 1</td>
<td>8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Intermediate elective course**

**Senior elective courses**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
</tr>
</thead>
<tbody>
<tr>
<td>U3.090</td>
<td>Asian Studies 2</td>
<td>8</td>
<td>U2.090</td>
</tr>
<tr>
<td>U3.271</td>
<td>Engineering Transportation and Planning</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>U3.431</td>
<td>Mechanical Props of Materials</td>
<td>4</td>
<td>U2.700 or U2.417</td>
</tr>
<tr>
<td>U3.506</td>
<td>Fundamentals of Biomedical Engineering</td>
<td>4</td>
<td>U3.540 or U2.504</td>
</tr>
<tr>
<td>U3.900</td>
<td>Innovation and International Competitiveness</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

**Senior Advanced elective courses**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
<th>Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>U4.005</td>
<td>Partial Differential Equations</td>
<td>2</td>
<td>U2.000</td>
<td></td>
</tr>
<tr>
<td>U4.070</td>
<td>Industrial Ergonomics</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.071</td>
<td>Human and Industrial Relations</td>
<td>6</td>
<td>36 units of Senior courses and completion of industrial experience</td>
<td></td>
</tr>
<tr>
<td>U4.090</td>
<td>Asian Studies 3</td>
<td>8</td>
<td>U3.090</td>
<td></td>
</tr>
<tr>
<td>U4.419</td>
<td>Thermal Engineering*</td>
<td>4</td>
<td>U3.420</td>
<td></td>
</tr>
<tr>
<td>U4.457</td>
<td>Computational Fluid Dynamics</td>
<td>4</td>
<td>U3.420</td>
<td></td>
</tr>
<tr>
<td>U4.422</td>
<td>Computational Methods for Partial Differential Equations*</td>
<td>4</td>
<td>U2.000</td>
<td></td>
</tr>
<tr>
<td>U4.430</td>
<td>Applied Numerical Stress Analysis*</td>
<td>6</td>
<td>U3.430</td>
<td></td>
</tr>
<tr>
<td>U4.433</td>
<td>Advanced Engineering Materials*</td>
<td>6</td>
<td>U3.430 or U3.431</td>
<td></td>
</tr>
<tr>
<td>U4.434</td>
<td>Aerospace Materials Engineering</td>
<td>4</td>
<td>U3.430 or U3.431 and U3.730</td>
<td></td>
</tr>
<tr>
<td>U4.438</td>
<td>Biomaterials and Biomechanics*</td>
<td>4</td>
<td>Any Intermediate year Materials course or Physics</td>
<td></td>
</tr>
<tr>
<td>U4.440</td>
<td>Advanced Design*</td>
<td>6</td>
<td>U3.440</td>
<td></td>
</tr>
</tbody>
</table>
## Recommended elective courses (continued)

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Tide</th>
<th>Unit value</th>
<th>Prerequisites*</th>
<th>(b)</th>
<th>Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>U4.441</td>
<td>Orthopaedic Engineering*</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.451</td>
<td>Dynamics and Systems Engineering*</td>
<td>6</td>
<td>U3.431; or U3.430</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.460</td>
<td>Industrial Engineering*</td>
<td>6</td>
<td>U2.000 and U3.460</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.461</td>
<td>Introduction to Operations Research</td>
<td>2</td>
<td>U2.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.462</td>
<td>Industrial and Engineering Management</td>
<td>2</td>
<td>U3.460 or U3.571 or U3.790 together with completion of the industrial period</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.470</td>
<td>Robotic Systems*</td>
<td>4</td>
<td>U3.450</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.490</td>
<td>Environmental Engineering*</td>
<td>6</td>
<td>U3.420</td>
<td></td>
<td>U4.486</td>
</tr>
<tr>
<td>U4.491</td>
<td>Environmental Acoustics and Noise Control</td>
<td>2</td>
<td>24 units of Senior courses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.694</td>
<td>Environmental Impact Assessment*</td>
<td>4</td>
<td>U3.420</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Mainstream electives.

For prerequisites in Column (a) a Terminating Pass is not acceptable.
Candidates for the degree of Bachelor of Engineering in Mechanical Engineering (Mechatronics) are required to gain credit for the core courses set out below. Any additional credit necessary to satisfy the requirements of Resolution 6 shall be gained by completing other courses from Table 1 and/or from the Senior and Senior Advanced elective courses prescribed by the Faculty from time to time.

### Junior and Intermediate courses (from Table 1)

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
<th>Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1.001 Mathematics 101F</td>
<td>6</td>
<td>U2.002 Mathematics 201F</td>
<td>4</td>
</tr>
<tr>
<td>U1.002 Mathematics 102S</td>
<td>6</td>
<td>U2.003 Mathematics 202F</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>U2.004 Mathematics 205S</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>U2.005 Mathematics 251S</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>U2.006 Mathematics 252S</td>
<td>2</td>
</tr>
<tr>
<td>U1.021 Physics IE</td>
<td>6</td>
<td>U2.410 Mechanical Engineering 2</td>
<td>10</td>
</tr>
<tr>
<td>U1.031 Chemistry IE</td>
<td>6</td>
<td>TJ2.417 Introductory Mechanics and Materials</td>
<td>8</td>
</tr>
<tr>
<td>U1.411 Mechanical Engineering 1</td>
<td>12</td>
<td>U2.440 Mechanical Design 1</td>
<td>8</td>
</tr>
<tr>
<td>U1.446 Engineering Computing</td>
<td>8</td>
<td>U2.443 Mechatronic Design 1*</td>
<td>2</td>
</tr>
<tr>
<td>U1.500 Introductory Electrical Engineering</td>
<td>4</td>
<td>U2.471 Introductory Mechatronics</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>U2.504 Electrical and Electronic Engineering</td>
<td>6</td>
</tr>
</tbody>
</table>

*U2.443 (Mechatronic Design 1): Intermediate core course to be taken by Mechanical/Mechatronic Engineering students undertaking the BE/BSc double degree.

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
<th>Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior courses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U3.431 Mechanical Properties of Materials</td>
<td>4</td>
<td>U2.700 or U2.417</td>
<td></td>
</tr>
<tr>
<td>U3.440 Mechanical Design 2</td>
<td>8</td>
<td>U2.700 or U2.417 and U2.440 or U2.441</td>
<td></td>
</tr>
<tr>
<td>U3.450 System Dynamics and Controls</td>
<td>8</td>
<td>U2.410 or U2.412</td>
<td></td>
</tr>
<tr>
<td>U3.460 Manufacturing Engineering and Management</td>
<td>10</td>
<td>U1.410</td>
<td></td>
</tr>
<tr>
<td>U3.465 Project and Practice</td>
<td>6</td>
<td>U3.431 U3.450 U3.460</td>
<td></td>
</tr>
<tr>
<td>U3.474 Electrical Machines and Drives</td>
<td>4</td>
<td>U2.471 and U2.504</td>
<td></td>
</tr>
<tr>
<td>U3.476 Industrial Electronics</td>
<td>10</td>
<td>U2.471 and U2.504</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
<th>Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior Advanced courses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.480 Thesis</td>
<td>12</td>
<td>36 units of Senior courses</td>
<td></td>
</tr>
<tr>
<td>U4.484 Professional Engineering</td>
<td>4</td>
<td>U3.460</td>
<td></td>
</tr>
<tr>
<td>U4.485 Professional Communication</td>
<td>4</td>
<td>Completion of industrial experience</td>
<td></td>
</tr>
<tr>
<td>U4.486 Practical Experience</td>
<td>6</td>
<td>28 units of Senior courses</td>
<td></td>
</tr>
</tbody>
</table>

Together with not less than 24 units of Senior and Senior Advanced level courses chosen from the elective courses available from time to time and subject to restriction upon combinations as the Head of the Department of Mechanical and Mechatronic Engineering may prescribe from time to time.

* For prerequisites in column (a) a Terminating Pass is not acceptable.
RESOLUTIONS OF THE FACULTY OF ENGINEERING relating to Table 4A — Mechanical Engineering (Mechatronics)

Acceptable alternative courses

Pursuant to Senate Resolution 2(b)(ii), the Faculty has prescribed the following acceptable alternatives to the core courses listed in Table 4A:

<table>
<thead>
<tr>
<th>Core course</th>
<th>Unit value</th>
<th>Acceptable alternative course(s)</th>
<th>Unit value</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1.021 Physics IE</td>
<td>6</td>
<td>U1.022 Physics 10IF and</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>U1.023 Physics 103S</td>
<td></td>
</tr>
<tr>
<td>U1.031 Chemistry IE</td>
<td>6</td>
<td>U1.033A Chemistry 11IF and</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>U1.033B Chemistry 112S</td>
<td></td>
</tr>
<tr>
<td>U1.445 Engineering Computing</td>
<td>12</td>
<td>U1.0401 Computer Science 10IF and</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>U1.0402 Computer Science 102S</td>
<td></td>
</tr>
<tr>
<td>U2.440 Mechanical Design 1</td>
<td>8</td>
<td>Both: U2.441 Mechanical Design 1A</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and U2.443 Mechatronic Design 1</td>
<td>2</td>
</tr>
</tbody>
</table>

RESOLUTIONS OF THE DEPARTMENT OF MECHANICAL AND MECHATRONIC ENGINEERING

Recommended elective courses

Students are required to complete 24 units of Senior and Senior Advanced elective courses. At least 3 courses must be chosen from the mainstream electives (starred in the list below).

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites* (a)</th>
<th>Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>U4.451</td>
<td>Dynamics and Systems Engineering*</td>
<td>6</td>
<td>U3.450 and</td>
<td>U3.540 and</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>U3.476</td>
<td>U2.504</td>
</tr>
<tr>
<td>U4.456</td>
<td>Sensors and Signals</td>
<td>6</td>
<td>U3.450</td>
<td>U3.476</td>
</tr>
<tr>
<td>U4.462</td>
<td>Industrial and Engineering Management</td>
<td>2</td>
<td>U3.460 or U3.571 or</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>U3.790 together with completion of the industrial period</td>
<td></td>
</tr>
<tr>
<td>U4.470</td>
<td>Robotic Systems</td>
<td>4</td>
<td>U3.450</td>
<td></td>
</tr>
<tr>
<td>U4.477</td>
<td>Computers in Real-time Control and Instrumentation*</td>
<td>6</td>
<td>U3.476</td>
<td></td>
</tr>
<tr>
<td>U4.478</td>
<td>Microprocessors in Engineered Products*</td>
<td>6</td>
<td>U3.476</td>
<td></td>
</tr>
<tr>
<td>U3.090</td>
<td>Asian Studies 2</td>
<td>8</td>
<td>U2.090</td>
<td></td>
</tr>
<tr>
<td>U3.506</td>
<td>Fundamentals of Biomedical Engineering</td>
<td>4</td>
<td>U3.540 or U2.504</td>
<td></td>
</tr>
<tr>
<td>U3.561</td>
<td>Computer Architecture</td>
<td>3</td>
<td>U2.510 or (U2.504 and U2.471)</td>
<td>U3.562</td>
</tr>
<tr>
<td>U3.562</td>
<td>Software Engineering</td>
<td>3</td>
<td>U2.510 or (U2.504 and U2.471)</td>
<td>U3.561</td>
</tr>
<tr>
<td>U4.438</td>
<td>Biomaterials and Biomechanics</td>
<td>4</td>
<td>Any Intermediate year Materials Course or Physics</td>
<td>U3.540 or U3.750 or U3.530 or U3.660</td>
</tr>
<tr>
<td>U4.070</td>
<td>Industrial Ergonomics</td>
<td>2</td>
<td>U2.510 or (U2.504 and U2.471)</td>
<td></td>
</tr>
<tr>
<td>U4.440</td>
<td>Advanced Design</td>
<td>6</td>
<td></td>
<td>U3.440</td>
</tr>
</tbody>
</table>

1For prerequisites in column (a) a Terminating Pass is not acceptable.

*Mainstream electives
### RESOLUTIONS OF THE SENATE

#### Table 5 — Electrical Engineering

Candidates for the degree of Bachelor of Engineering in Electrical Engineering are required to gain credit for the core courses set out below. Any additional credit necessary to satisfy the requirements of Resolution 6 shall be gained by completing other courses from Table 1 and/or from the Senior and Senior Advanced elective courses prescribed by the Faculty from time to time.

**Junior and Intermediate courses (from Table 1)**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1.001</td>
<td>Mathematics 101F</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>U1.003</td>
<td>Mathematics 103S</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>U1.022</td>
<td>Physics 101F</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>U1.023</td>
<td>Physics 103S</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>U1.0401</td>
<td>Computer Science 101F</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>U1.0402</td>
<td>Computer Science 102S</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>U1.511</td>
<td>Electrical Engineering 1</td>
<td>14</td>
<td></td>
</tr>
</tbody>
</table>

**Senior courses**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
</tr>
</thead>
<tbody>
<tr>
<td>U3.511</td>
<td>Circuit Theory</td>
<td>4</td>
<td>U2.511, U2.512 and (U2.000; or U2.001)</td>
</tr>
<tr>
<td>U3.512</td>
<td>Signals and Systems</td>
<td>5</td>
<td>U2.511, U2.512 and (U2.000; or U2.001)</td>
</tr>
<tr>
<td>U3.530</td>
<td>Control 1</td>
<td>4</td>
<td>U2.511 and U2.512</td>
</tr>
<tr>
<td>U3.540</td>
<td>Electronics 1</td>
<td>10</td>
<td>U2.511 and U2.512</td>
</tr>
<tr>
<td>U3.552</td>
<td>Communications 1</td>
<td>6</td>
<td>U2.511 and U2.512</td>
</tr>
<tr>
<td>U3.560</td>
<td>Digital Systems 1</td>
<td>4</td>
<td>U2.511 and U2.512</td>
</tr>
<tr>
<td>U3.571</td>
<td>Management for Engineers</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

**Senior Advanced courses**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
</tr>
</thead>
<tbody>
<tr>
<td>U4.512</td>
<td>Practical Experience</td>
<td>8</td>
<td>28 units of Senior courses</td>
</tr>
<tr>
<td>U4.588</td>
<td>Thesis A*</td>
<td>8</td>
<td>12 units of Senior Advanced Electrical Engineering Courses</td>
</tr>
<tr>
<td>U4.589</td>
<td>Thesis</td>
<td>12</td>
<td>24 units of Senior Advanced Electrical Engineering Courses</td>
</tr>
</tbody>
</table>

A further core requirement is to gain credit for 6 units from additional approved Senior courses, and for 36 units from additional approved Senior Advanced Electrical Engineering Courses, chosen from Table 5A or from the Table of Recommended Elective courses below.

---

* For prerequisites in Column (a) a Terminating Pass is not acceptable.
* For BE/BCom students only
Candidates for the degree of Bachelor of Engineering in Electrical Engineering (Information Systems Engineering) are required to gain credit for the core courses set out below. Any additional credit necessary to satisfy the requirements of Resolution 6 shall be gained by completing other courses from Table 1 and/or from the Senior and Senior Advanced elective courses prescribed by the Faculty from time to time.

**Junior and Intermediate courses (from Table 1)**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
<th>Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1.001</td>
<td>Mathematics 101F</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U1.003</td>
<td>Mathematics 103S</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U1.022</td>
<td>Physics 101F</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U1.023</td>
<td>Physics 103S</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U1.0401</td>
<td>Computer Science 101F</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U1.0402</td>
<td>Computer Science 102S</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U1.511</td>
<td>Electrical Engineering 1</td>
<td>12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Senior courses**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
<th>Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>U3.511</td>
<td>Circuit Theory</td>
<td>4</td>
<td>U2.511, U2.512 and 14 units of approved Maths 2 options</td>
<td></td>
</tr>
<tr>
<td>U3.512</td>
<td>Signals and Systems</td>
<td>5</td>
<td>U2.511, U2.512 and 14 units of approved Maths 2 options</td>
<td>U3.511</td>
</tr>
<tr>
<td>U3.530</td>
<td>Control 1</td>
<td>4</td>
<td>U2.511 and U2.512</td>
<td>U3.511</td>
</tr>
<tr>
<td>U3.540</td>
<td>Electronics 1</td>
<td>10</td>
<td>U2.511 and U2.512</td>
<td>U3.511, U3.512</td>
</tr>
<tr>
<td>U3.551</td>
<td>Engineering Electromagnetics</td>
<td>4</td>
<td>U2.511 and U2.512</td>
<td>U3.511</td>
</tr>
<tr>
<td>U3.552</td>
<td>Communications 1</td>
<td>6</td>
<td>U2.511 and U2.512</td>
<td>U3.512, U3.540, U3.551</td>
</tr>
<tr>
<td>U3.553</td>
<td>Digital Signal Processing 1</td>
<td>4</td>
<td>U2.511 and U2.512</td>
<td>U3.51-2</td>
</tr>
<tr>
<td>U3.560</td>
<td>Digital Systems 1</td>
<td>4</td>
<td>U2.511 and U2.512</td>
<td></td>
</tr>
<tr>
<td>U3.561</td>
<td>Computer Architecture</td>
<td>3</td>
<td>(U2.0422 and U2.0404) or U2.504</td>
<td>U3.560 or U3.476</td>
</tr>
<tr>
<td>U3.562</td>
<td>Engineering Software</td>
<td>3</td>
<td>U2.0422 and U2.0404</td>
<td></td>
</tr>
<tr>
<td>U3.571</td>
<td>Management for Engineers</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Senior Advanced courses**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
<th>Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>U4.512</td>
<td>Practical Experience</td>
<td>2</td>
<td>28 units of Senior courses</td>
<td></td>
</tr>
<tr>
<td>U4.540</td>
<td>Electronics 2</td>
<td>3</td>
<td>U3.540 and U3.511 and U3.512</td>
<td></td>
</tr>
<tr>
<td>U4.549</td>
<td>Electronic Design</td>
<td>4</td>
<td>U3.540 and U3.511 and U3.512</td>
<td></td>
</tr>
<tr>
<td>U4.558</td>
<td>Digital Communication Systems</td>
<td>4</td>
<td>U3.512 and U3.552</td>
<td></td>
</tr>
<tr>
<td>U4.559</td>
<td>Data Communication Networks</td>
<td>4</td>
<td>U3.552</td>
<td></td>
</tr>
<tr>
<td>U4.568</td>
<td>Real Time Computing</td>
<td>4</td>
<td>U3.560</td>
<td></td>
</tr>
<tr>
<td>U4.569</td>
<td>Digital Systems 2</td>
<td>4</td>
<td>U3.560 and U3.540</td>
<td></td>
</tr>
<tr>
<td>U4.589</td>
<td>Thesis</td>
<td>8</td>
<td>24 units of Senior Advanced Electrical Engineering courses</td>
<td></td>
</tr>
</tbody>
</table>
A further core requirement is to gain credit for 16 units of electives chosen from the Table of Recommended Elective courses below. Of these, at least 12 units must be chosen from the following set of 4-unit courses, not all of which may be available in a particular year:

- U4.544 Microwave Engineering
- U4.547 Optical Communication Systems
- U4.548 Integrated Circuit Design
- U4.555 Advanced Communication Networks
- U4.556 Error Control Coding
- U4.557 Satellite Communication Systems
- U4.563 Advanced Digital Engineering
- U4.564 Advanced Real Time Computer Systems
- U4.591 Image Processing and Computer Vision

For prerequisites in Column (a) a Terminating Pass is not acceptable.

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RESOLUTIONS OF THE FACULTY OF ENGINEERING relating to Tables 5 (Electrical Engineering) and 5a (Electrical Engineering—Information Systems)

Acceptable alternative courses

Pursuant to Senate Resolution 2(b)(ii), the Faculty has prescribed the following acceptable alternatives to the core courses listed in Tables 5 and 5a:

<table>
<thead>
<tr>
<th>Core course</th>
<th>Unit value</th>
<th>Acceptable alternative course(s)</th>
<th>Unit value</th>
</tr>
</thead>
<tbody>
<tr>
<td>U2.002 Mathematics 201F</td>
<td></td>
<td>U2.002 Mathematics 210F</td>
<td></td>
</tr>
<tr>
<td>U2.003 Mathematics 202F</td>
<td>14</td>
<td>U2.003 Mathematics 202F</td>
<td></td>
</tr>
<tr>
<td>U2.004 Mathematics 205S</td>
<td></td>
<td>U2.004 Mathematics 205S</td>
<td>16</td>
</tr>
<tr>
<td>U2.006 Mathematics 252S</td>
<td></td>
<td>U2.005 Mathematics 251S</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>U2.006 Mathematics 252S</td>
<td></td>
</tr>
<tr>
<td>U2.022E Physics 201F (mod)</td>
<td>12</td>
<td>U2.022 Physics 201F 1</td>
<td>16</td>
</tr>
<tr>
<td>U2.023E Physics 202S (mod)</td>
<td></td>
<td>U2.023 Physics 202S J</td>
<td></td>
</tr>
<tr>
<td>U2.0402 Computer Science 202F</td>
<td>4</td>
<td>U2.0401 Comp Science 201F</td>
<td></td>
</tr>
<tr>
<td>U2.0404 Computer Science 204S</td>
<td>1</td>
<td>U2.0402 Comp Science 202F</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>U2.0403 Comp Science 203S</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>U2.0404 Comp Science 204S</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>or U2.0402 Comp Science 202F</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>or U2.0404 Comp Science 204S</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>or U2.0405 Comp Science 205S</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>or U2.0406 Comp Science 206S</td>
<td></td>
</tr>
<tr>
<td>U2.0405</td>
<td>6</td>
<td>or U2.0401 Comp Science 201F</td>
<td></td>
</tr>
<tr>
<td>U3.561 Computer Architecture</td>
<td>3</td>
<td>or U2.0402 Comp Science 202F</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>or U2.0404 Comp Science 204S</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>or U2.0405 Comp Science 205S</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>or U2.0406 Comp Science 206S</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>or U2.0401 Comp Science 201F</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>or U2.0402 Comp Science 202F</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>or U2.0403 Comp Science 203S</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>or U2.0404 Comp Science 204S</td>
<td></td>
</tr>
</tbody>
</table>
## Recommended elective courses

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
<th>Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>(a)</td>
<td></td>
</tr>
<tr>
<td>U2.0405</td>
<td>Comp Science 205F</td>
<td>6</td>
<td>U1.0401; U1.0402; U1.001 and U1.003</td>
<td>U2.0402 and U2.0404</td>
</tr>
<tr>
<td>U2.0406</td>
<td>Comp Science 206S</td>
<td>6</td>
<td>U1.0401; U1.0402; U1.001 and U1.003</td>
<td>U2.0402 and U2.0404</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(b)</td>
<td></td>
</tr>
<tr>
<td>U3.506</td>
<td>Fundamentals of Biomedical Engineering</td>
<td>4</td>
<td>U2.511; U2.512 and U2.504</td>
<td></td>
</tr>
<tr>
<td>U3.521</td>
<td>Electrical Systems</td>
<td>3</td>
<td>U2.511 and U2.512</td>
<td></td>
</tr>
<tr>
<td>U3.522</td>
<td>Power Electronics and Drives</td>
<td>4</td>
<td>U2.511 and U2.512</td>
<td></td>
</tr>
<tr>
<td>U3.523</td>
<td>Topics in Electrical Engineering Design</td>
<td>3</td>
<td>U2.511 and U2.512</td>
<td></td>
</tr>
<tr>
<td>U3.554</td>
<td>Speech Processing</td>
<td>3</td>
<td>U3.512</td>
<td></td>
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</tbody>
</table>

**Senior Advanced elective courses**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
<th>Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>U4.506</td>
<td>Biomedical Engineering Systems</td>
<td>4</td>
<td>U3.506</td>
<td></td>
</tr>
<tr>
<td>U4.521</td>
<td>Electrical Systems Control</td>
<td>4</td>
<td>U3.521 and U3.530</td>
<td></td>
</tr>
<tr>
<td>U4.522</td>
<td>Advanced Power Electronics and Drives</td>
<td>4</td>
<td>U3.522</td>
<td></td>
</tr>
<tr>
<td>U4.529</td>
<td>Electrical Systems Analysis</td>
<td>4</td>
<td>U3.521</td>
<td></td>
</tr>
<tr>
<td>U4.533</td>
<td>Non-linear and Adaptive Control</td>
<td>4</td>
<td>U3.530</td>
<td></td>
</tr>
<tr>
<td>U4.539</td>
<td>Control 2</td>
<td>4</td>
<td>U3.530</td>
<td></td>
</tr>
<tr>
<td>U4.544</td>
<td>Microwave Engineering</td>
<td>4</td>
<td>U4.549</td>
<td></td>
</tr>
<tr>
<td>U4.547</td>
<td>Optical Communication Systems</td>
<td>4</td>
<td>U3.540 and U3.552</td>
<td></td>
</tr>
<tr>
<td>U4.555</td>
<td>Advanced Communication Networks</td>
<td>4</td>
<td>U4.559</td>
<td></td>
</tr>
<tr>
<td>U4.556</td>
<td>Error Control Coding</td>
<td>4</td>
<td>U4.558</td>
<td></td>
</tr>
<tr>
<td>U4.557</td>
<td>Satellite Communication Systems</td>
<td>4</td>
<td>U4.558</td>
<td></td>
</tr>
<tr>
<td>U4.562</td>
<td>Advanced Real Time Computer Systems</td>
<td>3</td>
<td>U4.561</td>
<td></td>
</tr>
<tr>
<td>U4.563</td>
<td>Advanced Digital Engineering</td>
<td>4</td>
<td>U4.569</td>
<td></td>
</tr>
<tr>
<td>U4.564</td>
<td>Advanced Real Time Computing</td>
<td>4</td>
<td>U4.568</td>
<td></td>
</tr>
<tr>
<td>U4.565</td>
<td>Digital Systems 3</td>
<td>3</td>
<td>U4.560</td>
<td></td>
</tr>
<tr>
<td>U4.566</td>
<td>Adaptive Pattern Recognition</td>
<td>3</td>
<td>U4.567</td>
<td></td>
</tr>
<tr>
<td>U4.567</td>
<td>Machine Intelligence and Pattern Recognition</td>
<td>3</td>
<td>U4.572</td>
<td></td>
</tr>
<tr>
<td>U4.572</td>
<td>Project Management</td>
<td>4</td>
<td>U4.572</td>
<td></td>
</tr>
<tr>
<td>U4.591</td>
<td>Image Processing and Computer Vision</td>
<td>4</td>
<td>U3.512 and U3.553</td>
<td></td>
</tr>
<tr>
<td>U4.592</td>
<td>Fuzzy Systems</td>
<td>4</td>
<td>U4.592</td>
<td></td>
</tr>
<tr>
<td>U4.593</td>
<td>Neural Computing</td>
<td>4</td>
<td>U4.593</td>
<td></td>
</tr>
<tr>
<td>U4.594</td>
<td>Adaptive Pattern Recognition</td>
<td>4</td>
<td>U4.594</td>
<td></td>
</tr>
</tbody>
</table>

For prerequisites in Column (a) a Terminating Pass is not acceptable.
Candidates for the degree of Bachelor of Engineering in Chemical Engineering are required to gain credit for the core courses set out below. Any additional credit necessary to satisfy the requirements of Resolution 6 shall be gained by completing other courses from Table 1 and/or from the Senior and Senior Advanced elective courses prescribed by the Faculty from time to time.

### Junior and Intermediate courses (from Table 1)

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Core Courses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U1.000</td>
<td>Mathematics 1</td>
<td></td>
<td>U2.000 Mathematics 2</td>
</tr>
<tr>
<td>U1.001</td>
<td>Maths 101F</td>
<td></td>
<td>U2.002 Mathematics 201F</td>
</tr>
<tr>
<td>U1.002</td>
<td>Maths 102S</td>
<td></td>
<td>U2.003 Mathematics 202F</td>
</tr>
<tr>
<td></td>
<td>One of the following 2nd Yr Chemistry courses:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U2.004</td>
<td>Mathematics 205S</td>
<td></td>
<td>U2.005 Mathematics 251S</td>
</tr>
<tr>
<td>U2.006</td>
<td>Mathematics 252S</td>
<td></td>
<td>U2.007 Mathematics 253S</td>
</tr>
<tr>
<td>U1.610</td>
<td>Chemical Engineering 1</td>
<td></td>
<td>U2.611 Fundamentals of Environmental Chemical Engineering</td>
</tr>
<tr>
<td>U1.620</td>
<td>Chemical Engineering Applications</td>
<td></td>
<td>U2.611 Fundamentals of Environmental Chemical Engineering</td>
</tr>
<tr>
<td>U1.630</td>
<td>Computing for Chemical Engineers</td>
<td></td>
<td>U2.611 Fundamentals of Environmental Chemical Engineering</td>
</tr>
<tr>
<td>U1.651</td>
<td>Chemical Process Case Studies</td>
<td></td>
<td>U2.612 Chemical Engineering Computations</td>
</tr>
<tr>
<td></td>
<td><strong>Electives</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Students who are planning to major in Biochemical Engineering, and who elect to take the second year Biochemistry courses U2.066A and U2.066B, will be exempt from the core courses U2.502 and U2.701.

### Senior courses

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Core Courses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U3.610</td>
<td>Unit Operations 1</td>
<td>12</td>
<td>U2.610</td>
</tr>
<tr>
<td>U3.621</td>
<td>Thermodynamics</td>
<td>8</td>
<td>U3.626</td>
</tr>
<tr>
<td>U3.626</td>
<td>Reaction Engineering 1</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>U3.631</td>
<td>Computations and Statistics</td>
<td>4</td>
<td>U2.000; U2.002; U2.003; U2.004; U2.005 and U2.006</td>
</tr>
<tr>
<td>U3.645</td>
<td>Project Economics</td>
<td>4</td>
<td>U1.610</td>
</tr>
<tr>
<td>U3.651</td>
<td>Materials and Corrosion</td>
<td>2</td>
<td>U3.660</td>
</tr>
<tr>
<td>U3.660</td>
<td>Process Control 1</td>
<td>4</td>
<td>U2.000</td>
</tr>
<tr>
<td>U3.671</td>
<td>Chemical Engineering Laboratory-</td>
<td>6</td>
<td>U2.610</td>
</tr>
</tbody>
</table>

### Senior Advanced courses

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
</tr>
</thead>
<tbody>
<tr>
<td>U4.600</td>
<td>Practical Experience</td>
<td>8</td>
<td>28 units of Senior courses</td>
</tr>
<tr>
<td>U4.640</td>
<td>Project Engineering</td>
<td>4</td>
<td>U4.684 and U4.685</td>
</tr>
<tr>
<td>U4.681</td>
<td>Thesis</td>
<td>8</td>
<td>U4.684 and U4.685</td>
</tr>
<tr>
<td>U4.684</td>
<td>Chemical Engineering Design 1</td>
<td>4</td>
<td>U3.610</td>
</tr>
<tr>
<td>U4.685</td>
<td>Chemical Engineering Design 2</td>
<td>8</td>
<td>U3.610 and U3.621</td>
</tr>
</tbody>
</table>

The total with not less than 12 units of Senior Advanced level courses chosen from the elective courses available from time to time and subject to restriction upon combinations as the Head of the Department of Chemical Engineering may prescribe from time to time.

*For prerequisites in Column (a) a Terminating Pass is not acceptable
RESOLUTIONS OF THE FACULTY OF ENGINEERING relating to Table 6 — Chemical Engineering

Acceptable alternative courses

Pursuant to Resolution 2, the Faculty has prescribed the following acceptable alternatives to the core courses listed in Table 6:

<table>
<thead>
<tr>
<th>Core course(s)</th>
<th>Acceptable alternative(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1.033A Chemistry 111F</td>
<td>U1.031 Chemistry IE and;</td>
</tr>
<tr>
<td>U1.033B Chemistry 112S</td>
<td>U1.032 Chemistry IES</td>
</tr>
</tbody>
</table>

RESOLUTIONS OF THE DEPARTMENT OF CHEMICAL ENGINEERING

Suggested elective courses

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites* (a)</th>
<th>Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U3.067A</td>
<td>Microbiology 203F</td>
<td>4</td>
<td></td>
<td>U2.066A and U2.066B</td>
</tr>
<tr>
<td>U3.067B</td>
<td>Microbiology 204S</td>
<td>4</td>
<td></td>
<td>U2.066A and U2.066B</td>
</tr>
<tr>
<td>U3.090</td>
<td>Asian Studies 2</td>
<td>8</td>
<td>U2.090</td>
<td></td>
</tr>
<tr>
<td>U3.646</td>
<td>Transport Phenomena</td>
<td>4</td>
<td>U2.610 plus 2nd yr WAM of 60% +</td>
<td></td>
</tr>
<tr>
<td>U3.647</td>
<td>Laboratory Projects in Unit Operations</td>
<td>4</td>
<td>U2.610</td>
<td>U3.610</td>
</tr>
<tr>
<td>U3.900</td>
<td>Innovation and International Competitiveness</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.005</td>
<td>Partial Differential Equations</td>
<td>2</td>
<td>16 units of approved 2nd Yr Maths courses</td>
<td></td>
</tr>
<tr>
<td>U4.080</td>
<td>Computer Based Design</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.090</td>
<td>Asian Studies 3</td>
<td>8</td>
<td>U3.090</td>
<td></td>
</tr>
<tr>
<td>U4.071</td>
<td>Human and Industrial Relations</td>
<td>6</td>
<td>36 units of Senior courses and completion of Industrial Exp.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.625</td>
<td>Reaction Engineering 2</td>
<td>4</td>
<td>U3.626</td>
<td></td>
</tr>
<tr>
<td>U4.629</td>
<td>Advances in Polymer Engineering</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.630</td>
<td>Mineral Processing (Mineral Dressing)</td>
<td>4</td>
<td>U3.610</td>
<td></td>
</tr>
<tr>
<td>U4.631</td>
<td>Mineral Processing (Extractive Metallurgy)</td>
<td>4</td>
<td></td>
<td>U3.610</td>
</tr>
<tr>
<td>U4.632</td>
<td>Separation Processes</td>
<td>4</td>
<td>U3.610</td>
<td></td>
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<tr>
<td>U4.633</td>
<td>Advanced Particle Mechanics</td>
<td>4</td>
<td>U3.610</td>
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<tr>
<td>U4.634</td>
<td>Advanced Topics in Environmental Engineering A</td>
<td>4</td>
<td>U3.610</td>
<td></td>
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<tr>
<td>U4.635</td>
<td>Advanced Topics in Environmental Engineering B</td>
<td>4</td>
<td>U3.610</td>
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<tr>
<td>U4.655</td>
<td>Adv. Fluid Dynamics Modelling</td>
<td>4</td>
<td></td>
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<td>U4.660</td>
<td>Process Control 2</td>
<td>4</td>
<td>U3.660</td>
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<td>U4.679</td>
<td>Major Industrial Project</td>
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<tr>
<td>U4.689</td>
<td>Adv. in Chemical Engineering A</td>
<td>4</td>
<td>U3.610</td>
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<tr>
<td>U4.690</td>
<td>Reservoir Engineering</td>
<td>4</td>
<td></td>
<td>U3.610</td>
</tr>
<tr>
<td>U4.692</td>
<td>Optimisation Techniques</td>
<td>4</td>
<td>U3.631</td>
<td></td>
</tr>
<tr>
<td>U4.694</td>
<td>Environmental Impact Assessment</td>
<td>4</td>
<td>U3.610 or U3.420</td>
<td></td>
</tr>
<tr>
<td>U4.695</td>
<td>Biochemical Engineering</td>
<td>8</td>
<td>U2.610</td>
<td>U2.066 and U3.067</td>
</tr>
</tbody>
</table>
Biochemical Engineering

Students who wish to specialise in biochemical applications of chemical engineering should choose the following courses:

Intermediate Year — U2.066A Biochemistry 211F (4 units) and U2.066B Biochemistry 212S (4 units) in place of U2.502 Electrical Technology (4 units) and U2.701 Mechanics of Solids 1 (4 units).

Senior Year — the elective course U3.067A Microbiology 203F (4 units) and U3.067B Microbiology 204S (4 units). (One or more of the Senior core courses may need to be deferred until the following year.)

Senior Advanced Year — the elective course U4.695 Biochemical Engineering.

Industrial Experience and Perspectives

In addition to having to complete the course U4.600 Practical Experience, students in Chemical Engineering are required to undertake a number of additional activities during their course designed to increase their understanding and experience of practical Chemical Engineering.

1. Design competition

This is a light-hearted exercise in which students of U2.610 Chemical Engineering 2 design, build and operate a simple device to solve an unusual Chemical Engineering problem. Past problems have included the task of producing separated shell, yolk and white from a whole raw egg. A small entry fee is charged and prizes are awarded.

2. Chemical plant inspection tour

For one week of a vacation period during the Senior Year, students visit a number of chemical plants outside the Sydney area. Tours in the past years have been to Southeastern Queensland, Tasmania, Victoria and the Hunter Valley.

3. Mid-term week exercises

A number of one-week exercises are organised during the teaching periods of the Senior Year. Normal classes are suspended during these weeks.

Senior students spend a week working on selected plant problems on major chemical plants in the Sydney area. In these exercises the students work in small groups in cooperation with plant engineers and academic staff to investigate chemical engineering problems in a plant environment.

RESOLUTIONS OF THE SENATE

Table 7—Aeronautical Engineering

Candidates for the degree of Bachelor of Engineering in Aeronautical Engineering are required to gain credit for the core courses set out below. Any additional credit necessary to satisfy the requirements of Resolution 6 shall be gained by completing other courses from Table 1 and/or from the Senior and Senior Advanced elective courses prescribed by the Faculty from time to time.

Junior and Intermediate courses (from Table 1)

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites*</th>
<th>Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1.001</td>
<td>Mathematics 101F</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>U1.002</td>
<td>Mathematics 102S</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>U1.010</td>
<td>Mechanics IE</td>
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<td></td>
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<tr>
<td>U1.021</td>
<td>Physics IE</td>
<td></td>
<td></td>
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<tr>
<td>U1.031</td>
<td>Chemistry IE</td>
<td></td>
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<tr>
<td>U1.280</td>
<td>Engineering Programming</td>
<td></td>
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</tr>
<tr>
<td>U1.281</td>
<td>Computer Graphics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U1.710</td>
<td>Aeronautical Engineering 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U2.002</td>
<td>Mathematics 201F</td>
<td></td>
<td></td>
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</tr>
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<td>U2.003</td>
<td>Mathematics 202F</td>
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</table>

U2.004 Mathematics 205S
U2.005 Mathematics 251S
U2.006 Mathematics 252S
U2.411 Introductory Thermodynamics
U2.412 Engineering Dynamics
TJ2.441 Mechanical Design IA
U2.502 Electrical Technology
U2.700 Mechanics and Properties of Solids 1
U2.710 Fluid Mechanics
U2.770 Engineering Computation
<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites 1.</th>
<th>(a)</th>
<th>(b)</th>
<th>Corequisites</th>
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</thead>
<tbody>
<tr>
<td></td>
<td><strong>Senior courses</strong></td>
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<tr>
<td>U3.421</td>
<td>Thermodynamics</td>
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<td>U2.411</td>
<td>16 units of approved 2nd Yr Maths courses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U3.431</td>
<td>Mechanical Properties of Materials</td>
<td>4</td>
<td>U2.700</td>
<td>16 units of approved 2nd Yr Maths courses</td>
<td></td>
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</tr>
<tr>
<td>U3.720</td>
<td>Aerodynamics 1</td>
<td>4</td>
<td>U2.710 and 16 units of approved 2nd Yr Maths courses</td>
<td>U3.725</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U3.725</td>
<td>Aerodynamics 2</td>
<td>4</td>
<td>U2.710 and 16 units of approved 2nd Yr Maths courses</td>
<td>U3.720</td>
<td></td>
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</tr>
<tr>
<td>U3.730</td>
<td>Aircraft Structures 1</td>
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<td>U2.700 and 16 units of approved 2nd Yr Maths courses</td>
<td>U3.730</td>
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<tr>
<td>U3.735</td>
<td>Aircraft Structures 2</td>
<td>4</td>
<td>U2.441 and U2.700</td>
<td>U3.730 and U3.730</td>
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<tr>
<td>U3.740</td>
<td>Aircraft Design 1</td>
<td>6</td>
<td>U2.500</td>
<td>U3.730</td>
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<tr>
<td>U3.750</td>
<td>Flight Mechanics 1</td>
<td>4</td>
<td>U2.412 and 16 units of approved 2nd Yr Maths courses</td>
<td>U3.750</td>
<td></td>
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<tr>
<td>U3.755</td>
<td>Flight Mechanics 2</td>
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<tr>
<td>U3.760</td>
<td>Laboratory</td>
<td>4</td>
<td>U2.770</td>
<td>U3.725 and U3.730</td>
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<tr>
<td>U3.770</td>
<td>Flying Operations</td>
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<td></td>
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<td>U3.750 and U3.755 and 36 units of Senior Aeronautical courses</td>
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<tr>
<td>U3.780</td>
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<td>96 units of Junior and Intermediate courses</td>
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<tr>
<td>U3.790</td>
<td>Industrial Organisation and Management</td>
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<tr>
<td></td>
<td><strong>Senior Advanced courses</strong></td>
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<tr>
<td>U4.720</td>
<td>Aerodynamics 3</td>
<td>4</td>
<td>U3.720 and U3.725</td>
<td>U4.720</td>
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<td>U4.725</td>
<td>Aerodynamics 4</td>
<td>4</td>
<td></td>
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</tr>
<tr>
<td>U4.730</td>
<td>Aircraft Structures 3</td>
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<td>U3.730 and U3.735</td>
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<tr>
<td>U4.740</td>
<td>Aircraft Design 2</td>
<td>4</td>
<td>U3.740 and U3.725</td>
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<td></td>
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<tr>
<td>U4.750</td>
<td>Flight Mechanics 3</td>
<td>4</td>
<td>U3.725 and U3.755</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>U4.770</td>
<td>Propulsion</td>
<td>4</td>
<td>U3.421 and U3.725</td>
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<tr>
<td>U4.775</td>
<td>Engineering Experience</td>
<td>4</td>
<td>40 units of Senior courses</td>
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<tr>
<td>U4.780</td>
<td>Seminar</td>
<td>4</td>
<td>40 units of Senior courses</td>
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</tr>
<tr>
<td>U4.785</td>
<td>Thesis</td>
<td>12</td>
<td>40 units of Senior courses</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*For prerequisites in Column (a) a Terminating Pass is not acceptable.
RESOLUTIONS OF THE FACULTY OF ENGINEERING relating to Table 7 — Aeronautical Engineering

Acceptable alternative courses

Pursuant to Resolution 2, the Faculty has prescribed the following acceptable alternatives to the core courses listed in Table 7:

<table>
<thead>
<tr>
<th>Core course</th>
<th>Acceptable alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1.201 Physics IE</td>
<td>U1.022 * Physics 101F and U1.023 Physics 103S</td>
</tr>
<tr>
<td>U1.031 Chemistry IE</td>
<td>U1.033A Chemistry 111F and U1.033B Chemistry 112S</td>
</tr>
<tr>
<td>U1.280 Engineering Programming</td>
<td>U1.0401 Computer Science 101F and</td>
</tr>
<tr>
<td>U1.281 Computer Graphics</td>
<td>U1.0402 Computer Science 102S</td>
</tr>
<tr>
<td>U4.785 Thesis (12 units)</td>
<td>U5.785 Honours Thesis (16 units)</td>
</tr>
</tbody>
</table>

For students who wish to proceed towards the double degree of BSc BE, the following alternatives are acceptable with permission from the Head of the Department of Aeronautical Engineering:

U2.502 Electrical Technology
U2.411 Introductory Thermodynamics  U2.022 Physics 201F
U2.412 Engineering Dynamics         U2.023 Physics 202S
U2.770 Engineering Computation      

RESOLUTIONS OF THE DEPARTMENT OF AERONAUTICAL ENGINEERING

Recommended elective courses

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Unit value</th>
<th>Prerequisites* (a)</th>
<th>(b)</th>
<th>Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Senior Advanced elective courses</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.422</td>
<td>Computational Methods for Partial Differential Equations</td>
<td>4</td>
<td>16 units of approved 2nd Yr Maths courses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.434</td>
<td>Aerospace Materials Engineering</td>
<td>4</td>
<td>U3.430 or U3.431 and U3.730</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.461</td>
<td>Introduction to Operations Research</td>
<td>2</td>
<td>16 units of approved 2nd Yr Maths courses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.790</td>
<td>Rotary Wing Aircraft</td>
<td>4</td>
<td>U3.720 and U3.750</td>
<td>U4.720</td>
<td></td>
</tr>
<tr>
<td>U4.791</td>
<td>Advanced Rotary Wing Dynamics</td>
<td>2</td>
<td>U4.790</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.792</td>
<td>Aviation Operation and Management</td>
<td>2</td>
<td>U4.740</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U4.796</td>
<td>Advanced Computational Aerodynamics</td>
<td>2</td>
<td>U3.725</td>
<td>U4.720 and U4.725</td>
<td></td>
</tr>
<tr>
<td>U4.797</td>
<td>Unsteady Aerodynamics</td>
<td>2</td>
<td></td>
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</tbody>
</table>

1For prerequisites in Column (a) a Terminating Pass is not acceptable.
**Mutually exclusive courses**

The Faculty has determined that the following courses are mutually exclusive of each other and will attract reduced credit.

<table>
<thead>
<tr>
<th>Junior courses</th>
<th>Mutually exclusive with...</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1.022 Physics 101F and U1.023 Physics 103S</td>
<td>U1.021 Physics IE</td>
</tr>
<tr>
<td>U1.021 Physics IE</td>
<td>U1.022 Physics 101F and U1.023 Physics 103S</td>
</tr>
<tr>
<td>U1.033A Chemistry 111F and U1.033B Chemistry 112S</td>
<td>U1.031 Chemistry IE</td>
</tr>
<tr>
<td>U1.031 Chemistry IE</td>
<td>U1.033A Chemistry 111F and U1.033B Chemistry 112S</td>
</tr>
<tr>
<td>U1.032 Chemistry IE Supplementary</td>
<td>U1.033A Chemistry 111F and U1.033B Chemistry 112S</td>
</tr>
<tr>
<td>U1.0401 Computer Science 101F and U1.0402 Computer Science 102S</td>
<td>U1.280 Engineering Programming</td>
</tr>
<tr>
<td>U1.0401 Computer Science 101F and U1.0402 Computer Science 102S</td>
<td>U1.445 Engineering Computing</td>
</tr>
<tr>
<td>U1.050A Geology 101F and U1.050B Geology 102S</td>
<td>U1.050A Geology 101F and U1.050B Geology 102S</td>
</tr>
<tr>
<td>U1.051 Engineering Geology 1</td>
<td>U1.050A Geology 101F and U1.050B Geology 102S</td>
</tr>
<tr>
<td>U1.100 Manufacturing Technology</td>
<td>U1.410 Mechanical Engineering 1</td>
</tr>
<tr>
<td>U1.100 Manufacturing Technology</td>
<td>U1.710 Aeronautical Engineering 1</td>
</tr>
<tr>
<td>U1.220 Statics</td>
<td>U1.410 Mechanical Engineering 1</td>
</tr>
<tr>
<td>U1.220 Statics</td>
<td>U1.400 Engineering Mechanics 1</td>
</tr>
<tr>
<td>U1.280 Engineering Programming</td>
<td>U1.415 Engineering Mechanics 1</td>
</tr>
<tr>
<td>U1.280 Engineering Programming</td>
<td>U1.410 Mechanical Engineering 1</td>
</tr>
<tr>
<td>U1.445 Engineering Computing</td>
<td>U1.710 Aeronautical Engineering 1</td>
</tr>
<tr>
<td>U1.445 Engineering Computing</td>
<td>U1.415 Engineering Mechanics 1</td>
</tr>
<tr>
<td>U1.411 Mechanical Engineering 1</td>
<td>U1.100 Manufacturing Technology 1</td>
</tr>
<tr>
<td>U1.411 Mechanical Engineering 1</td>
<td>U1.220 Statics</td>
</tr>
<tr>
<td>U1.445 Engineering Computing</td>
<td>U1.710 Aeronautical Engineering 1</td>
</tr>
<tr>
<td>U1.445 Engineering Computing</td>
<td>U1.415 Engineering Mechanics 1</td>
</tr>
<tr>
<td>U1.500 Introd Elec Eng</td>
<td>U1.511 Electrical Engineering 1</td>
</tr>
<tr>
<td>U1.500 Introductory Electrical Engineering</td>
<td>U2.502 Electrical Technology</td>
</tr>
<tr>
<td>U1.511 Electrical Engineering 1</td>
<td>U2.511 Electrical Engineering 2A</td>
</tr>
<tr>
<td>U1.511 Electrical Engineering 1</td>
<td>U2.512 Electrical Engineering 2B</td>
</tr>
<tr>
<td>U1.630 Computing for Chemical Engineers</td>
<td>U1.445 Engineering Computing</td>
</tr>
<tr>
<td>U1.630 Computing for Chemical Engineers</td>
<td>U1.0401 Computer Science 101F and U1.0402 Computer Science 102S</td>
</tr>
<tr>
<td>Code</td>
<td>Course</td>
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<tr>
<td>--------</td>
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</tr>
<tr>
<td>U1.651</td>
<td>Chemical Process Case Studies</td>
</tr>
<tr>
<td>U1.710</td>
<td>Aeronautical Engineering I</td>
</tr>
</tbody>
</table>

### Intermediate courses

<table>
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<tr>
<th>Code</th>
<th>Course</th>
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</thead>
<tbody>
<tr>
<td>U2.002</td>
<td>Maths 201F and</td>
</tr>
<tr>
<td>U2.003</td>
<td>Maths 202F and</td>
</tr>
<tr>
<td>U2.005</td>
<td>Maths 205S and</td>
</tr>
<tr>
<td>U2.006</td>
<td>Maths 252S</td>
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</table>

Any other Intermediate course in Physics

<table>
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<th>Course</th>
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</thead>
<tbody>
<tr>
<td>U2.022E</td>
<td>Physics 201F (mod) and</td>
</tr>
<tr>
<td>U2.023E</td>
<td>Physics 202S (mod)</td>
</tr>
<tr>
<td>U2.0405</td>
<td>Computer Science 205F</td>
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<tr>
<td>U2.0406</td>
<td>Computer Science 206S</td>
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Any other Intermediate course in Computer Science

<table>
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</thead>
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<tr>
<td>U2.052</td>
<td>Engineering Geology 2</td>
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<table>
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<tr>
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<tbody>
<tr>
<td>U2.210</td>
<td>Introduction to Materials</td>
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<tr>
<td>U2.221</td>
<td>Structural Mechanics</td>
</tr>
<tr>
<td>U2.261</td>
<td>Fluids 1</td>
</tr>
<tr>
<td>U2.410</td>
<td>Mechanical Engineering 2</td>
</tr>
<tr>
<td>U2.411</td>
<td>Introductory Thermodynamics</td>
</tr>
<tr>
<td>U2.412</td>
<td>Engineering Dynamics</td>
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<td>U2.417</td>
<td>Introductory Mechanics and Materials</td>
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<table>
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<tr>
<td>U2.440</td>
<td>Mechanical Design 1</td>
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<td>U2.441</td>
<td>Mechanical Design 1A</td>
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<tr>
<td>U2.442</td>
<td>Mechanical Design 1</td>
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<td>U2.443</td>
<td>Mechatronic Design 1</td>
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<td>Introductory Mechatronics</td>
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<td>U2.502</td>
<td>Electrical Technology</td>
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<td>U2.504</td>
<td>Electrical and Electronic Engineering</td>
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<td>Electrical Engineering 2A</td>
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### Any other Intermediate courses in Mathematics

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<tbody>
<tr>
<td>U2.700</td>
<td>Mechanics &amp; Properties of Solids 1</td>
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<tr>
<td>U2.701</td>
<td>Mechanics of Solids 1</td>
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<td>U2.475</td>
<td>Physics for Automation</td>
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### Any other Intermediate course in Computer Science

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<td>U1.281</td>
<td>Computer Graphics</td>
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<td>U3.561</td>
<td>Computer Architecture</td>
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<td>U2.050A</td>
<td>Geology 201F</td>
</tr>
<tr>
<td>U2.050B</td>
<td>Geology 202S</td>
</tr>
<tr>
<td>U2.050C</td>
<td>Geology 203S</td>
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<td>U2.052</td>
<td>Engineering Geology B</td>
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<tbody>
<tr>
<td>U1.210</td>
<td>Materials 1</td>
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<tr>
<td>U1.650</td>
<td>Materials and Corrosion</td>
</tr>
<tr>
<td>U1.710</td>
<td>Aeronautical Engineering 1</td>
</tr>
<tr>
<td>U2.700</td>
<td>Mechanics &amp; Properties of Solids 1</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
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</thead>
<tbody>
<tr>
<td>U1.500</td>
<td>Introductory Electrical Engineering</td>
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<td>U1.511</td>
<td>Electrical Engineering 1</td>
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<tr>
<td>U2.471</td>
<td>Introductory Mechatronics</td>
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<tr>
<td>U2.510</td>
<td>Electrical Engineering 2</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
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</thead>
<tbody>
<tr>
<td>U2.511</td>
<td>Electrical Engineering 2A</td>
</tr>
<tr>
<td>U4.512</td>
<td>Electrical Engineering 2B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>U2.502</td>
<td>Electrical Technology</td>
</tr>
<tr>
<td>U2.504</td>
<td>Electrical Technology</td>
</tr>
<tr>
<td>U2.504</td>
<td>Electrical and Electronic Engineering</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
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</thead>
<tbody>
<tr>
<td>U2.510</td>
<td>Electrical Engineering 2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>U2.471</td>
<td>Introductory Mechatronics</td>
</tr>
<tr>
<td>U2.502</td>
<td>Electrical Technology</td>
</tr>
<tr>
<td>U2.504</td>
<td>Electrical and Electronic Engineering</td>
</tr>
</tbody>
</table>

### Any other Intermediate course in Engineering

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1.500</td>
<td>Introductory Electrical Engineering</td>
</tr>
<tr>
<td>U2.510</td>
<td>Electrical Engineering 2</td>
</tr>
</tbody>
</table>

### Any other Intermediate course in Engineering Geology

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
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<tbody>
<tr>
<td>U2.471</td>
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</tr>
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<td>U2.502</td>
<td>Electrical Technology</td>
</tr>
<tr>
<td>U2.504</td>
<td>Electrical and Electronic Engineering</td>
</tr>
<tr>
<td>U2.510</td>
<td>Electrical Engineering 2</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Name</td>
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<tr>
<td>U2.512</td>
<td>Electrical Engineering 2B</td>
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<tr>
<td>U2.700</td>
<td>Mechanics and Properties of Solids 1</td>
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<td></td>
<td></td>
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<tr>
<td>U2.701</td>
<td>Mechanics of Solids 1</td>
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<tr>
<td>U2.710</td>
<td>Fluid Mechanics</td>
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<td><em>Senior courses</em></td>
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<tr>
<td>U3.212</td>
<td>Properties of Materials</td>
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<td></td>
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<tr>
<td>U3.244</td>
<td>Soil Mechanics A</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>U3.262</td>
<td>Fluids 2</td>
</tr>
<tr>
<td>U3.284</td>
<td>Risk and Reliability Analysis</td>
</tr>
<tr>
<td>U3.420</td>
<td>Thermo-fluid Engineering</td>
</tr>
<tr>
<td>U3.421</td>
<td>Thermodynamics</td>
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<td></td>
<td></td>
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<tr>
<td>U3.431</td>
<td>Mechs and Props of Materials</td>
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<tr>
<td>U3.450</td>
<td>System Dynamics and Control</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>U3.474</td>
<td>Electr. Machines and Drives</td>
</tr>
<tr>
<td>U3.476</td>
<td>Industrial Electronics</td>
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<tr>
<td>U3.480</td>
<td>Mechanical Engineering Laboratory</td>
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<tr>
<td>U3.530</td>
<td>Control 1</td>
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<tr>
<td>U3.540</td>
<td>Electronics 1</td>
</tr>
<tr>
<td>U3.560</td>
<td>Digital Systems 1</td>
</tr>
<tr>
<td>U3.561</td>
<td>Computer Architecture</td>
</tr>
<tr>
<td>U3.730</td>
<td>Aircraft Structures 1</td>
</tr>
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<td></td>
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<tr>
<td>U3.750</td>
<td>Flight Mechanics 1</td>
</tr>
<tr>
<td>U3.522</td>
<td>Power Electronic and Drives</td>
</tr>
<tr>
<td><em>Senior Advanced courses</em></td>
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<tr>
<td>U4.005</td>
<td>Partial Differential Equations</td>
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<tr>
<td>U4.070</td>
<td>Industrial Ergonomics</td>
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<tr>
<td>U4.214</td>
<td>Materials Aspects in Design</td>
</tr>
<tr>
<td>U4.236</td>
<td>Concrete Structures 2</td>
</tr>
<tr>
<td>U4.237</td>
<td>Structural Dynamics</td>
</tr>
<tr>
<td>U4.238</td>
<td>Steel Structures 2</td>
</tr>
<tr>
<td>U4.246</td>
<td>Environmental Geotechnics</td>
</tr>
<tr>
<td>U4.247</td>
<td>Foundation Engineering</td>
</tr>
<tr>
<td>U4.251</td>
<td>Surveying 2</td>
</tr>
<tr>
<td>U4.260</td>
<td>Environmental Fluids 1</td>
</tr>
<tr>
<td>U4.265</td>
<td>Environmental Fluids 2</td>
</tr>
<tr>
<td>U4.430</td>
<td>Applied Numerical Stress Analysis</td>
</tr>
<tr>
<td>U4.460</td>
<td>Industrial Engineering</td>
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<td></td>
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</tr>
<tr>
<td>U4.461</td>
<td>Introduction to Operations Research</td>
</tr>
</tbody>
</table>
Interpretation of Resolution 6(c) of the Resolutions of the Senate relating to the BE degree

In accordance with the provisions of Resolution 6(c) of the Resolutions of the Senate relating to the degree of Bachelor of Engineering, the Faculty resolves as follows:

As a general principle, a student may be permitted by the Faculty of Engineering to undertake courses at another tertiary institution to be credited towards the student's candidature for the degree of Bachelor of Engineering at this University only if that student is undertaking those studies under the aegis of an official student exchange agreement between The University of Sydney and the other institution concerned. Under certain circumstances, however, the Faculty recognises that there may be good reasons for a student to undertake courses at another tertiary institution, and, on the recommendation of the Head of Department concerned, the Faculty may permit that student to complete courses elsewhere under the provisions of Resolution 6(c). In approving such an application from a student, the Faculty will require: (a) a complete course plan which should, as a general rule, be equivalent to one year of full-time study at the University of Sydney; and (b) that such a plan be submitted and approved before the student's departure.
Courses are subject to alteration
Courses and arrangements for courses, including staff allocated as stated in this or any other publication, announcement or advice of the University are an expression of intent only and are not to be taken as a firm offer or undertaking. The University reserves the right to discontinue or vary such courses, arrangements or staff allocations at any time without notice.

On the following pages details of the courses are provided in a form which is convenient for reference. Every care has been taken to ensure that the information given is complete and accurate. However, variations may be made from time to time. These will be announced by the lecturer or posted on the relevant noticeboards. It is the responsibility of students, by attendance at lectures and frequent inspection of the noticeboards, to ensure that they have the latest information on any course.

Textbooks
Changes sometimes occur in the selection of prescribed textbooks, or reference books, owing to supply difficulties, or the publication of new and more suitable works. Such changes will be announced by lecturers and it is prudent to check with the relevant lecturer before buying the books you expect to need.

Elective courses in other faculties
The Faculty of Engineering has resolved that students may take any full First-Year Arts, Economics or Science course towards their BE degrees (e.g. Economics 1, Psychology 1, etc.). There is also provision for students to apply to the Faculty of Engineering for special permission to take any other courses which are available in other degree programs towards their BE degrees (e.g. Computer Science 3, Economics 2, etc.). Any course which is not listed in the Tables of Courses or in the list of recommended elective courses in this handbook is referred to as a 'non-listed' course by the Faculty.

If you have a strong interest in taking a particular 'non-listed' course, you should consult the relevant faculty handbook for details about it. You will also need to check whether or not there is a quota for this course or any special assumed knowledge/prerequisite.

There are potential pitfalls for students who take 'non-listed' courses as set out in Chapter 3 with reference to 'one-off enrolments. You should therefore discuss the advisability of taking such a course with the advisers at enrolment time.

If you decide that you wish to enrol in a 'non-listed' course other than a First-Year Arts, Economics or Science course, you will need to apply for special permission to do so. Please ask to see the Chairman of the Committee for Undergraduate Studies or the Faculty Secretary at enrolment time for application procedure.

If you proceed with an enrolment in a 'non-listed' First-Year Arts, Economics or Science course or in any other 'non-listed' course for which you have been granted permission, then you will need to consult the Faculty Secretary for enrolment instructions. 'Non-listed' courses are not held in the Engineering enrolment database in the VAX and enrolments in same have to be added manually on the appropriate form.

Course numbering system
Types of courses
The courses available for the degree are designated Junior, Intermediate, Senior, Senior Advanced or Honours. These names indicate the year of attendance in which the course becomes available to you if you are making normal progress.

Course numbers
The letter 'U' prefixes all undergraduate courses. The first digit of the course number indicates the level of course, as follows:

<table>
<thead>
<tr>
<th>Number</th>
<th>Type</th>
<th>Available</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Junior</td>
<td>in the first or later years</td>
</tr>
<tr>
<td>2</td>
<td>Intermediate</td>
<td>in the second or later years</td>
</tr>
<tr>
<td>3</td>
<td>Senior</td>
<td>in the third or later years, subject to completion of the prerequisite courses in the final year to Honours candidates</td>
</tr>
<tr>
<td>4</td>
<td>Senior Advanced</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Honours</td>
<td></td>
</tr>
</tbody>
</table>

The second digit of the course number indicates the Department responsible for the course, as follows:

<table>
<thead>
<tr>
<th>Number</th>
<th>Department in the Faculty of Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Departments from outside the University</td>
</tr>
<tr>
<td>1</td>
<td>Civil</td>
</tr>
<tr>
<td>2</td>
<td>Mining</td>
</tr>
<tr>
<td>3</td>
<td>Mechanical</td>
</tr>
<tr>
<td>4</td>
<td>Electrical</td>
</tr>
<tr>
<td>5</td>
<td>Chemical</td>
</tr>
<tr>
<td>6</td>
<td>Aeronautical</td>
</tr>
</tbody>
</table>

The third and fourth digits are serial numbers within the level and department.

For courses taught by departments in the Faculty of Science, the third digit indicates the particular subject:

<table>
<thead>
<tr>
<th>Number</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>U-00</td>
<td>Mathematics</td>
</tr>
<tr>
<td>1</td>
<td>Mechanics</td>
</tr>
<tr>
<td>2</td>
<td>Physics</td>
</tr>
<tr>
<td>3</td>
<td>Chemistry</td>
</tr>
<tr>
<td>4</td>
<td>Computer Science</td>
</tr>
<tr>
<td>5</td>
<td>Geology</td>
</tr>
<tr>
<td>6</td>
<td>Biology, Biochemistry and Microbiology</td>
</tr>
<tr>
<td>8</td>
<td>Architectural and Design Science</td>
</tr>
<tr>
<td>9</td>
<td>East Asian Studies</td>
</tr>
</tbody>
</table>

The section that follows contains the courses in numerical order:
**Courses of study**

**U1.001 MATH 101F Differential Calculus and Linear Algebra** 6 units  
*AKn* HSC 3-unit Mathematics  
*Classes* Sem 1: (4 lec, 2 tut & 1 optional computer lab)/wk  
*Assessment* two 2hr exams, assignments

**U.001 A MATH 191F Differential Calculus and Linear Algebra (Advanced)** 6 units  
*AKn* HSC 4-unit or top decile 3-unit Mathematics  
*Classes* Sem 1: (4 lec, 2 tut & 1 optional computer lab)/wk  
*Assessment* two 2hr exams, assignments

**U1.002 MATH 102S Integral Calculus and Statistics** 6 units  
*Prereq* Mathematics 101 or 191 or Distinction in Mathematics 111  
*Classes* Sem 2: (4 lec, 2 tut & 1 optional computer lab)/wk  
*Assessment* two 2hr exams, assignments

**U1.002A MATH 192S Integral Calculus and Statistics (Advanced)** 6 units  
*Prereq* Credit in Mathematics 101 or 191  
*Classes* Sem 2: (4 lec, 2 tut & 1 optional computer lab)/wk  
*Assessment* two 2hr exams, assignments

**U1.003 MATH 103S Integral Calculus and Discrete Mathematics** 6 units  
*Prereq* Mathematics 101 or 191 or Distinction in Mathematics 111  
*Classes* Sem 2: (4 lec, 2 tut & 1 optional computer lab)/wk  
*Assessment* two 2hr exams, assignments

**U1.003A MATH 193S Integral Calculus and Discrete Mathematics (Advanced)** 6 units  
*Prereq* Credit in Mathematics 101 or 191  
*Classes* Sem 2: (4 lec, 2 tut & 1 optional computer lab)/wk  
*Assessment* two 2hr exams/assignments

**U1.010 Mechanics 1E** 6 units  
*Junior core course* for the degree in Aeronautical, Chemical and Civil Engineering and in Project Engineering and Management (Civil). The course is provided jointly by the School of Mathematics and Statistics and the School of Physics.  
*AKn* Mathematics 3-unit course and the Science 4-unit course (or the Physics core of 3/4-unit Science) at the HSC  
*Coreq* U1.000 Mathematics  
*Classes* Sem 1: (3 lec/tut & 3 prac)/wk and seven 2hr lab sessions  
*Assessment* one 3hr exam at end of Sem 1; lab work will be assessed  
*Syllabus summary:* Vectors, statics, stability of equilibrium, kinematics, dynamics of a single particle, dynamics of particle systems, collisions, two dimensional rigid body dynamics.  
*Textbook*  
None  
*Lecture notes to be purchased from the University Cooperative Bookshop*  
*Reference book*  
Bullen *An Introduction to the Theory of Mechanics* (Science Press, 1971)  
*Library classification:* U531 (Fisher Library)

**First Year Physics Courses**

These are offered at two levels: Physics 1 (Advanced) and Physics 1. Both provide a sound foundation for a further study of physics. Physics 1 (Advanced) is available to students with a very good record in Physics (TER at least 95.0 and 2-unit Physics scores at least 90) and proceeds faster than the Regular Strand of Physics 1, covering further and more difficult ground.

**U1.021 Physics 1E 6 units**  
*Junior core course* for the degree in Aeronautical and Mechanical Engineering. Elective course for Chemical and Civil Engineering and for Project Engineering and Management (Civil).  
*AKn* Mathematics 3-unit course and either 2-unit Physics or the Physics core of 3/4-unit Science at the HSC  
*Mutually exclusive with* U1.020 Physics 1  
*Coreq* one of U1.010 Mechanics IE or U1.400 Engineering Mechanics 1 or U1.710 Aeronautical Engineering 1  
*Classes* Sem 2: (3 lec & one 3hr lab or tut)/wk  
*Assessment* one 3hr exam at end of Sem 2; an assessment of lab work, project reports and a written lab exam may also be included  
*Syllabus summary:* Waves, electro-statics, current electricity, magnetism, electro-magnetism, quantum physics.  
*Textbook*  
Sears, Zemansky and Young *University Physics* 7th edn (Addison-Wesley, 1987)  
*Reference books*  
As indicated during classes  
*Library classification:* U530 (Fisher Library)

**U1.022 PHYSICS 101F Physics (Regular)** 6 units  
*AKn* HSC Physics or HSC 4-unit Science  
*Classes* Sem 1: (3 lec/tut & 3 prac)/wk  
*Assessment* one 3hr exam, lab & assignments  
This course is for students who gained 65 marks or better in HSC 2-unit Physics or equivalent. The lecture course contains three four-week modules on the topics of Mechanics, Fluids and Fields, and Waves.  
*Textbooks*  
*Physics Laboratory Manuals* (School of Physics Publication)

**U1.022A PHYSICS 191F Physics (Advanced) A** 6 units  
*Prereq* TER at least that for acceptance into BSc (Advanced) program or at least 90 in HSC 2-unit Physics or a least 180 in HSC 4-unit Physics  
*Classes* Sem 1: (3 lec/tut & 3 prac)/wk  
*Assessment* one 3hr exam, lab & assignments
Physics 191 (Advanced) A is intended for students who have a strong background in Physics and an interest in studying more advanced topics. It proceeds faster than Physics 101 (Regular), covering further and more difficult material. The lecture course contains three four-week modules on the topics of Mechanics, Fluids and Fields, and Waves. The laboratory work also provides an introduction to computational physics using chaos theory as the topic of study.

Textbooks
*Physics Laboratory Manuals* (School of Physics Publication)

**U1.023 PHYSICS 103S Physics (Technological)** 6 units

*Prereq:* Physics 101 or 102 or 191
*Classes* Sem 2: (3 lec/tut & 3 prac)/wk
*Assessment* one 3hr exam, lab & assignments

This course is designed for students majoring in the physical and engineering sciences and emphasis is placed on applications of physical principles to the technological world. The lecture course contains three four-week modules on the topics of electromagnetism, thermal physics, and quantum and materials physics.

Textbooks
*Physics Laboratory Manuals* (School of Physics Publication)

**U1.023B PHYSICS 192S Physics (Advanced) B** 6 units

*Prereq:* Physics 191 or Distinction or Better in Physics 101 or 102
*Classes* Sem 2: (3 lec/tut & 3 prac)/wk
*Assessment* one 3hr exam, lab & assignments

This course is a continuation of Physics 191 (Advanced). A. Students who have completed Physics 101 (Regular) or Physics 102 (Fundamentals) at Distinction level may enrol. It proceeds faster than Physics 103 (Technological), covering further and more difficult material. The lecture course contains three four-week modules on the topics of electromagnetism, thermal physics, quantum and materials physics, and superconductivity.

Textbooks
*Physics Laboratory Manuals* (School of Physics Publication)

**U1.031 Chemistry 1E** 6 units

*Junior core course* for the degree in all branches of engineering except Chemical, Electrical and Project Engineering and Management (Civil).

*Akn:* Mathematics 2-unit course and a satisfactory knowledge of 2-unit Chemistry or the Chemistry component of the 3 or 4-unit Science HSC course

*Mutually exclusive with:* U1.030 Chemistry 1

*Classes* Sem 1: (3 lec & one 3hr lab/tut session)/wk
*Assessment* one 3hr exam at end of course. At the beginning of the course students are informed of other factors that contribute to the final assessment

Textbooks
A detailed textbook list is available from the School of Chemistry

**U1.032 Chemistry 1E Supplementary** 6 units

*Junior elective course.*

This course is designed to satisfy the prerequisite requirements for the Intermediate Chemistry courses provided by the Faculty of Science for students who have completed the course work for U1.031 Chemistry IE. It may only be taken in the same academic year as U1.031 and is only available to students with an excellent record in U1.031 and then only with the permission of the Dean of the Faculty of Engineering and the Head of the School of Chemistry.

The course consists of the lectures and laboratory exercises of Sem 2 of U1.030 Chemistry 1.

*Mutually exclusive with:* U1.030 Chemistry 1

*Classes* Sem 2: (3 lec & one 3hr lab)/wk
*Assessment* one 3hr exam at end of year. At the beginning of the course students are informed of other factors that contribute to the final assessment

**Syllabus summary:** As for the Sem 2 syllabus of U1.030. There will be some repetition of the material given in U1.031.

Textbooks
A detailed textbook list is available from the School of Chemistry

**U1.033A CHEMISTRY 111F Chemistry 1A** 6 units

*Akn:* HSC Mathematics 2-unit course; and the Chemistry component of the 4-unit or 3-unit HSC Science course, or 2-unit Chemistry

*Recommended concurrent course* Preferred—Mathematics 101 or 191; otherwise—Mathematics 111

*May not be counted with:* Chemistry 101 or 191 or 193

*Classes* Sem 1: (3 lec & 3hr prac or tut workshop)/wk

Chemistry 1A is built on a satisfactory prior knowledge of the chemistry component of the 4-unit or 3-unit HSC Science course or 2-unit Chemistry. A brief
revision of basic concepts of the high school course is
given. Chemistry IA covers chemical theory and
physical chemistry.

Lectures, practical work, examinations, textbooks
As for Chemistry 101.

U1.033B CHEMISTRY 112S Chemistry 1B
6 units
Prereq Chemistry 111 or a Distinction in Chemistry 101 or equivalent
Coreq Chemistry 111 may be taken if available
Recommended concurrent course Preferred—Mathematics 102 or
103 or 192 or 193; otherwise—Mathematics 104 or 112
May not be counted with Chemistry 102 or 192 or 194
Classes Sem 2: (3 lec & 3hr prac or tut workshop)/wk

Chemistry IB is built on a satisfactory prior knowledge of
Chemistry IA and covers inorganic and organic
chemistry. Chemistry IB is an acceptable prerequisite
for entry into Intermediate Chemistry courses.

Lectures, practical work, examinations, textbooks
As for Chemistry 101.

U1.034A CHEMISTRY 191F Chemistry 1A
(Advanced) 6 units
Prereq TER of at least 88 and at least 75% in HSC 2-unit
Chemistry or equivalent
Recommended concurrent course Preferred—Mathematics 110 or
111; otherwise—Mathematics 111
May not be counted with Chemistry 101 or 111 or 193
Classes Sem 1: (3 lec & 3hr prac or tut workshop)/wk

Chemistry IA (Advanced) is available to students
with a very good HSC performance (typically a TER of
88+) as well as a very good school record in chemistry
or science. Students in these categories are expected
to do Chemistry IA (Advanced) rather than Chemistry
1A.

The theory and practical work syllabuses for
Chemistry IA and Chemistry IA (Advanced) are very
similar, though the level of treatment in the latter
course is more advanced, presupposing a very good
grounding in the subject at secondary level. Chemistry
IA (Advanced) covers chemical theory and physical
chemistry.

Lectures, practical work, examinations, textbooks
As for Chemistry 101.

U1.034B CHEMISTRY 192S Chemistry 1B
(Advanced) 6 units
Qual Chemistry 191 or 193 or Distinction in Chemistry 111 or
equivalent
Recommended concurrent course Preferred—Mathematics 102 or
103 or 192 or 193; otherwise—Mathematics 112 or 104
May not be counted with Chemistry 102 or 112 or 194
Classes Sem 2: (3 lec & 3hr prac or tut workshop)/wk

Chemistry IB (Advanced) is built on a satisfactory
prior knowledge of Chemistry IA (Advanced) and
covers inorganic and organic chemistry. Chemistry
IB (Advanced) is an acceptable prerequisite for entry
into Intermediate Chemistry courses.

Lectures, practical work, examinations, textbooks
As for Chemistry 101.

U 1.0401 COMPUTER SCIENCE 101F
Introductory Programming 6 units
Akn HSC 3-unit Mathematics
Classes Sem 1: (3 lec, 1 tut & 2 prac)/wk
Assessment assignments, written exam, prac exam

This course introduces the fundamental skill that
underlines all of Computer Science: computer
programming. Using the Blue object-oriented
programming language, students learn modern
programming techniques based on recent
developments in the subject. No previous knowledge
of computers or programming is assumed.

U1.0402 COMPUTER SCIENCE 102S
Introductory Computer Science 6 units
Prereq COMP 101 or 191
Classes Sem 2: (3 lec, 1 tut & 2 prac)/wk
Assessment assignments, written exam, prac exam

This course is a continuation of COMP 101. Advanced
features of the Blue programming languages are
presented, and a beginning is made on some topics
from the wider field of Computer Science, such as
assembly language programming and reasoning about
the correctness and efficiency of computer programs.

U1.0491 COMPUTER SCIENCE 191F
Introductory Programming (Advanced) 6 units
Akn HSC 3-unit Mathematics (Requires permission by the
Head of Department)
Classes Sem 1: (3 lec, 1 tut & 2 prac)/wk
Assessment assignments, written exam, prac exam

This course is the advanced alternative to COMP 101.
While the subject matter is the same, a higher degree
of elegance and rigour in programming is expected,
and the programming problems are more challenging,
although not more time consuming. No previous
knowledge of computers or programming is assumed.

U1.0492 COMPUTER SCIENCE 192S
Introductory Computer Science (Advanced) 6 units
Prereq COMP 191 or 101(with sufficient merit)
Classes Sem 2: (3 lec, 1 tut & 2 prac)/wk
Assessment assignments, written exam, prac exam

This course is the advanced alternative to COMP 101.
While the subject matter is the same, a higher degree
of elegance and rigour in programming is expected,
the programming problems are more challenging
although not more time consuming, and a deeper
approach is taken to the Computer Science topics.

U1.050A GEOLOGY 101F Earth and Its
Environment 6 units
Coordinator Dr Keene
Classes Sem 1: (3 lec & prac or tut)/wk
Assessment one 3hr exam, class and field work

The aim of this course is to provide students with an
understanding of how the Earth system works, its
origin, plate tectonics, surface processes, evolution
of life and geologic time. Students will learn techniques
and types of observations used to decipher the history and evolution of the Earth, processes operating in the surface environments and dating sediments and rocks. Laboratory classes and a one day field trip to the south coast will involve exercises in observing and describing Earth materials and in interpreting Earth history from geological information, including fossils and maps.

**U1.050B GEOLOGY 102S Earth Processes and Resources** 6 units

*Coordinator* Dr Keene  
*Classes* Sem 2: (3 lec & prac or tut)/wk  
*Assessment* one 3hr exam, class and field work

The aim of this course is to examine the chemical and physical processes involved in mineral formation, the interior of the Earth, volcanoes, and metamorphism. Lectures and laboratory sessions on mountainbuilding processes and the formation of ore deposits will lead to an understanding of the driving forces in geology. The course concludes with the study of Australia's sedimentary basins, their fossil fuel content and implications for our economy and an assessment of our own impact on the Earth together with the role of geologists in protecting and monitoring the environment. In addition to laboratory classes there are two field trips: one weekend excursion to the Hunter Valley and a one day excursion to the Blue Mountains. Students will be required to pay hostel accommodation for one night.

**U1.051 Engineering Geology 1** 5 units

*Junior core course* for the degree in Civil Engineering, unless the course U1.050 Geology 1 has been completed.

*Mutually exclusive with* U1.050 Geology 1  
*Classes* 26hrs lec, 39hrs lab. Field excursions in the Sydney region, as appropriate  
*Assessment* practical laboratory work plus a combined theory and practical exam at the end of semester

*Course objectives* to introduce basic geology to civil engineering students.

*Expected outcomes* students should acquire knowledge of the most important rocks and minerals and be able to identify them. They should develop an appreciation of structural geology, as it influences civil engineering works.

*Syllabus summary:* Basic geological concepts relevant to civil engineering. Introduction to minerals, rocks and soils, their mode of occurrence, formation and significance. General introduction to physical geology and geomorphology, structural geology, tectonics, and hydrogeology. Associated laboratory work on minerals, rocks and mapping.

*Textbooks*  
Press and Seiver *Earth* 4th edn (Freeman)  
or  
Branagan *Beneath the Scenery* (Science Press)

*Reference books*  
As indicated during classes

*Library classification:* U550, U551 (Fisher Library)

**U1.060A Biology 101F Concepts in Biology** 6 units

*Aktn Biology section of the HSC 3-unit Science course*  
*Classes* Sem 1: (3 lec & 3 prac)/wk  
*Assessment* one 2hr exam, assignments, classwork

‘Concepts in Biology’ is an introduction to the major themes of modern biology. Starting with interactions between organisms in biological communities, we move on to the diversity of microorganisms, plants and animals. This is followed by introductory cell biology, which particularly emphasises how cells obtain and use energy, and leads into an introduction to molecular biology through the role of DNA in protein synthesis and development. The genetics of organisms is then discussed, leading to consideration of theories of evolution and the origins of the diversity of modern organisms. This course is prerequisite for all second semester Biology courses.

**U1.060B BIOLOGY 192S Living Systems (Advanced)** 6 units

*Prereq* Biology 101 or 191  
*Classes* Sem 2: (3 lec & 3 prac)/wk  
*Assessment* one 2hr exam, assignments, classwork

Selected students may be invited to participate in a more demanding alternative component of the Living Systems course. The content and nature of this component will be determined each year. Details and selection criteria are announced in the first semester.

**U1.060C BIOLOGY 103S Human Biology** 6 units

*Prereq* Biology 101 or 191  
*Classes* Sem 2: (3 lec & 3 prac)/wk  
*Assessment* one 2hr exam, assignments, classwork

This course provides an introduction to human evolution and ecology, cell biology, physiology and anatomy, through both lectures and practical work. It begins with human evolution, human population dynamics and the impact of people on the environment. The course includes human nutrition, distribution of essential requirements to and from the cells, control of body functions and defence mechanisms. After discussion of reproduction and development, the course concludes with some controversial aspects of human genetics. Enrolment may be restricted by the availability of places. This course provides entry to Intermediate courses in genetics and cell biology in the School of Biological Sciences, but not to the School’s other Intermediate courses.

*Textbook*  
S.S. Mader *Human Biology* 4th edn (Wm. C. Brown, 1995)

**U1.100 Manufacturing Technology** 4 units

*Junior elective course.*  
*Mutually exclusive with* U1.410 Mechanical Engineering 1, U1.710 Aeronautical Engineering 1  
*Classes* Sem: approx. one 3hr lab at Sydney Technical College/wk  
*Assessment* prac work
Syllabus summary:
(a) Fitting—Measurement, measuring tools, marking tools, testing tools, holding tools, hammers, cutting tools, bolts and studs, tapping and screwing, reaming and scraping.
(b) Machining—Various metals and their machinability, cutting tool materials, cutting tool shape, the machine tools: lathe, mill grinder, drill, shaper, deburring and finishing operations.
(c) Welding—Various welding processes, distortions, flame cutting, resistance welding. Practical work in gas welding and arc welding.
(d) Heat treatment, blacksmithing and forging—Definition and importance of heat treatment, and the process of forging, normalising hardening, case hardening.
(e) Founding—Materials used in the foundry, moulding and core making, the casting process.

Safety requirements: All students are required to comply with the safety regulations of the Sydney Technical College. 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.

Library classification: 671

U1.200 Civil Engineering 1 4 units
Junior core course for the degree in Civil Engineering and Project Engineering and Management (Civil). Elective course for the other branches.

Akn Mathematics 3-unit course and a satisfactory knowledge of 2-unit Chemistry or the Chemistry component of the 3 or 4-unit Science HSC course and of the 2-unit Physics course or the Physics component of the 3 or 4-unit Science HSC course

Classes Sem: 13hrs lec, 13hrs tut and 26hrs lab/drawing office
Assessment specified assignments and one 3hr exam at end of course

Syllabus summary:
(a) Engineering Projects—Introduction to the planning, design, construction and operation of engineering projects. Economic and non-economic evaluation of projects.
(b) Elements of Engineering Science—Structures, geomechanics, materials, hydraulics and water resources, environment, systems, management.
(c) Communications—Freehand and scale drawing, engineering plans, shop drawings, techniques for producing drawings. Preparation of reports, verbal and written.

Reference books
Krick An Introduction to Engineering—Concept, Methods and Issues (John Wiley and Sons)
Morris Engineering—A Decision Making Process (Houghton Mifflin Company)
Hoganand Firkins Economical Structural Steelwork (Australian Institute of Steel Construction)
Brown Getting Across (Edward Arnold)
Thompson Organization and Economics of Construction (McGraw-Hill)
Strunk and White The Elements of Style (Macmillan)
Concrete Institute of Australia Recommended Practice—Reinforced Concrete Detailing Manual (CIA)
Dandy and Warner Planning and Design of Engineering Systems (Unwin Hyman)
Eagleson Writing in Plain English (Aust. Govt Publishing Service)

Library classification: 620.0023,658.15,658.4,744,808

U1.220 Statics 4 units
Junior core course for the degree in Civil Engineering and in Project Engineering and Management (Civil).

Akn Mathematics 3-unit course at the HSC
Mutually exclusive with U1.410 Mechanical Engineering 1, U1.400 Engineering Mechanics 1, U1.710 Aeronautical Engineering 1 and U2.415 Engineering Mechanics 2
Coreq U1.000 Mathematics 1

Classes Sem 2:26hrs lec and 26hrs tut
Assessment class test during sem and one 2hr exam at end of sem

Syllabus summary: Basic concepts: scalars and vectors; units. Statics of the rigid body; forces and moments; system isolation; free body diagrams, and equilibrium criteria. Principle of virtual work; friction, distributed force systems; beams with distributed loads, statically determine pin-jointed structures.

Textbook

Library classification: U531-2, U620-1 (Fisher Library)

U1.280 Engineering Programming 3 units
Junior core course for the degree in Aeronautical and Civil Engineering and in Project Engineering and Management (Civil). U1.040 Computer Science 1 and U1.445 Engineering Computing are acceptable alternatives.

Mutually exclusive with U1.400 Computer Science 1 and U1.445 Engineering Computing
Coreq U1.281 Computer Graphics

Classes Sem 1: (1 lec & one 2hr computer lab session)/wk
Assessment one 1.5hr exam at end of sem plus assessment of computer exercises during sem

Syllabus summary: Fundamental instruction in a structured computer language using FORTRAN 77 and/or C. Data types, input and output, operators, expressions, control flow, loops, if else statement, switching, files, functions, subroutines, arrays, compilers, linkers.

Textbook
Page, Didday and Alpert FORTRAN 77 for Humans 3rd edn (West Publishing Co., 1986)

Reference book
Kernighan and Ritchie The C Programming Language 2nd edn (Prentice Hall, 1988)

Library classification: U001, U005 (Fisher Library)

U1.281 Computer Graphics 3 units
Junior core course for the degree in Aeronautical and Civil Engineering and in Project Engineering and Management (Civil). U2.040 Computer Science 2 is an
acceptable alternative for the degree in Civil Engineering and in Project Engineering and Management (Civil).

**Mutually exclusive with U1.445 Engineering Computing and U2.040 Computer Science 2**

Coreq either U1.280 Engineering Programming or U1.040 Computer Science 1

Classes Sem 2: (1 lec & one 2hr computer lab session)/wk

Assessment one 2hr exam at end of sem plus assessment of computer exercises during sem

**Syllabus summary:** Fundamental instruction in a graphical computer language using the international standard language GKS (Graphical Kernel System).

Graphical control functions, workstation functions, windows and viewpoints, graphical primitives, attribute functions, segments, input functions, graphical output devices including plotters and VDU’s, graphical input devices including cursers, graphical tablets and mice.

Fundamental instruction in viewing 3-dimensional objects using a 2-dimensional graphics system.

Geometric representation of 3D objects, data structures, perspective projections, 2D translational, scaling and rotational transformations, solid object modelling.

Textbook

Sproull, Sutherland and Ulner *Device Independent Graphics* (McGraw-Hill, 1985)

Reference books

Donald and Hearn *Computer Graphics* (Prentice-Hall, 1986)


DEC GKS Fortran Binding Reference Manual

Library classification: U006 (Fisher Library)

**U1.411 Mechanical Engineering 1** 12 units

Junior core course for the degrees in Mechanical and Mechatronic Engineering.

**Mutually exclusive with U1.100 Manufacturing Technology 1, U1.220 Statics, U1.710 Aeronautical Engineering 1**

Coreq U1.000 Mathematics 1

Classes Sem 1: (three 1hr lec & 3hr lab at Sydney Technical College)/wk; Sem 2: (three 1hr lec & 3hr tut)/wk

Assessment assignments, exam at end of sem 2

Course objectives: To develop an understanding of:

- the role of professional engineers and their responsibilities;
- the machining and manufacturing processes required to make mechanical components; and
- the basic methods required to perform static and dynamic engineering mechanics calculations.

Expected outcomes: Students should develop skills in:

- engineering management techniques;
- working in groups;
- verbal and written communication;
- machining and manufacturing methods;
- solving problems in mechanics;
- analysis of particle kinematics; and
- analysis of static engineering structures.

**Syllabus summary:**

**Semester 1**

**Professional Engineering (2 units):** Structure and management of engineering projects, engineering project planning, engineering economics. Engineering management issues, Total Quality Management, ethics, liability, environment, health, etc. Development of both verbal and written communication skills. Accessing information technology.

**Workshop Technology (4 units):** Fitting, machining, lathe, mill grinder, drill, shaper, deburring and finishing operations. Welding and fabrication, distortion, flame cutting, resistance welding, practical work in gas and arc welding. Heat treatment, blacksmithing and forging, forging processes, normalising, hardening, case hardening. Founding, materials used in foundry, moulding and core making, casting process. Fundamentals of machining, casting, powder metallurgy, metal working, welding, cutting, polymer processing, bending and composite manufacturing processes.

Safety requirements: All students are required to comply with the safety regulations of the Sydney Technical College. 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.

**Mechanics part A (3 units):** Scalar and vectors, units, units and dimensional homogeneity. Gearing, fundamental law of toothed gearing, parallel axis gear trains, epicyclic gear trains, tubular analysis of planetary trains, free body, diagrams power transmission.

**Semester 2**

**Mechanics part B (3 units):** Statics of a rigid body; forces and moments; free body diagrams in two and three dimensions; resultants of forces and moments. Equilibrium of rigid bodies; trusses, frames and machines; statically determinate pin-jointed structures. Distributed forces, centroids of lines, areas and volumes; cables. Friction, wedges, screws; flexible belts. Kinetics of systems of particles and virtual forces.

Textbook


**U1.446 Engineering Computing 8 units**

Junior core course for the degree in Mechanical and Mechatronic Engineering. Computer Science 1 is an acceptable alternative. U1.445 Engineering Computing is not an acceptable prerequisite for U2.040 Computer Science 2.

**Akin Mathematics 3-unit course at the HSC**

**Mutually exclusive with U1.040 Computer Science 1, U1.440 Computer Science IE, U1.280 Engineering Programming**

Coreq U1.000 Mathematics 1

Classes Yr: (two 1hr lec & 2hr computing lab)/wk

Assessment one 2hr exam at the end of semester 1, one 3hr exam at the end of semester 2, plus programming assignments. Satisfactory computing laboratory performance is also required

Course objectives: To provide an introduction to computer hardware and operating systems, and to their application in solving engineering problems. To introduce spreadsheets and mathematical computing
environments as tools for problem solving. To provide experience in computer program design, and in implementing and validating straightforward programs written in the FORTRAN and C languages.

**Expected outcomes:** The student will have an appreciation of binary number representation, and of the underlying issues in computer hardware and software. The student will be comfortable and competent with the use of computer workstations and the UNIX operating system, including electronic mail, with the use of spreadsheets and the Matlab environments for solving engineering problems, and with the design and implementation of C and FORTRAN programs of moderate complexity. The student will be able to use these engineering computing tools to solve typical problems encountered in the Junior year.

**Syllabus summary:**


Reference books
Kernighan and Ritchie *The C Programming Language* 2nd edn (Prentice Hall, 1988)
McConnell *Code Complete* (Microsoft Press, 1994)
Page, Didday and Alpert *Fortran 77 for Humans* 3rd edn (West Publishing Co., 1986)
Etter Engineering program solving with MATLAB (Prentice Hall, 1993)

Library classifications: 001.6424, 005.133, 005.1, 517.6

**U1.511 Electrical Engineering 1** 14 units

Junior core course for the degree in Electrical Engineering.


Reference book
Smith and Dorf *Circuits, Devices and Systems* 5th edn

**Coreq** U1.000 Mathematics 1

**Classes** 8 contact hours per week in Sem 1 and 6 per week in Sem 2 combining lectures, laboratory work, computing, tutorials and presentations

**Assessment** presentations, reports and assignments plus a 1hr exam and two 2hr exams at the end of Sem 1, and two 2hr exams at the end of Sem 2

**Mutually exclusive with** U1.511 Electrical Engineering 1, U2.502 Electrical Technology

**Coreq** U1.000 Mathematics 1

**Classes** Sem: 2 lec/wk and nine 3hr lab/tut

**Assessment** one 2hr exam at end of sem; lab reports; and mid-sem tests. 80% exam, 20% lab


Reference book
Smith and Dorf *Circuits, Devices and Systems* 5th edn

**U1.511 Electrical Engineering 1** 14 units

Junior core course for the degree in Electrical Engineering.

**Syllabus summary:** The course consists of three modules:

**Introductory Electronic Systems (6 units):** has three contact hours per week over the year. An integrated course, it combines computer-based problem solving and simulation with linear DC circuits, DC switching, transients, AC circuits, frequency response, non-linear circuits, operational amplifier functions and electrical safety. The supporting laboratories include instrumentation and computer-based instrument emulation.
Introductory Digital Systems (6 units): has three contact hours per week over the year. An integrated course, it combines construction and manufacturing techniques for digital systems, schematic capture, simulation and printed circuit board software with number representation, combinatorial logic design, sequential logic design, registers, counters, ROM and RAM elements Generic Array Logic (GAL) integrated circuits and synchronous sequential circuits. The associated laboratories include a team-based digital design, construct and test project.

Communication Skills (2 units): has 2 contact hours per week over the first semester. The course includes reinforcement of skills in English expression and report writing, while introducing the necessary elements of engineering drawing, graphical drawing, spreadsheets, graphics, documentation and document control. The course provides a framework for the introduction of total quality management (TQM) concepts.

U1.610 Chemical Engineering 1 8 units
Junior core course for the degree in Chemical Engineering. Elective course for other branches.

Akn Mathematics 3-unit course and a satisfactory knowledge of 2-unit Chemistry or the Chemistry component of the 3- or 4-unit Science HSC course and of the 2-unit Physics course or the Physics component of the 3- or 4-unit Science HSC course
Classes Yr: (3hr of lec & one 2hr tut)/wk
Assessment one 3hr exam at end of Sem 1; project and one 2hr exam at end of Sem 2, continuous assessment of assignments

Syllabus summary: Introduction to large-scale chemical processing; discussion of typical flowsheets for the manufacture of basic chemicals. The application of physico-chemical principles to materials and energy balance calculations.

A major assignment involves the computation of material and energy balances for a complete flow sheet.

Textbook

Reference book

U1.620 Chemical Engineering Applications 4 units
Junior core course for the degree in Chemical Engineering. Elective course for other branches.

Classes Sem: (2 lec & one 3hr tut or lab)/wk
Assessment lab, tut work and one 2hr exam at end of Sem 1

Syllabus summary:
(a) What is chemical engineering? A survey of the nature of chemical engineering, of the nature of the Australian process industries, and of the main professional activities of chemical engineers. Lectures are given by invited speakers from government, industry and academia. Visits to works in the Sydney region are undertaken with tutorial exercises based on these visits.

(b) Chemical engineering applications laboratory. An appreciation of: (i) the methods and materials of construction of items of process equipment, (ii) the role of this equipment in building up an entire chemical processing plant, (iii) its operation and maintenance and (iv) safety requirements and procedures. Students will dismantle, reassemble and operate items of process equipment. They will present written answers to questions supplemented by drawings of process flow-sheets, diagrams of dismantled equipment, and discussions of heat and mass balances and of process parameter values.

Reference book
Field Chemical Engineering: Introductory Aspects (MacMillan, 1988)

Reference material will be identified during the course

U1.630 Computing for Chemical Engineers 2 units
Junior core course for the degree in Chemical Engineering.

Mutually exclusive with U1.040 Computer Science 1 and U1.445 Engineering Computing
Classes Sem: (1 lec & one 2hr tut)/wk
Assessment assignments and one 1hr exam

Syllabus summary: Introduction to personal computers, MS-DOS, Lotus 123 and Excel. Application to chemical engineering problems.

U1.651 Chemical Process Case Studies 4 units
Junior core course for the degree in Chemical Engineering.

Mutually exclusive with U1.210 Materials I, U1.410 Mechanical Engineering 1, U1.710 Aeronautical Engineering 1 and U2.416 Introductory Mechanics and Materials
Classes Sem: (2 lec & one 2hr tut/lab)/wk
Assessment one 3hr exam plus assignments

Syllabus summary:
Chemical Process Case Studies will introduce students to the major processes of the contemporary chemical industry, and the economic and environmental constraints that shape them. The case study format will be used to develop a number of professional skills in the student—team work, use of library and computer resources and presentation skills.

U1.710 Aeronautical Engineering 1 12 units
Junior core course for the degree in Aeronautical Engineering.

Coreq U1.000 Mathematics 1
Classes Sem 1: one 3hr lab at Sydney Technical College/wk; Sem 2: (5 lec, one 2hr tut & one 1hr tut)/wk and two 3hr labs/sem
Assessment prac work in Sem 1; one 3hr, one 2hr exam at end of Sem 2; assignment work in Sem 2
machinability, cutting tool materials, cutting tool and scraping. bolts and studs, tapping and screwing, reaming and scraping.

shape, the machine tools: lathe, mill grinder, drill, shaper, deburring and finishing operations.

Various welding processes, distortions, flame cutting, resistance welding. Practical work in gas welding and arc welding.

Definition and importance of heat treatment, and the process of forging, normalising, hardening, case hardening.

(machining)—Various metals and their machinability, cutting tool materials, cutting tool shape, the machine tools: lathe, mill grinder, drill, shaper, deburring and finishing operations.

(iii) Welding—Various welding processes, distortions, flame cutting, resistance welding. Practical work in gas welding and arc welding.

(iv) Heat treatment, blacksmithing and forging—Definition and importance of heat treatment, and the process of forging, normalising, hardening, case hardening.

(v) Founding—Materials used in the foundry, moulding and core making, the casting process.

Safety requirements: All students are required to comply with the safety regulations of the Sydney Technical College. 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.

Semester 2:
(a) Mechanics part B (3 units): Statics of the rigid body; forces and moments; free body diagrams in two and three dimensions, resultants of forces and moments. Equilibrium of rigid bodies, trusses, frames and machines, statically determinate pin-jointed structures. Distributed forces, centroids of lines, areas and volumes, cables. Friction, wedges, screws, flexible belts. Kinematics of systems of particles and virtual forces.


(c) Introductory Aeronautics (3 units): Classification of aircraft, fixed-wing, rotary wing, aerostats, surface effect vehicles. Glossary of terms for aircraft and their components. Introduction to mechanics of flight, aerodynamics, airframe structures, materials and propulsion systems. Elementary aircraft performance calculations, operating characteristics. Modern developments in aviation.

Reference books
Ashby and Jones Engineering Materials—An Introduction to their Properties and Applications (Pergamon, 1981)
Crawford Basic Engineering Processes IS edn (Hodder and Stoughton)

Cutler Understanding Aircraft Structures (BSP Professional, 1988)
Jane's All the World's Aircraft (Annual)
Stinton The Anatomy of the Aeroplane (Collins, 1985)

U2.002 MATH 201F Vector Calculus and Complex Variables 4 units
Qual Mathematics 102 or 103 or 192 or 193
Classes Sem 1: (3 lec & 1 tut)/wk
Assessment one 2hr exam, assignments, tutorial participation

U2.003 MATH 202F Matrix Applications 4 units
Qual Mathematics 101 or 191 or Distinction in Mathematics 111
Classes Sem 1: (2 lec, 1 tut & 1 computer lab)/wk
Assessment one 2hr exam, assignments, tutorial participation

U2.004 MATH 205S Fourier Series and Differential Equations 4 units
Prereq Mathematics 201 or 291
Classes Sem 2: (3 lec & 1 tut)/wk
Assessment one 2hr exam, assignments

U2.005 MATH 251S Linear Programming and Numerical Solution of Boundary Value Problems 2 units
Syllabus summary not yet available.

U2.006 MATH 252S Numerical Methods 2 units
Syllabus summary not yet available.

Advanced courses (Pure)
U2.007 MATH 291F Vector Calculus and Complex Variables (Advanced) 4 units
Qual Mathematics 192 or 193 or Credit in either Mathematics 102 or 103
Classes Sem 1: (3 lec & 1 tut)/wk
Assessment one 2hr exam, assignments

U2.008 MATH 292F Linear Algebra (Advanced) 4 units
Qual (Mathematics 191 or Credit in 101) and (Mathematics 192 or 193 or 194 or Credit in one of 102 or 103 or 104)
Classes Sem 2: (3 lec & 1 tut)/wk
Assessment one 2hr exam, assignments

U2.009 MATH 297S Analysis (Advanced) 4 units
Prereq Mathematics 291 or Credit in 201
Classes Sem 2: (3 lec & 1 tut)/wk
Assessment one 2hr exam, assignments

U2.010 MATH 253S Differential Equations (Advanced) 2 units
(Not available to Electrical Engineering students).
Syllabus summary not yet available.
U2.011 MATH 295S Mathematical Methods (Advanced) 4 units

Prereq Mathematics 291 or Credit in Mathematics 201
Classes Sem 2: (3 lec & 1 tut)/wk
Assessment one 2hr exam, assignments

U2.022 PHYSICS 201F Physics (Technological) A 8 units

Dr Tango
Qual Physics 103 or 104 or 192
Prereq 12 units of Junior Mathematics other than Mathematics 111 and 112 (Mathematics 101 or 191 plus 102 or 192 recommended) or Credit or better in Mathematics 111 and 112
Classes Sem 1: (3 lec, 3 prac & 2 microlab)/wk
Assessment one 3hr exam, microlab (report & test)

Lectures
This course is designed for students majoring in the physical and engineering sciences. The lecture topics are quantum mechanics, with applications to solid state and particle physics, astronomy, and introductory electromagnetic theory.

Practical work
Experimental physics is taught as a laboratory course of three-hour sessions and includes experiments in the areas of instrumentation, quantum physics, properties of matter and environmental sensing and measurement. The course is based on mastery of the material, with marks awarded on completion of each experiment. Assessment is also based on reviews of the students' logbooks.

Microlab
Computational Physics is taught in ten two-hour sessions in a PC based computing laboratory. An introductory session is held at the beginning of the semester for students who are not familiar with personal computers. Students work in teams of three and use simple Pascal programming to develop solutions to problems in quantum mechanics. Computational physics is assessed by a short written report and a one-hour test administered individually.

Textbooks
R. Eisberg and R. Resnick Quantum Physics (Wiley, 1985)
J. C. Byrne (ed.) Experimental Physics Notes (School of Physics)

U2.022A PHYSICS 291F Physics (Advanced) A 8 units

Dr Tango
Qual Physics 192 or Credit or better in Physics 103 or 104
Prereq 12 units of Junior Mathematics other than Mathematics 111 and 112 (Mathematics 101 or 191 plus 102 or 192 recommended) or Credit or better in Mathematics 111 and 112
Classes Sem 1: (3 lec, 3 prac & 2 microlab)/wk
Assessment two 2.5hr exam, microlab (report & test)

Lectures
The advanced Intermediate courses are intended for students who have a strong interest in Physics. The advanced lecture subjects are generally more rigorous and cover material in greater depth than is done in the regular lecture series. The assessment of the advanced subjects will reflect the more challenging nature of the material presented. The lectures in Physics 291 include advanced quantum mechanics, astronomy, and an introduction to advanced electrodynamics.

Practical work
As for Physics 201.

Microlab
As for Physics 201.

Textbooks
R. Eisberg and R. Resnick Quantum Physics (Wiley, 1985)
J. C. Byrne (ed.) Experimental Physics Notes (School of Physics)

U2.022E PHYSICS 201F Physics (modified) 6 units

For Electrical Engineering students only.

Syllabus as for U2.022 minus Computational Physics A and Astronomy.

U2.023 PHYSICS 202S Physics (Technological) B 8 units

Dr Tango
Qual Physics 103 or 104 or 192
Prereq 12 units of Junior Mathematics other than Mathematics 111 and 112 (Mathematics 101 or 191 plus 102 or 192 recommended) or Credit or better in Mathematics 111 and 112
Classes Sem 2: (3 lec, 3 prac & 2 microlab)/wk
Assessment two 2.5hr exam, 2 prac reports, microlab (report & test)

Lectures
This course is designed for students majoring in the physical and engineering sciences. The lecture topics are electromagnetic properties of matter, instrumentation for the physical and environmental sciences, and optics for communications and sensing.

Practical work
As for Physics 201, except that in the second semester course students will be asked to submit one or two written and oral reports on selected experiments.

Microlab
The computational physics component is similar to that of Physics 201, except that the material for the course will be drawn from the optics textbook.

Textbook
J. O'Byrne (ed.) Experimental Physics Notes (School of Physics)

Reference book
E. Hecht Optics (Addison-Wesley, 1987)

U2.023A PHYSICS 292S Physics (Advanced) B 8 units

Dr Tango
Qual Physics 192 or Credit or better in Physics 103 or 104
Prereq 12 units of Junior Mathematics other than Mathematics 111 and 112 (Mathematics 101 or 191 plus 102 or 192 recommended) or Credit or better in Mathematics 111 and 112
Classes Sem 2: (3 lec, 3 prac & 2 microlab)/wk
Assessment two 2.5hr exam, 2 prac reports, microlab (report & test)
Lectures
Refer to Physics 291 for an overall description of the advanced Intermediate program. The lectures in Physics 292 include advanced electrodynamics, advanced optics, and instrumentation for the physical and environmental sciences.

Practical work
As for Physics 202.

Microlab
As for Physics 202.

Textbooks
D.J. Griffiths *Introduction to Electrodynamics* (Prentice Hall, 1989)
J. CByrne (ed.) *Experimental Physics Notes* (School of Physics)

Reference Book
E. Hecht *Optics* (Addison-Wesley, 1987)

**U2.023E PHYSICS 202S Technological B (modified)**
6 units
For Electrical Engineering students.

Syllabus as for U2.023 minus AC Circuit Theory.

**U2.030A CHEM 201F Chemistry 2 (Life Sciences)**
8 units
*Prereq* Chemistry 112 or 192 or 194 and 12 units of Junior Mathematics courses
*May not be counted with* Chemistry 211 or 221 or 231 or 291 or 252
*Classes* Sem 1: (4 lec & 4hr prac)/wk
*Assessment* exam (67%), lab exercises (33%)

*Lectures and tutorials*
In addition to the core, the remaining 20 lectures are distinct for this course and apply the core knowledge to chemical problems in Life Sciences. Areas covered include: structure and thermodynamics of biomolecules and biomaterials, and biological organic chemistry. Non-compulsory tutorials will also be provided at a rate of one per week.

*Practical work*
Practical work entails 4 hours per week for 14 weeks during the semester. Students must ensure that one complete afternoon from 1pm to 5pm, free from other commitments, is available for this practical work.

*Additional information*
The aim of this course is to provide students interested in life sciences with the chemical knowledge required for an understanding of the subject.

*Textbooks*
To be advised

**U2.030B CHEM 211F Chemistry 2 (Environmental)**
8 units
*Prereq* Chemistry 112 or 192 or 194 and 12 units of Junior Mathematics courses
*May not be counted with* Chemistry 201 or 211 or 221 or 231 or 252
*Classes* Sem 1: (4 lec & 4hr prac)/wk
*Assessment* exam (67%), lab exercises (33%)

*Lectures*
This course consists of: 18 lectures in which the structure, bonding and properties of inorganic compounds and complexes will be presented; 18 lectures of physical chemistry on statistical thermodynamics and thermodynamics; and 18 lectures in organic chemistry which will include amine chemistry, electrophilic substitution and the chemistry of aromatics, the chemistry of carbonyls, nucleophilic organometallic reagents and organic synthesis and synthetic methods.

*Practical work*
As for Chemistry 201.

*Additional information*
Chemistry Principles is designed for students who wish to continue to Senior chemistry courses after taking the more descriptive Intermediate courses in first semester.

**U2.030C CHEM 221F Chemistry 2 (Materials)**
8 units
*Prereq* Chemistry 112 or 192 or 194 and 12 units of Junior Mathematics courses
*May not be counted with* Chemistry 201 or 211 or 221 or 231 or 252
*Classes* Sem 1: (4 lec & 4hr prac)/wk
*Assessment* exam (67%), lab exercises (33%)

*Lectures*
In addition to the core, the remaining 20 lectures are distinct for this course and apply the core knowledge to chemical problems in Environmental Science.

*Practical work*
As for Chemistry 201.

*Additional information*
The aim of this course is to provide students interested in environmental science with the chemical knowledge required for an understanding of the subject.

*Textbooks*
To be advised

**U2.030D CHEM 222S Chemistry 2 (Principles)**
8 units
*Prereq* Chemistry 201 or 211 or 221 or 231 or 252
*May not be counted with* Chemistry 232 or 292
*Classes* Sem 2: (4 lec & 4hr prac)/wk
*Assessment* exam (67%), lab exercises (33%)

*Lectures*
This course consists of: 18 lectures in which the structure, bonding and properties of inorganic compounds and complexes will be presented; 18 lectures of physical chemistry on statistical thermodynamics and thermodynamics; and 18 lectures in organic chemistry which will include amine chemistry, electrophilic substitution and the chemistry of aromatics, the chemistry of carbonyls, nucleophilic organometallic reagents and organic synthesis and synthetic methods.
U2.030E CHEM 231F Chemistry 2A 8 units
Prereq Chemistry 112 or 192 or 194 and 12 units of Junior Mathematics courses
May not be counted with Chemistry 201 or 211 or 221 or 252 or 291
Classes Sem 1: (4 lec & 4hr prac)/wk
Assessment exam (67%), lab exercises (33%)

Lectures and tutorials
A course of 18 lectures in inorganic chemistry, 18 lectures in organic chemistry and 18 lectures in physical/theoretical chemistry. Non-compulsory tutorials will also be provided at a rate of one per week.

Practical work
As for Chemistry 201.

Additional information
This is the main chemistry course for students expecting to major in chemistry.

Textbooks
To be advised

U2.030F CH EM 232S Chemistry 2B 8 units
Prereq Chemistry 201 or 111 or 221 or 231 or 252
May not be counted with Chemistry 222 or 292
Classes Sem 2: (4 lec & 4hr prac)/wk
Assessment exam (67%), lab exercises (33%)

Lectures
This course consists of: 18 lectures in which the structure, bonding and properties of inorganic compounds and complexes will be presented; 18 lectures of physical chemistry on statistical thermodynamics and thermodynamics; and 18 lectures in organic chemistry which include chemistry, electrophilic substitution and the chemistry of aromatics, the chemistry of carbenes, nuclophilic organometallic reagents and organic synthesis and synthetic methods.

Practical work
As for Chemistry 201.

Additional information
Main chemistry course for students expecting to major in chemistry.

Textbooks
To be advised

U2.036A CHEM 291F Chemistry 2A (Advanced) 8 units
Prereq WAM greater than 80 and a Distinction average in Chemistry(I1lor191lor193) and in (112lor192lor194); and 12 units of Junior Mathematics courses. Entry to this course is by invitation. Students in the Faculty of Science Talented Students Program are automatically eligible
May not be counted with Chemistry 201 or 211 or 221 or 231 or 252
Classes Sem 1: (5 lec & 3hr prac)/wk
Assessment exam (67%), lab exercises (33%)

Lectures and tutorials
Lectures and tutorials in Chemistry 291 (Advanced) comprise two sets: Four lectures per week in common with any other Intermediate Chemistry course and one lecture per week of advanced lectures on topics that are complementary to the other courses.

Practical work
Practical work entails 3 hours per week during the semester. For 8 weeks students take practical exercises in common with any other Intermediate Chemistry course; for 6 weeks special advanced project-oriented exercises are offered.

Additional information
The number of places in Chemistry 291 (Advanced) is limited. Applications are invited from students with a high WAM and an excellent record in a Junior Chemistry course. Places are restricted to students enrolled in the Faculty of Science except by permission of the Head of the School of Chemistry. Students in the Faculty of Science Talented Student Program who are enrolled in the BSc or BSc(Adv) degree are automatically eligible. Students enrolled in other Advanced degree programs within the Faculty are not normally admitted because of timetabling.

Textbooks
To be advised
**Additional information**

The number of places in Chemistry 292 (Advanced) is limited. Normally entry to this course is restricted to those students enrolled in Chemistry 291. However, a student who has performed particularly well in another first semester Chemistry course may be invited by the Head of School to enrol in Chemistry 292S (Advanced). See the Intermediate Chemistry Course Coordinator for further information.

**Textbooks**

To be advised

**U2.0401 COMPUTER SCIENCE 201F**  
Computer Systems  
4 units  
Qual COMP 102 or 192  
Classes Sem 1: (2 lec, 2 prac)/wk  
Assessment assignments, written exam

An overview of the aspects of computer hardware that are important for understanding the function and performance of software. The course consists of two principal components. Machine Principles: In this section we discuss the organisation of a computer central processing unit, CPU, and the assembly and machine language commands that control it. We also pay particular attention to the different data types supported, such as two's complement integers and floating point. System Structures: In this section we discuss the low-level organisation of system software including the organisation and action of a simple compiler and its run-time environment, and the system call and interrupt handling mechanisms.

**U2.0402 COMPUTER SCIENCE 202F Design and Data Structures**  
4 units  
Qual COMP 102 or 192  
Classes Sem 1: (2 lec & 1 tut)/wk  
Assessment assignments, written exam

When there is numerous data, its structure (arrangement) determines what operations can be done with it. For example, the Sydney telephone directory may be used to find out a subscriber's telephone number, but not which subscriber has a given number. Many data structures have been developed over the years, each suited to a particular set of operations. This course introduces the most frequently used ones, including the array, linked list, binary tree, B-tree, hash table, heap, adjacency matrix, and adjacency lists. It shows how to implement them, verify their correctness, calculate their time complexity, and decide when to use them. More generally, this focus on data and its associated operations will lead to a productive approach to the design of large programs: data abstraction.

**U2.0403 COMPUTER SCIENCE 203S**  
Languages and Logic  
4 units  
Qual COMP 102 or 192  
Prereq COMP 202 or 292, (MATH 103 or 104 or 193 or 194)  
Classes Sem 2: (2 lec & 1 tut)/wk  
Assessment assignments, written exam

All communication requires a language. People communicate with each other in a natural language such as English; they communicate with computers in a formal language such as Pascal. This course studies two important kinds of formal languages (called regular and context-free), and the algorithms, or automata, that are used to recognise them. On the theoretical side, several ways to represent languages are presented, and their capabilities and limitations discovered; on the practical side, sound and indeed foolproof methods are derived for writing programs to recognise formal languages such as Pascal. Considerable emphasis is also put on the use of logic (both prepositional and first-order), which provides a powerful design tool for hardware implementations of automata.

**U2.0404 COMPUTER SCIENCE 204S**  
Programming Practice  
4 units  
Qual COMP 102 or 192  
Prereq COMP 202 or 292  
Classes Sem 2: (2 lec & 1 tut)/wk  
Assessment assignments, written exam

In this course we attack the task of the programmer from an engineering viewpoint. This means that a major focus is on using existing tools as building blocks to complete a task. This course will teach C programming, its idiom and its considerable array of powerful programming tools. In addition, students will study the implementation of some of the library tools so that they gain an appreciation of how much better these are than a typical programmer would be able to create. In addition, it will introduce students to some of the very elegant ideas from computer science that have been applied in the construction of the tools.

Advanced Options are available for U2.0401 - U2.0404 inclusive. Entry requirements and syllabus summaries available from Computer Science

**U2.0405 COMPUTER SCIENCE 205F**  
Computer Systems (EE)  
3 units  
For Electrical Engineering students only.

Syllabus available from Computer Science.

**U2.0406 COMPUTER SCIENCE 206S**  
Languages and Logic (EE)  
3 units  
For Electrical Engineering students only.

Syllabus available from Computer Science.

**Intermediate Geology courses**

Only part of geology can be learned from books and laboratory research, the rest has to be investigated in the field. The courses designated Geology 201, 202 and 203 all contain a field work component.

For further details of the following courses consult the pamphlet on the Intermediate courses in Geology, obtainable from the Enquiry Office in the Edgeworth David Building.

**U2.050A GEOLOGY 201F Plate Tectonics and Materials**  
8 units  
Coordinator Dr Klepeis  
Prereq Geology 102 or Environmental Science 101  
Classes Sem 1: (4 lec & 2 prac or tut)/wk  
Assessment two 2hr theory, lab exam, class work
This course introduces students to new practical techniques that provide a heightened understanding of the concepts introduced in the Junior courses in Geology. The principal objectives of this course are: (1) to explore the quantitative tectono-physical approach to global plate tectonics, (2) to introduce students to the analysis and interpretation of geological structures, (3) to provide a theoretical and practical introduction to the use of the polarising microscope in mineralogy and petrography, (4) to provide an introduction to the methods of optical crystallography and optical mineralogy, (5) to investigate the fundamental processes responsible for the origin and evolution of the main types of rocks, and (6) to use the polarising microscope to reveal the textures and phases present in the common igneous, sedimentary and metamorphic rocks.

**U2.050B GEOLOGY 202S Resource Exploration** 4 units

**Coordinator** Dr Birch  
**Prereq** Geology 201  
**Classes** Sem 2: (2 lec & 1 prac or tut)/wk  
**Assessment** one 3hr exam, class work

Mining is an important and essential part of the Australian economy. This course reviews the various economic mineral deposits that are currently mined in Australia. It shows how the geological concepts developed in Geology 201 can be applied to the study of fuels and ore deposits. The course also includes an introduction to the techniques used in geophysical exploration.

**U2.050C GEOLOGY 203S Fossils and Time** 4 units

**Coordinator** Dr Buick  
**Prereq** 24 units of Science courses  
**Classes** Sem 2: (2 lec & 1 prac or tut)/wk  
**Assessment** one 3hr theory, lab exam, class work

This palaeontology and stratigraphy course is aimed at geoscientists, archaeologists, biologists, geographers and others who use fossils or stratigraphic data to determine ages, environments or evolutionary lineages. It provides an overview of fossil biodiversity, concentrating on invertebrate animals but also covering vertebrates, plants and microorganisms, with the emphasis on those groups that are most environmentally or stratigraphically useful. It also considers the main methods of stratigraphic age determination.

**U2.052 Engineering Geology 2** 5 units

*Intermediate core course* for the degree in Civil Engineering, unless the course U2.050 Geology 2 has been completed.

**Mutually exclusive with** U2.050 Geology 2, U2.052 Engineering Geology B  
**Prereq** either U1.050 Geology 1 or U1.051 Engineering Geology 1  
**Coreq** nil  
**Classes** 26hrs lec, 39hrs lab. Field excursions in the Sydney region, as appropriate

**Assessment** practical lab work plus one 3hr exam at the end of the semester. Assignment work may also be included in the final assessment, as advised at the commencement of the course

**Course objectives:** To introduce and emphasise the role of geology in civil engineering projects.

**Expected outcomes:** Students should gain an appreciation of the importance of geology in the planning and execution of civil engineering projects, and be able to apply their knowledge of geology to the solution of soil and rock engineering problems.

**Syllabus summary:** Application of geological principles and practices to solving problems in civil engineering.

**Textbooks**

- A.B.A. Brink *Engineering Geology of South Africa* (Blackwell)
- P.J.N. Pells (ed.) *Engineering Geology of the Sydney Region* (Balkema)

**Library classifications:** 552,624.15

**U2.065A Biochemistry 201F: Genes and Proteins** 8 units

**Dr Denyer, Mrs Loke, Biochemistry staff**  
**Qual** 12 units of Junior Chemistry which must include Chemistry 112 or 192 or 194  
**Prereq** 12 units of Junior courses in either Biology or Physics  
**Classes** Sem 1: (3 lec & 5 prac)/wk  
**Assessment** one 3hr exam, one 2hr theory of prac exam, prac tasks

The lecture course introduces the main principles of biochemistry i.e. the molecular basis of life. In the beginning the course concentrates on proteins and, in particular, the mechanism of action of enzymes in the light of what we know of their structures. The second half of the course concentrates on nucleic acids (DNA and KNA) as the molecules of heredity and gene expression, and includes aseconon DNA replication, transcription and translation. The processes of replication and transcription are highly controlled in multicellular organisms and these control mechanisms are discussed. The last section of the course will describe how these processes are put together in a whole organism in order to maintain life; the anabolism and catabolism of fuels under normal conditions and under conditions of starvation or exercise.

The practical course aims to teach basic biochemical skills. The emphasis is on obtaining quality data by individual and cooperative interactions within groups for problem solving.

**Textbooks**

To be advised

**U2.065B Biochemistry 202S Molecules, Metabolism and Cells** 8 units

**Dr Denyer, Mrs Loke, Biochemistry staff**  
**Qual** Biochemistry 201 or 291  
**Classes** Sem 2: (3 lec & 5 prac)/wk  
**Assessment** one 3hr exam, one 2hr theory of prac exam, prac tasks
This course aims to describe, at the molecular level, how cells work. The chemical reactions which occur inside cells is described in the first series of lectures, Cellular Metabolism. Aspects of the molecular architecture of cells which enable them to function and communicate are described in the second half of the course, Molecular Aspects of Cell Biology. At every stage the course relates how the function of each individual cell is coordinated and integrated with other cells especially in humans.

**Cellular Metabolism**

How cells extract energy from fuel molecules like fatty acids and carbohydrates. The regulation of energy extraction. How the body selects which fuels to use under different circumstances such as starvation and exercise. The metabolic inter-relationships of the muscle, brain, adipose tissue and liver. The role of hormones in coordinating the regulation of fuel utilisation and the mobilisation of fuel stores. How cells lay down stores of fuels. The synthesis and storage of fat and carbohydrate. The digestion of fats, starches and sugars and the use of ingested materials to make new cellular components. Synthesis and use of biochemical building blocks. The chemistry of life: the strategies and mechanisms involved in biochemical reactions and the involvement of coenzymes and vitamins in biological inter-conversions.

**Molecular Aspects of Cell Biology**


The practical course builds on the skills acquired in Biochemistry 201. The work is more complicated and more structured.

**Assessment**

one 3hr exam at end of course. Satisfactory lab work is a requirement for passing the course and it is included in the final assessment.

**Course objectives:** To develop an understanding of the microstructure and mechanical properties of metals, ceramics, polymers and their composites.

**Course outcomes:** Ability to describe the influence of microstructure of metals, ceramics, polymers upon their strength, elastic, plastic and creep behaviour.

**Syllabus summary:** Microstructure and bonding of metals, ceramics, polymers and composites and their influence upon the mechanical properties of these materials (i.e. strength, elasticity, plasticity, creep, etc.).

**Textbooks**

To be advised

**U2.090 Asian Studies 1** 8 units Intermediate elective course.

**Classes** Yr: one 2hr class/wk in the early evening and a 3-week full-time intensive course in the July vacation. Attendance is required at all lectures and classes

**Assessment** oral tests, written assignments, and one 2hr written exam in each of June and November

**Syllabus summary:** language study (75%), general culture (15%), business culture (10%) for the country chosen.

**U2.210 Introduction to Materials** 4 units Intermediate core course for the degree in Civil Engineering.

**Mutually exclusive with** U1.210 Materials 1

**Classes** 40hrs lec & approx. 12hrs lab

**Assessment** one 3hr exam at end of course. Satisfactory lab work is a requirement for passing the course and it is included in the final assessment.

**Course objectives:** To develop an understanding of the microstructure and mechanical properties of metals, ceramics, polymers and their composites.

**Course outcomes:** Ability to describe the influence of microstructure of metals, ceramics, polymers upon their strength, elastic, plastic and creep behaviour.

**Syllabus summary:** Microstructure and bonding of metals, ceramics, polymers and composites and their influence upon the mechanical properties of these materials (i.e. strength, elasticity, plasticity, creep, etc.).

**Textbooks**

To be advised

**Reference books**


Library classification: U620.11-19, U668.4, U669 (Fisher Library)

**U2.221 Structural Mechanics** 5 units Intermediate core course for the degree in Civil Engineering.

**Mutually exclusive with** U2.220 Structures 1

**Prereq** U1.000 Mathematics 1, U1.010 Mechanics IE and U1.220 Statics

**Classes** 39hrs lec, 26hrs tut

**Assessment** class assignments and one 3hr closed-book exam covering the whole syllabus at the end of semester
Course objectives: To provide a basic understanding of the principles of elementary stress and stiffness analyses of simple structural elements under static loading and to be able to use these principles to analyze simple structural elements using hand computation methods.

Expected outcomes: Proficiency in basic methods of simple structural analysis and interpretation of results.

Syllabus summary: Review of basic statics; elementary elasticity, geometric properties of plane areas, axial loading, flexure in beams, shear stresses in beams, uniform torsion, bending deflections, elementary instability, influence lines, triangulated frames and trusses, combined stresses, continuum mechanics—stresses and strains in 2D, failure theories for materials.

Textbook
Megson Strength of Materials for Civil Engineering 2nd edn (Arnold)

Reference books
Gordon Structures (Penguin, 1978)

Library classification: U624.17 (Fisher Library)

U2.261 Fluids 1 5 units
Intermediate core course for the degree in Civil Engineering.

Mutually exclusive with U3.261 Fluids 1
Prereq U1.000 Mathematics 1
Classes 26hrs lec, 39hrs lab/tut
Assessment one 3hr exam covering the whole syllabus at the end of semester. Satisfactory laboratory and tutorial performance is also a requirement. Credit will be given for laboratory and tutorial submissions, as indicated at the commencement of the course

Course objectives: To develop an understanding of: patterns of movement of fluid particles and associated force and energy relationships; applications of basic concepts to cases of fluids in containers and conduits.

Expected outcomes: Students should gain the ability: to determine fluid movements and forces in pipes and open channels and around bodies in fluid streams.


Textbooks
Hydraulics Data Sheets (School of Civil and Mining Engineering, University of Sydney)
Rouse Elementary Mechanics of Fluids (Dover)
or
Streeter and Wylie Fluid Mechanics (McGraw-Hill)
or
Douglas, Gasior and Swaffield Fluid Mechanics (Pitman)
or
Vennard and Street Elementary Fluid Mechanics (Wiley)

Library classification: 532

U2.272 Engineering Communications 1 2 units
Intermediate core course for the degree in Civil Engineering.

Classes 12hrs lec, 14hrs discussion/oral presentation
Assessment based on three written reports and three oral presentations. Extra credit for some or all oral presentations may be given for verifiable public speaking activities with the students' section of the Institution of Engineers, Australia, the University of Sydney Debating Society or equivalent organisation. Students are encouraged to engage in these activities

Course objectives: To develop effective written and oral communication skills.

Expected outcomes: Ability to make written and oral presentations on topics of general, technical and/or social significance to small peer groups.

Syllabus summary: 12 hours of lectures on effective report writing and oral presentation. Written reports and oral presentation on three topics of general, technical and/or social significance of 5, 10 or 15 minutes' duration. Oral presentation in groups of eight students in a lecture or round-table discussion format.

Reading material
According to chosen topic in consultation with academic staff

U2.290 Structural Design 4 units
Intermediate core course for the degree in Civil Engineering.

Prereq U1.000 Mathematics 1, U1.010 Mechanics IE and U1.220 Statics
Coreq U2.221 Structural Mechanics
Classes 26hrs lec, 26hrs design classes
Assessment design class assignments and one 3hr closed-book exam covering the whole syllabus on steel and concrete design at the end of semester

Course objectives: To provide a basic understanding of design concepts and the design steel and concrete elements to current code criteria.

Expected outcomes: Proficiency in the design of simple structural elements in steel and concrete.

Syllabus summary: Steel and concrete structures; introduction to the behaviour, analysis and design of simple elements. Introduction to the concepts of design through case histories and a design competition.

Textbooks
SAA HB2.2—Australian Standards for Civil Engineering Students: Part 2: Structural Engineering
or
SAA AS4100—Steel Structures Code
SAA AS3600—Concrete Structures Code and SAA AS1170—Loading Code, Parts I and II
Buckle The Elements of Structures 2nd edn (Pitman International)
Schodek Structures (Prentice-Hall)

Reference books
Cowan The Design of Reinforced Concrete student edn (Sydney U.P.)
Ferguson Reinforced Concrete Fundamentals student edn (Wiley)
Gordon Structures—or Why Things Don't Fall Down (Pelican)
Park and Paulay Reinforced Concrete Structures (Wiley)
Trahair and Bradford Behaviour and Design of Steel Structures 2nd edn (Chapman and Hall)
Warner, Rangan and Hall Reinforced Concrete (Pitman)

Library classification: U624.182: U624.183 (Fisher Library)
Objectives: To understand the governing laws of thermodynamics, fluid mechanics and kinematics. To be able to apply these laws to common engineering problems.

Outcomes: (i) ability to apply the first and second laws of thermodynamics to a range of engineering situations including power and refrigeration cycles; (ii) ability to determine loads on dam walls, stability of ships, to calculate thrust of jets, output from windpower generators; to predict drag of bodies from scale model testing, to predict pressures, forces and velocities in fluid flow; (iii) ability to formulate and solve one- and two-dimensional dynamic problems, including those involving moving frame of reference. Ability to construct velocity and acceleration diagrams for a planar mechanism.

Reference books
Mabie and Reinholtz *Mechanisms and Dynamics of Machinery* 4th edn (Wiley, 1987)
U2.417 Introductory Mechanics and Materials 8 units

Intermediate core course for the degrees in Mechanical and Mechatronic Engineering.

Mutually exclusive with: U1.210 Materials 1; U1.650 Materials and Corrosion; U1.710 Aeronautical Engineering; U2.700 Mechanics and Properties of Solids 1 and U2.701 Mechanics of Solids 1

Prereq: U1.000 Materials 1

Classes: Sem 1: (5 lec & 3 hrs tut)/wk plus three 3hr lab sessions

Assessment: one 3-hr exam at end of Sem 1 plus assignment work

Course objectives: (a) To understand the classification of engineering materials, their properties in relation to microstructure; and (b) to understand simple stress systems and material response.

Expected outcomes: Students should be able to appreciate the properties of a range of engineering materials and how and why these are connected with microstructures and forming and treatment methods. They should also be capable of selecting materials for mechanical design involving simple stress systems and different service conditions.


Textbooks

Reference books
- Ashby and Jones Engineering Materials 1—An Introduction to their Properties and Applications (Pergamon, 1981)
- Bailey The Role of Microstructure in Metal (Metallurgical Services, 1966)
- Bailey Introductory Practical Metallography (Metallurgical Services, 1966)
- Bailey The Structure and Strength of Metal (Metallurgical Services/1967)
- John Understanding Phase Diagrams (Macmillan, 1974)

Library Classification: 620,624,666-679

U2.440 Mechanical Design 1 8 units

Intermediate core course for the degree in Mechanical and Mechatronic Engineering.

Mutually exclusive with U2.441 Mechanical Design IA and U2.443 Mechatronic Design I

Coreq: U2.700 Mechanics and Properties of Solids 1 or U2.417 Introductory Mechanics and Materials

Classes: Sem 2: (4 lec/ tut, one 2hr & one 3hr drawing office session)/wk

Assessment: assignments and quizzes

Course Objectives: To develop an understanding of:
- the need for and use of standard drawings in the communication and definition of parts and assemblies,
- creativity,
- the design process from initial idea to finished product,
- the use of analog and digital electronic components and sensors in a mechanical design environment.

Expected Outcomes: Students should develop skills in:
- working in teams,
- freehand sketching and drafting practices,
- idea generation methods,
- design analysis techniques and layout,
- design development and testing,
- written and graphical communication, and
- Incorporating electronic components and sensors in the design of simple mechanical systems.

Syllabus summary:

Syllabus summary: Detail design of components including: design loads, failure and factor of safety; calculation approach and presentation conventions; stress effects in shape and material selection; introduction to engineering hardware including fasteners, bearings and mechanical power transmission. Introduction to involute gears and gear trains (including epicyclic).

(c) Mechatronic Design—Introduction to design of mechatronic systems. Elements of mechatronic systems; actuators, sensors, interfacing electronics. Industrial examples.

Textbooks
- Boudny Engineering Drawing (McGraw-Hill)
- Shigley Mechanical Engineering Design (McGraw-Hill)

U2.441 Mechanical Design 1A 6 units

Intermediate core course—iox the degree in Aeronautical Engineering.

Mutually exclusive with U2.440 Mechanical Design 1

Coreq: U2.700 Mechanics and Properties of Solids 1 or U2.417 Introductory Mechanics and Materials

Classes: Sem 2: (2 lec, one 2hr & one 3hr drawing office session)/wk

Assessment: assignments and quizzes

Course Objectives: To develop an understanding of:
- the need for and use of standard drawings in the communication and definition of parts and assemblies,
- creativity,
- the design process from initial idea to finished product.
• methods use to analyse designs,
• standard components, and
• the use of analog and digital electronic components and sensors in a mechanical design environment.

Expected Outcomes: Students should develop skills in:
• working in teams,
• freehand sketching and drafting practices,
• idea generation methods,
• design analysis techniques and layout,
• design development and testing, and
• written and graphical communication incorporating electronic components and sensors in the design of simple mechanical systems.

Syllabus summary:


Detail design of components including: design loads, failure and factor of safety; calculation approach and presentation conventions; stress effects in shape definition and material selection; introduction to engineering hardware including fasteners, bearings and mechanical power transmission. Introduction to involute gears and gear trains (including epicyclic).

Textbooks
Boundy Engineering Drawing (McGraw-Hill)
Shigley Mechanical Engineering Design (McGraw-Hill)

U2.443 Mechatronic Design 1 2 units
Intermediate core course for Mechanical/Mechatronic Engineering students doing the Bachelor of Engineering/Bachelor of Science double degree.

Mutually exclusive with U2.440 Mechanical Design 1
Coreq U2.441 Mechanical Design IA
Classes Sem 2: (one 2hr lec/tut)/wk
Assessment assignments and quizzes

Course objectives: To provide a basic understanding of the use of analog and digital electronic components and sensors in a mechanical design environment.

Expected outcomes: The development of some of the skills required to incorporate electronic components and sensors in the design of simple mechanical systems.

Syllabus summary: Introduction to design of mechatronic systems. Elements of mechatronic systems; actuators, sensors, interfacing electronics. Industrial and sensors in the design of simple mechanical systems.

U2.471 Introductory Mechatronics 6 units
Intermediate core course for the degree in Mechanical Engineering (Mechatronics).

Mutually exclusive with U2.510 Electrical Engineering 2; U2.511 Electrical Engineering 2A, U2.512 Electrical Engineering 2B and U3.500 Industrial Electronics

Prereq U1.410 Mechanical Engineering 1
Coreq U2.504 Electrical and Electronic Engineering
Classes Sem 2: (3 lec & 3hrs lab/tut)/wk
Assessment one 3hr exam at end of Sem 2 plus lab reports and mid-semester tests

Syllabus summary:
Circuit theory. Linear network analysis: complex frequency representation; complete response; special circuits; complex power; network functions; stability.

Aspects of machine control: review of electric motor types (DC and SC) and their characteristics; protection of machines: thermal overload switches, relays, fuses, circuit breakers and electronic protection; electronic control: SCRs, Triacs, GTOs, IGBTs. Controlled rectifiers and inverter circuits; harmonics, power factor; application of power control to electric motor drives.

Digital systems: concepts in digital design; combinational circuit design; sequential circuit design; algorithms and architectures; design decisions and implementation; computer aids and design process.

U2.502 Electrical Technology 4 units
Intermediate core course for the degrees in Chemical and Aeronautical Engineering.

Prereq U1.000 Mathematics 1
Classes Sem: 2 lec/wk and nine 3hr tut/lab sessions
Assessment one 2hr exam at end of sem; lab reports; and mid-sem tests


U2.504 Electrical and Electronic Engineering 6 units
Intermediate core course for the degrees in Mechanical and Mechatronic Engineering.

Mutually exclusive with U2.510 Electrical Engineering 2, U2.511 Electrical Engineering 2A, U2.512 Electrical Engineering 2B
Prereq U1.410 Mechanical Engineering 1
Classes Sem 1: (3 lec & 3hrs lab/tut)/wk
Assessment one 3hr exam at end Sem 1 plus lab reports and mid-semester tests


Principle of electromagnetic energy conversion.


Operational amplifiers: Characteristics, ideal and real. Feedback. Design with op amps: inverting, non-inverting and differential amplifiers; integrator and differentiator; simple filters, comparator and Schmitt trigger.

Digital electronics: Numbering systems. Gates and combinational logic. Latches, synchronous and asynchronous counters. Flip-flops and memory. TTL and CMOS logic families. Practical design examples.


Textbooks
Smith, RJ and Dorf, RC *Circuits Devices and Systems* 5th edn

U2.511 Electrical Engineering 2A 8 units
*Intermediate core course* for the degree in Electrical Engineering.

*Mutually exclusive with* U2.471 Introductory Mediatronics, U2.502 Electrical Technology, U2.504 Electrical and Electronic Engineering

*Prereq* U1.511 Electrical Engineering I

*Classes* 5lec/wk plus 36hrs of lab/tut

*Assessment* two 2hr exams plus reports and assignments

**Syllabus summary:**

**Circuits and energy conversion**—Transient and steady state responses of electric circuits. Complex frequency analysis, phasors. Laplace transform, transfer functions and frequency response. Transformers. Two port networks. Introduction to energy conversion; balanced three phase circuits. Modelling and simulation using Matlab.

**Digital systems**—Computer architecture and assembly language programming. Microprocessor and microcontroller systems, memory and IO interfacing, serial and parallel communications; real time control; system design decision, implementation and debugging.

**Engineering development and structure**—Engineering in history; early electrical engineering; engineering in Australia; industry and the economy; Australian economy in a world context; electrical engineering and economic development.

U2.512 Electrical Engineering 2B 8 units
*Intermediate core course* for the degree in Electrical Engineering.

*Mutually exclusive with* U2.502 Electrical Technology, U2.504 Electrical and Electronic Engineering

*Prereq* U1.511 Electrical Engineering I

*Coreq* U2.021 Physics 2EE

*Classes* 5lec/wk plus 36hrs of lab/tut

*Assessment* two 2hr exams plus reports and assignments

**Syllabus summary:**

**Electronics**—Basics of semiconductors, diodes, transistors; small-signal and large-signal models, rectification, biasing, gain; FET and BJT circuits, introduction to operational amplifiers.

**Signals and communications**—Time and frequency characteristics of elementary signals and periodic and non-periodic signals. Fourier series and transform. Linear systems: impulse and frequency response. System function of analog filters. Communication system fundamentals: channels, baseband communication of analog signals and binary data, amplitude and frequency modulation and demodulation.

**Product innovation**—The product innovation process; role of the engineer in innovation.

U2.610 Chemical Engineering 2 8 units
*Intermediate core course* for the degree in Chemical Engineering.

*Prereq* U1.000 Mathematics I

*Coreq* U1.610 Chemical Engineering 1

*Classes* Yr: (2 lec & 1 tut)/wk; plus 5 lab sessions in Sem 2

*Assessment* lab reports; assignments; and 2 exam papers, one at end of each sem

**Syllabus summary:** An integrated introductory treatment of the transport of momentum, heat and mass.

Fluid statics: application to pressure measurement and forces on storage vessels. Inviscid flow theory: application to flow measurement and enlargement losses. Laminar flow of Newtonian fluids in pipes: derivation of velocity profile, flow rate and frictional loss. Turbulent flow in pipes: application of dimensional analysis, frictionfactors; energy balances for pipe flow systems. Pumps: theory of reciprocating and centrifugal pumps; cavitation and NPSH.


**Design competition**

This is a light-hearted exercise in which students of U2.610 Chemical Engineering 2 design, build and operate a simple device to solve an unusual Chemical Engineering problem. Past problems have included the task of producing separated shell, yolk and white from a whole raw egg. A small entry fee is charged and prizes are awarded.

Textbooks

Others as advised during classes
U2.611 Fundamentals of Environmental Chemical Engineering 4 units
Intermediate core course for the degree in Chemical Engineering.
Prereq: U1.000 Mathematics I, U.031 Chemistry IE, U1.610 Chemical Engineering I
Coreq: U2.610 Chemical Engineering 2
Classes: 4 hrs lec & tut/wk
Assessment: tut assignments and one 2 hr exam at end of course

Objectives: to acquaint the student with environmental pollutants and their effects; to introduce the application of engineering concepts to the analysis of pollution problems and their control; to introduce common processes and technologies designed to reduce pollution or its impact on the environment.


Textbook
Course notes (Department of Chemical Engineering) based on: Reible Fundamentals of Environmental Engineering (in preparation)

U2.612 Chemical Engineering Computations 4 units
Intermediate core course for the degree in Chemical Engineering.
Prereq: U1.000 Mathematics I, U1.630 Computing for Chemical Engineers
Classes: 4 hrs lec & tut/wk
Assessment: tutorial assignments and one 2 hr exam at end of course


Textbook
Course notes (Department of Chemical Engineering)

U2.700 Mechanics and Properties of Solids 1 6 units
Intermediate core course for the degree in Aeronautical Engineering.

Mutually exclusive with U2.701 Mechanics of Solids 1 or U2.417 Introductory Mechanics and Materials
Prereq: U1.000 Mathematics I
Classes: 3 lec & one 2 hr tut/wk plus three 3 hr lab sessions
Assessment: one 3 hr exam at end of course

Syllabus summary: Mechanics of Solids—Concepts of equilibrium, compatibility, stress and strain; study of internal stress systems due to tension, bending, torsion and shear; statistically determinate and indeterminate structural elements; concepts of energy methods, displacement analysis; simple buckling. Presentation and emphasis based on type of structure common to mechanical, aeronautical, mining and engineering in general.

Properties of Materials—Dislocation in materials; heat treatment and metalworking processes; fundamentals of corrosion and oxidation.

Textbook

Reference books
There are about 30 different texts in the Engineering Library with titles such as 'Strength of materials', 'Mechanics of Solids' and 'Properties of Materials'. Students will see from perusal of these, different ways of describing the contents of this course
Bailey The Role of Microstructure in Metal (Metallurgical Services, 1966)
Bailey Introductory Practical Metallography (Metallurgical Services)
Bailey The Structure and Strength of Metals (Metallurgical Services)
Hull and Bacon Introduction to Dislocations (Pergamon, 1984)
John Understanding Phase Diagrams (Macmillan, 1974)
Popov Mechanics of Material's IS edn (Prentice-Hall, 1978)
Library classification: 620.11

U2.701 Mechanics of Solids 1 4 units
Intermediate core course for the degree in Chemical Engineering.

Mutually exclusive with U2.700 Mechanics and Properties of Solids 1
Prereq: U1.000 Mathematics I
Classes: 2 lec & one 2 hr tut/wk
Assessment: one 2 hr exam at end of course

Syllabus summary: Concepts of equilibrium, compatibility, stress and strain; study of internal stress systems due to tension, bending, torsion and shear; statistically determinate and indeterminate structural elements; concepts of energy methods, displacement analysis; simple buckling. Presentation and emphasis based on type of structure common to mechanical, aeronautical, mining and Engineering in general.

Textbook

Reference books
There are about 30 different texts in the Engineering Library with titles such as 'Strength of Materials', 'Mechanics of Solids' and 'Properties of Materials'. Students will see from perusal of these, different ways of describing the contents of this course
Bailey The Role of Microstructure in Metals (Metallurgical Services, 1966)
Bailey Introductory Practical Metallography (Metallurgical Services)
Bailey The Structure and Strength of Metals (Metallurgical Services)
U2.710 Fluid Mechanics 4 units

**Intermediate core course** for the degree in Aeronautical Engineering.

*Mutually exclusive with U2.410 Mechanical Engineering 2*

**Classes**
- Sem 1: 1 lec/wk and associated tut
- Sem 2: 2 lec/wk and associated tut

**Assessment**
- One 1.5hr exam at end of Sem 1;
- One 2hr exam at end of Sem 2

**Syllabus summary:**
- Properties of a fluid; definition of pressure, temperature, density, viscosity, surface tension, etc., perfect gas laws.
- Definition of a continuum; Newtonian and non-Newtonian fluid behaviour; flow similitude and governing non-dimensional parameters; Reynolds number; Froude number; Weber number; Mach number.

Fluid statics. Basic hydrostatic equations; buoyancy; stability of floating bodies. Pressure measuring devices; barometers; manometers. Properties of the atmosphere.

Fluid dynamics. Conservation of mass, momentum and energy equations. Continuity equation; Bernoulli equation; Euler equation. Applications in flow rate and velocity measuring devices; venturi; pitot-static tube; orifice plate. Velocity potential equation for flow modelling; internal flows, external flows around immersed bodies and ground-water flows. Equations for steady flow in open channels; calculation of free surface; hydraulic jump; critical flow rate.

Viscosity and compressibility effects. Skin friction: boundary layer flows; laminar and turbulent flows; flow in pipes and ducts; friction losses. Speed of sound of waves in a fluid medium; effects of Mach number; introduction to supersonic flow; shock waves.

**Reference books**
- Houghton and Brock *Aerodynamics for Engineering Students* (Edward Arnold, 1988)

U2.770 Engineering Computation 4 units

**Intermediate core course** for the degree in Aeronautical Engineering.

*Prereq*
- U1.280 Engineering Programming and U1.281 Computer Graphics

**Classes**
- Sem 2: (1 lec & one 3hr computer lab)/wk

**Assessment**
- One 2hr exam at the end of Sem 2 and computer programming assignments during sem

**Syllabus summary:**
- Application of numerical solution techniques to solve problems in engineering. Numerical techniques for matrix multiplication; matrix inversion; solution of simultaneous linear equations. Calculation of eigenvalues and eigenvectors; discrete Fourier transforms. Procedures for iteration; numerical integration and differentiation. The storage of data in efficient file or memory structure; data retrieval; sorting algorithms. Random number generation and statistical analysis.

- The use and evaluation of package software; benchmarking; determination of limits and applicability. Usage of spreadsheets, databases, word processors, mathematical symbol manipulation; CAD/CAM, graphing programs and engineering analysis programs. Definitions for user-friendly interfaces; output format requirements.

Students will be required to carry out programming examples, in a variety of programming languages. These sample applications will cover topics such as the numerical solution of governing equations for fluid statics and fluid dynamics; numerical calculations of structural behaviour and force equilibrium; numerical simulation of the motion of simple kinematic systems; numerical modelling of simple thermodynamic cycles.

**Reference books**
- The Student Edition of MATLAB (Prentice-Hall, 1992)

U2.800 Engineering Construction 1 4 units

**Intermediate core course** for the degree in Civil Engineering and in Project Engineering and Management (Civil). Elective course for other branches.

*Prereq*
- U1.000 Mathematics 1

**Classes**
- Sem: 26hrs lec & 26hrs tut

**Assessment**
- One 3hr exam at end of course and assignments

**Syllabus summary:**
- Introduction to construction engineering fundamentals. Techniques for analysis of construction systems; productivity and cost evaluation. Selection and evaluation of plant and methods. Materials handling with special reference to earth and rock moving.

**Library classification:** 624, 624.068

U2.820 Engineering Economics 4 units

**Intermediate core course** for the degree in Project Engineering and Management (Civil). Elective course for other branches.

*Coreq*
- U2.000 Mathematics 2

**Assessment**
- Coursework and written examination

**Syllabus summary:**
- Engineering economy problems and alternatives, the decision making process, equivalence, discounted cash flow analyses, introduction to depreciation accounting, inflation, break-even analysis, probability in economy studies, appraisal of public projects, introduction to risk analysis.

U2.821 Engineering Accounting 4 units

**Intermediate core course** for the degree in Project Engineering and Management (Civil). Elective course for other branches.

*Coreq*
- U2.820 Engineering Economics

**Assessment**
- Coursework and written examination

**Syllabus summary:**
- Accounting fundamentals, business and accounting procedures, taxation, financial
statements, financial ratios, management of financial information, cash flow and profitability management.

**U3.607A MICR 203F Theoretical Microbiology A**
- **4 units**
- **Coordinator:** Mrs Dalins
- **Prereq:** Chemistry 112 or 192 or 194 and Mathematics (101 or 111 or 191) and 102 or 104 or 112 or 192 or 194
- **Classes:** 3 lec/wk
- **Assessment:** one 3hr exam

This course is suitable for students who are majoring in other aspects of biology and who wish to acquire a broad background knowledge of microbiology. Students attend the same lectures as those enrolled in Microbiology 201. There is no practical work and no tutorial component.

**Textbook**
As for Microbiology 201

**U3.607 B MICR 204S Theoretical Microbiology B**
- **4 units**
- **Coordinator:** Mrs Dalins
- **Prereq:** Microbiology 201 or 202 or 291
- **Classes:** 3 lec/wk
- **Assessment:** one 3hr exam

This course is suitable for students who are majoring in other aspects of biology and who wish to expand their knowledge of microbiology beyond that acquired in Microbiology 201,203 or 291 with further theoretical considerations of the subject. Students attend the same lectures as those enrolled in Microbiology 202. There is no practical or tutorial component.

**Textbook**
As for Microbiology 201

**U3.090 Asian Studies 2**
- **8 units**
- **Senior elective course.**
- **Prereq:** U2.090 Asian Studies 1.
- **Classes:** Yr. one 2hr class/wk and a three-week study tour of the country being studied in the July vacation. Students unable to participate in the study tour will have alternative coursework assigned.
- **Attendance is required at all lectures and classes**
- **Assessment:** oral tests, written assignments and one 2hr written exam in each of June and November

**Syllabus summary:** language study (60%), general culture (15%), business culture (25%) for the country chosen.

**U3.212 Properties of Materials**
- **4 units**
- **Senior core courses for the degree in Civil Engineering.**
- **Mutually exclusive with:** U3.211 Materials 2
- **Prereq:** U2.210 Introduction to Materials
- **Classes:** 40hrs lec & 12hrs lab
- **Assessment:** one 3hr exam covering the whole syllabus.

Satisfactory lab work is a prerequisite for passing the exam.

Textbooks
Rasmussen Structural Analysis I (University of Sydney)
Popov Introduction to the Mechanics of Solids (Prentice-Hall)
Parkes Braced Frameworks (Pergamon)
Timoshenko and Young Theory of Structures (McGraw-Hill)
Library classification: 624.17

U3.232 Concrete Structures 1 6 units
Senior core course for the degree in Civil Engineering.
Prereq U2.000 Mathematics 2, U2.221 Structural Mechanics and U2.290 Structural Design
Coreq U3.212 Properties of Materials and U3.222 Structural Analysis
Classes 42hrs lec, 42hrs tut/lab/drawing office
Assessment two 3hr exams plus design project

Course objectives: 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 behaviour (including an understanding of capabilities and limitations); to provide basic design training in a simulated professional engineering environment.

Expected outcomes: Proficiency in basic methods of reinforced concrete analysis and interpretation of results; proficiency in basic reinforced concrete design.

Syllabus summary: The behaviour and design of reinforced concrete members and structures.

- Behaviour—introduction, material properties, ‘elastic’ analysis (stresses/deformations), ultimate strength of beams (flexure/shear/torsion), ultimate strength of columns (short and slender), introdution to behaviour of reinforced concrete slabs, introduction to prestressed concrete.
- Design—design of typical elements of a reinforced concrete building, structural modelling, analysis of load-effects (incl. earthquakes), design criteria (for durability, fire-resistance, serviceability and strength), design calculation procedures, reinforcement detailing, structural drawings.

Textbooks
Warner el al. Reinforced Concrete (Pitman)
Standards Australia Specifications—current editions
AS1170 Loading Code—Parts 1, 2 & 4
AS3600 Concrete Structures Code
AS HB2.2 Structural Engineering Standards

Reference books
Park and Paulay Reinforced Concrete Structures
Warner and Faulkes Prestressed Concrete (Longman Cheshire)
Concrete Design Handbook (Cement and Concrete Association of Australia)
Reinforcement Detailing Handbook (Concrete Institute of Australia)
Library classification: 624.183

U3.235 Steel Structures 1 6 units
Senior core course for the degree in Civil Engineering.
Prereq U2.221 Structural Mechanics, U2.290 Structural Design and U2.000 Mathematics 2
Coreq U3.212 Properties of Materials and U3.222 Structural Analysis
Classes 42hrs lec, 42hrs tut/lab/drawing office
Assessment one 2hr exam at the end of each semester plus assessment of design assignments

Course objectives: To provide a basic understanding of the behaviour and design of steel members and structures.

Expected outcomes: The development of some of the skills required for the design of practical steel structures.

Syllabus summary: The behaviour and design of steel members and structures—design concept loads and load combinations, strength, stability and service-ability criteria, safety and reliability, practical steel structures, properties of cross-sections, local buckling, elastic beams, plastic beams, tension members, compression members, effective lengths and elastic in-plane frame buckling, lateral buckling of beams, in-plane bending of beam-columns, lateral buckling of beam-columns, biaxial bending of beam-columns, bolted and welded connections.

Textbooks
BHP Hot Rolled and Structural Products Handbook
Bradford, Bridge and Trafair Worked Examples for Steel Structures (AISC, 1992)
Standards Australia Specifications—current editions
AS1170 Parts 1 and 2 Loading Code; and
AS4100 Steel Structures Code; or
AS HB2.2 Structural Engineering Standards
Trafair and Bradford Behaviour and Design of Steel Structures (Chapman and Hall, 1991)
Reference books
AISC Design Capacity Tables for Structural Steel
Bresler et al. Design of Steel Structures (Wiley)
Gaylord and Gaylord Design of Steel Structures 15 edn (McGraw-Hill)
Lothers Advanced Design in Steel Structures (Longmans)
McGuire Steel Structures (Prentice Hall)
Other books as indicated in classes
Library classification: 624.17, 624.182

U3.244 Soil Mechanics A 4 units
Senior core course for the degree in Civil Engineering.
Mutually exclusive with U3.240 Soil Mechanics, U4.241 Soil Engineering
Prereq U2.210 Introduction to Materials, U2.221 Structural Mechanics, U1.000 Mathematics 1
Classes 26hrs lec, 26hrs lab/tut
Assessment one 3hr exam covering the whole syllabus at the end of semester. Satisfactory laboratory performance is also a requirement. Credit will be given for laboratory and tutorial submissions, as indicated at the commencement of the course

Course objectives: To develop an understanding of: the nature of soils as engineering materials; the common soil classification systems; the importance of water in the soil and the engineering effects of water movement; the factors controlling soil settlements.
**Expected outcomes:** Students should gain the ability: to predict the engineering behaviour of soils based on soil classification; to quantify the effects of water in the soil; to predict soil settlement.


Textbook
**Soil Mechanics Data Sheets** (School of Civil and Mining Engineering, University of Sydney)

Reference books
Scott *An Introduction to Soil Mechanics* (Applied Science) or Lambe and Whitman *Soil Mechanics* (Wiley)
Library classification: 624.151.

**U3.245 Soil Mechanics B** 4 units
*Senior core course* for the degree in Civil Engineering.

**Mutually exclusive with** U3.240 Soil Mechanics, U4.241 Soil Engineering

**Prereq** U2.210 Introduction to Materials, U2.221 Structural Mechanics, U1.000 Mathematics 1

**Coreq** U3.244 Soil Mechanics A

**Classes** 26hrs lec, 26hrs lab/tut

**Assessment** one 3hr exam covering the whole syllabus at the end of the course. Satisfactory laboratory performance is also a requirement. Credit will be given for laboratory and tutorial submissions, as indicated at the commencement of the course

**Course objectives:** To develop an understanding of the concept of soil strength, and how this can be used in estimating the stability of soil constructions.

**Expected outcomes:** Students should gain an understanding of: the strength of soil masses and the factors that control the strength; the basic theories of bearing capacity and slope stability. In particular, students should gain the ability: to interpret soil strength tests; to predict the strength and stability of soil.

**Syllabus summary:** Shear strength of soils. Earth pressure theories. Elementary bearing capacity theory. Slope stability analysis.

Textbook
**Soil Mechanics Data Sheets** (School of Civil and Mining Engineering, University of Sydney)

Reference books
Scott *An Introduction to Soil Mechanics* (Applied Science) or Lambe and Whitman *Soil Mechanics* (Wiley)
Library classification: 624.151

**U3.250 Surveying 1** 4 units
*Senior core course* for the degree in Civil Engineering.

**Mutually exclusive with** U3.250 Surveying 1

**Prereq** U1.000 Mathematics 1

**Classes** 32hrs lec, 20hrs fieldwork/tut

**Assessment** fieldwork, reports, tutorials, and one 3hr exam at the end of the course

**Course objectives:** To introduce students to basic distance, angle, and height measurement; to give students sufficient knowledge to achieve basic computational, analytical, and interpretational skills based on the measurements; to introduce students to basic electronic field equipment; to give students an insight into future trends in measurement technologies.

**Expected outcomes:** Students should gain ability to: undertake basic angle and distance measurement; undertake appropriate calculations and checks involving observed data; understand errors associated with measurement; select the correct measurement alternatives for simple measurement problems.

**Syllabus summary:** Introduction to engineering surveying, distance measurement (steel band), angle measurement (theodolite), levelling, measurement errors, traversing, topographic surveys, optical distance measurement, error analysis, electronic surveying equipment, future surveying technologies.

Textbook
Fryer and Elfick *Elementary Surveying* 7th edn (Harper & Row) or Uren and Price *Surveying for Engineers* 2nd edn (Macmillan)
Library classification: 526.9

**U3.262 Fluids 2** 4 units
*Senior core course* for the degree in Civil Engineering.

**Mutually exclusive with** U4.262 Fluids 2

**Prereq** U2.261 Fluids 1

**Classes** 26hrs lec, 26hrs prac work/tut

**Assessment** one 3hr exam covering the whole syllabus at the end of the semester. Credit will be given for practical work and tutorial submissions, as indicated at the commencement of the course

**Course objectives:** To develop an understanding of theory and practical aspects of analysis of fluid behaviour in pipes and open channels, and of fluid machines.

**Expected outcomes:** Students should gain the ability: to calculate heads and flows through pipe and open channel systems for steady and for unsteady conditions; and to determine machine requirements for various systems.


Textbooks
As for U2.261 Fluids 1

**U3.271 Transportation Engineering and Planning** 2 units
*Senior core course* for the degree in Civil Engineering and in Project Engineering and Management (Civil). *Senior elective course* for the degree in Mechanical Engineering.

**Classes** 26hrs lec

**Assessment** one 2hr exam and assignments


Reference books
Hay Introduction to Transportation Engineering (Wiley) 
Wright and Ashford Transportation Engineering—Planning and Design (Wiley, 1989) 
ICAO Airport Planning Manual Rural Road Design (Austroads 1989) 
Pavement Design (Austroads 1992) 
Library classification: 385, 625

U3.275 Engineering Communications 2 2 units
Senior core course for the degree in Civil Engineering. 
Prereq U2.272 Engineering Communications 1 
Classes 26hrs discussion/oral presentation 
Assessment based on two written reports and two oral presentations. Extra credit for one or both presentations may be given for verifiable public speaking activities with students’ section of the Institution of Engineers, Australia, or the University of Sydney Debating Society, or equivalent organisation. Students are encouraged to engage in these activities 
Course objectives: To develop effective written and oral communication, and advocacy and interpersonal skills. 
Expected outcomes: Ability to argue in writing and orally for (or against) topics of general, technical and/or social significance to large peer groups. 
Syllabus summary: Written reports and oral presentations on two topics of general, technical and/or social significance. Oral presentation in a formal meeting or debating format. Each student is assigned to a group of four which argues both for and against a motion (topic) on two separate occasions each of 30 minutes' duration. 
Reading material 
According to chosen topic in consultation with academic staff

U3.284 Risk and Reliability Analysis 2 units
Senior core course for the degrees in Civil Engineering. 
Prereq U1.000 Mathematics 1, U2.221 Structural Mechanics, U2.290 Structural Design 
Classes 16hrs lec; 12hrs tut 
Assessment one 3hr exam plus assignments 
Course objectives: To provide a basic understanding of the principles of statistical decision theory, probabilistic risk assessment and structural reliability analysis; to develop proficiency in basic methods of risk and reliability analysis, including event trees, fault trees and decision trees and First Order Second Moment methods of structural reliability analysis; to develop an understanding of the principles of reliability-based design. 
Expected outcomes: Proficiency in basic methods of risk and reliability analysis and interpretation of results. 
Syllabus summary: Review of basic statistical methods of analysis (including significance testing, and linear regression); probability concepts, Bayes’ Theorem, statistical decision theory, preposterior analysis; probability measures, types of uncertainty, principles of probabilistic risk assessment, event trees, risk acceptance criteria; structural safety and reliability; First Order Second Moment methods of reliability analysis, the Safety Index, the design point, reliability-based design, simulation methods, system effects. 
Reference books 
Madsen, Krenk and Lind Methods of Structural Safety (Prentice-Hall, 1986) 
Melchers Structural Reliability Analysis and Prediction (Ellis Horwood/Wiley, 1987) 
Library classification: 624.171

U3.420 Thermo-fluid Engineering 10 units
Senior core course for the degree in Mechanical Engineering. 
Prereq U2.410 Mechanical Engineering 2 and U2.000 Mathematics 2 
Classes Sem 1: (3hrs lec & tut)/wk; Sem 2: 2.5hrs/wk; plus lab work 
Assessment one 2hr exam at end of each component of the course 
Syllabus summary: 
Thermodynamics—Availability, statistical entropy and second law of thermodynamics, generalised charts for properties, engine characteristics, gas mixtures, psychrometry, air conditioning and refrigeration, thermodynamics of combustion. 
Heat transfer—Plane and cylindrical conduction convection, thermal networks, fins, heat exchangers, LMTD and NTU methods, unsteady conduction, forced and natural convectionheat transfer coefficients, dimensional analysis, radiation introduction. 
Fluid mechanics 
Navier-Stokes equations—derivation, significance and fundamental importance. 
Closed solutions—Poiseuille flow, Couette flow, lubrication theory. 
Potential flow—stream function and potentials, Laplace's Equation, some basic building blocks. 
Flow around a cylinder, lift, drag, etc. 
Boundary layers—derivation of equations, solution procedures for Laminar case, introduce the concept of turbulence, transition. 
Turbulence—concept, properties of turbulence, eddy viscosity, more advanced approaches. 
Turbulent flow near a wall—law of the wall, pipe flow velocity profiles, turbulent jet entrainment. 
Channel flow—flow in a channel, weir, hydraulic jump, etc. 
Compressible flow—sound waves, normal shock, nozzle flow, shock tube. 
Objectives: To develop an understanding of: (i) the thermodynamics of practical devices, air conditioning and combustion systems; (ii) all types of heat transfer
situations involving conduction, convection and radiation; (ii) pipe flow, pumps, free surface flow, boundary layers, drag, lift and turbulent flow.

Outcomes: Ability to tackle and solve a range of heat transfer, thermodynamics and fluid flow problems including: (i) finned heat exchangers, coolingby fluids, quenching, insulation, and solar radiation; (ii) complex thermodynamics cycles, air conditioning, combustion, chemical equilibrium, problems involving gas mixtures; (iii) an intuitive understanding of force and energy balances in fluid mechanics. Ability to design pipe networks and determine pump requirements; to determine and optimise the drag on streamlined and bluff bodies, to apply basic turbulence models.

Textbooks
Cengel and Boles Thermodynamics, an Engineering Approach (McGraw-Hill)
Incropera and DeWitt Fundamentals of Heat and Mass Transfer (Wiley)
Sabersky, Acosta and Hauptmanri F/ufd Flow—a First Course in Fluid Mechanics (Macmillan)

U3.421 Thermodynamics 4 units
Senior core course for the degree in Aeronautical Engineering.

Mutually exclusive with U3.420 Thermo-fluid Engineering
Prereq U2.411 Introductory Thermodynamics and U2.000 Mathematics 2
Classes Sem 1: (3hrs lec & tut)/wk plus lab work
Assessment one 2hr exam at end of course

Syllabus summary: Thermodynamics—Availability, statistical entropy and second law of thermodynamics, generalised charts for properties, engine characteristics, gas mixtures, psychrometry, air conditioning and refrigeration, thermodynamics of combustion.

Textbook
Cengel and Boles Thermodynamics, an Engineering Approach (McGraw-Hill)

U3.430 Mechanics and Properties of Solids 2 8 units
Senior core course for the degree in Mechanical Engineering.

Mutually exclusive with U3.431 Mechanical Properties of Materials, U3.730 Aircraft Structures 1
Prereq U2.000 Mathematics 2 and either U2.700 Mechanics and Properties of Solids 1 or U2.417 Introductory Mechanics and Materials
Classes Yr: (2 lec & 2 tut)/wk
Classes Sem 1: 1.4 lec/wk and associated tut and lab classes
Assessment one 2hr exam at the end of each semester plus assignments as specified at the commencement of each semester

Course objectives: To understand (a) how to evaluate the behaviour of solid materials subjected to stress and deformation, (b) how to find the relationship between properties of materials and their microstructures, and (c) how to improve a mechanical design with the knowledge of mechanics and properties of solids.

Expected outcomes: Students should gain the ability: (a) to analyse simple engineering problems in terms of

strength, stress, and deformation in relation to properties of materials, and (b) to select proper materials for simple mechanical designs.

Syllabus summary:
(a) Sem 1: Short-term and long-term mechanical properties, failure analysis, introductory fracture mechanics, single- and multi-phase alloys, phase diagrams, polymers and polymer composite materials, structure-property relationships.
(b) Sem 2: Stress and strain, linear elasticity and fundamental plasticity, primary solution strategy, introduction to variational methods, introduction to numerical stress analysis, case studies.

Textbooks
Lecture notes
Reference books

Chandrupatla and Belegundu Introduction to Finite Elements in Engineering (Prentice Hall, 1991)
Timoshenko and Goodier Theory of Elasticity (McGraw-Hill, 1951)

U3.431 Mechanical Properties of Materials 4 units
Senior core course for the degree in Aeronautical Engineering and Mechanical Engineering (Mechatronics).

Mutually exclusive with U3.430 Mechanics and Properties of Solids 2
Prereq U2.000 Mathematics 2 and either U2.700 Mechanics and Properties of Solids 2 or U2.417 Introductory Mechanics and Materials
Classes Sem 1: (2 lec & 2 tut)/wk
Assessment one 2hr exam at the end of Sem 1 plus assignments as specified at the commencement of the semester

Course objectives: (a) To understand the relationship between properties of materials and their microstructures; and (b) to improve mechanical design based on knowledge of mechanics and properties of materials.

Expected outcomes: Students should gain the capabilities: (a) to analyse simple engineering problems in terms of strength, stress, and deformation in relation to properties of materials, and (b) to select proper materials for simple mechanical design.

Syllabus summary: Short-term and long-term mechanical properties, dislocations, introductory fracture and fatigue mechanics, polymers and polymer composite materials, ceramics and glasses, high temperature deformation and failure, structure-property relationships, selection of materials in mechanical design.

Textbooks
Lecture notes
Reference books
Ashby Materials Selection in Mechanical Design (Pergamon, 1993)
Ashby and Jones Engineering Materials 2—an introduction to microstructures, processing and design (Pergamon 1986)

Library classification: 620, 624, 666-679

U3.440 Mechanical Design 2 8 units
Senior core course for the degrees in Mechanical and Mechatronic Engineering.

Prereq U2.440 Mechanical Design 1 or U2.441 Mechanical Design 1A
Classes Sem 1: (2 lec & two 3hr drawing office sessions)/wk
Assessment assignments and quizzes

Syllabus summary: In this course selected components and whole machines are examined. Their uses, functions and evolution are considered. A synthesis of modelling, stress and deflection analysis, together with practical considerations, is emphasised in arriving at design solutions. Moderate scale realistic problems are eventually introduced requiring inventivesolutions and comprising several detail designs and assemblies selection. The material covered includes: welded and bolted joints, power screws, shafts, flexible mechanical elements and other torque transmission components, brakes and clutches, rolling element and hydrodynamic bearing, springs, involute and cycloidal gears and scheduling. CAD (computer aided drafting and designing) is used in several problems, highlighting areas of advantage. Application to programing in CAD is introduced.

The importance of management in design is highlighted where relevant, i.e. relationship with drafting and manufacturing personnel, effective communication with suppliers and subcontractors, planning and scheduling a project. Aspects of acceptable design for the client. Product reliability and quality.

Textbook
Shigley Mechanical Engineering Design (McGraw-Hill)

Reference books
Orlov Fundamentals of Machine Design (M.I.R.)
Deutschman et al. Machine Design (Collier-Macmillan)
Groover and Zimmers CAD/CAM Computer Aided Design and Manufacturing (Prentice-Hall)
Reference may also be made to other texts during lectures
Library classification: 621.815, 001.6443

U3.451 System Dynamics and Control 6 units
Senior core course for the degrees in Mechanical and Mechatronic Engineering.

Mutually exclusive with U3.750 Mechanics of Flight 1
Prereq U2.000 Mathematics 2 and U2.410 Mechanical Engineering 2 or U2.412 Engineering Dynamics

Classes Yr: (2 lec & 1 tut)/wk
Assessment two 3hr exams plus assignments

Syllabus summary:

Objectives: To provide students with techniques from mechanics and linear system theory applicable to mechanical systems (machines and structures), and to introduce them to classical control theory.

Outcomes: Students will be competent in modelling mechanical and electro-mechanical systems and setting up their governing equation, and will be able to solve them numerically or analytically. They will be familiar with the occurrence, isolation, and measurement of vibration, and with the analysis and design of linear feedback controllers for common mechanical systems.

Reference books
Bolton Engineering Materials Technology 2nd edn
(Rao Mechanical Vibrations (Addison-Wesley, 1986)
Ogata System Dynamics 2nd edn (Prentice-Hall, 1992)
Library Classification 531.32, 620.1, 620.101,620.3, 629.8

U3.460 Manufacturing Engineering and Management 10 units
Senior core course for the degree in Mechanical Engineering and Mechanical Engineering (Mechatronics).

Prereq U1.410 Mechanical Engineering I

Classes Sem 1: 3hrs lec/wk; Sem 2: 3hrs lec/wk; plus an average of 2hrs/wk throughout the year for tut, lab and works visits, the latter mainly in Sem 2
Assessment to be advised at beginning of course

Syllabus summary:
Manufacturing processes—several manufacturing processes will be considered from the points of view of fundamentals of the process, limitations on the production rates and runs and product quality, general purpose and specialised machinery, automation, numerical control and computer-aided manufacture. Processes considered include machining, casting, powder metallurgy, metal working, welding, cutting, polymer processing, bending and composite manufacture.

Manufacturing systems—economics of automation, flexible manufacturing, Just-in-Time, group technology, materials requirements planning, quality control, introduction of new technology, human factors, plant layout.
Industrial hazards—(a) Recognition of hazards presented by chemical and physical agents: nature, mode of entry and effects of toxic substances; adverse effects of noise, work physiology and thermal stress. (b) Evaluation of hazards: survey design, hygienic standards and interpretation of results, (c) Principles of hazard control: industrial ventilation, personal protective equipment, safety organisation and the prevention of industrial accidents, stress in the workplace.

Industrial organisation and management—Micro-economics, the Australian business environment, the role of government, accounting systems and procedures, the accounting cycle, financial statements, internal performance, financial structuring, intellectual property, contract law, legal obligations of business, capital budgeting and investment analysis, introduction to contract administration. Social responsibility in engineering, including professional responsibility and liability, social and environmental issues and ethics of engineering practice.

Textbooks
Samson Management for Engineers (Longmans, 1990)
Clark Student Economics Brief (Fairfax)
Reference books
Stanley How to Read and Understand a Balance Sheet (Schwartz & Wilkinson, Melbourne)
The Small Business Handbook (Small Business Development Corporation, Victoria)
Eyre Mastering Basic Management (Macmillan)
Stoner, Collins, Vetton Management in Australia (Prentice-Hall)
Blank and Tarquin Engineering Economy (McGraw-Hill)

U3.461 Manufacturing Engineering 5 units
Senior core course for students doing the double degree BE (Mechanical or Mechatronics) and BCom.
Mutually exclusive with U3.460 Manufacturing Engineering and Management
Prereq U1.410 Mechanical Engineering I
Classes Sem 1: 3hrs lec/wk; plus an average of 2hrs/wk for tut, lab and works visits
Assessment to be advised at beginning of course

Syllabus summary:
Manufacturing processes—several manufacturing processes will be considered from the points of view of fundamentals of the process, limitations on the production rates and runs and product quality, general purpose and specialised machinery, automation, numerical control and computer-aided manufacture. Processes considered include machining, casting, powder metallurgy, metal working, welding, cutting, polymer processing, bending and composite manufacture.

Manufacturing systems—economics of automation, flexible manufacturing, Justin Time, group technology, materials requirements planning, quality control, introduction of new technology, human factors, plant layout.

Reference books


U3.465 Project and Practice 6 units
Senior core course for the degrees in Mechanical and Mechatronic Engineering.
Classes Project: 1hr/wk for team consultations and several lectures on relevant topics; presentations in final two weeks of Sem 1:
Laboratory: Yr. approx. twenty 3hr lab sessions
Assessment Project: (2 units) on the basis of progressive contribution to the group effort and on the quality of the final presentations
Laboratory: (4 units) through quizzing during lab sessions, on the basis of lab reports and on the basis of quality of report writing

Syllabus summary:
Project—Team building, considerations of conceptual design, economic analysis, project management outline, environmental impact and consideration of benefits to society in major projects. This part of the course will culminate in team presentations at the end of Sem 1.
Laboratory—A range of experimental investigations to complement the Senior Year courses. The section includes training in written communication and report presentation. Several detailed reports need to be presented.

Objectives:
To plan a multidisciplinary project, to consider technical, managerial, economic, environmental and societal factors in bringing a project from concept to conclusion and to make a verbal presentation. To work as a team in practical sessions and to carry out experimental investigations in order to form technical conclusions and to present reports.

Outcomes:
Students will learn how to work in a team, to plan and assign responsibilities and to achieve common objectives. Tasks will include information searches, conceptual planning and design and consideration of all the complexities of modern project planning. Students will gain practical and analytical experience from the experimental laboratory tasks. The project and laboratory sections of the course will require students to learn how to make effective written reports and verbal presentations.

U3.474 Electrical Machines and Drives 4 units
Senior core course for the degree in Mechanical Engineering (Mechatronics).
Mutually exclusive with U3.522 Power Electronics and Drives
Prereq U2.471 Introductory Mechatronics and U2.504 Electrical and Electronic Engineering
Classes Sem 2: (2 lec & one 3hr lab/tut)/wk
Assessment to be advised by Electrical Engineering
Syllabus summary: Applications and historical context, principles of electronic control of power flow, power semiconductors, phase-controlled rectifiers and derivatives, AC-DC phase control, DC-DC converters.

Electromagnetic transducers, rotating magnetic field principles, synchronous machines, induction machines, DC and AC servo motors, electronically-controlled machine operation.

Textbook
To be advised by Electrical Engineering

U3.476 Industrial Electronics 10 units
Senior core course for the degree in Mechatronic Engineering.

Mutually exclusive with U3.540 Electronics 1, U3.560 Digital Systems 1
Prereq U2.471 Introductory Mechatronics and U2.504 Electrical and Electronic Engineering
Classes Sem 1: (2 lec & one 2hr lab/tut) / wk (Digital Systems);
Sem 2: (3 lec & one 3hr lab/tut) / wk (Electronics)
Assessment one 3hr exam at end of Sem 1 and Sem 2, plus lab reports and mid-semester tests


Filters—passive RC and LC filters, design of high-order active filters, time and phase circuits.

Oscillators—A/D and D/A converters; sample and hold; applications.

Transducers—principles of operation, signal conditioning and interfacing for measurement of position, velocity, pressure, strain, force and temperature.

Optoelectronics—LED and displays, photodiode, phototransistor, optocouplers and isolation.

Electromagnetic noise—EMI control, guarding, earthing.

Power supplies—linear unregulated and regulated, thermal design and protection, switch-mode power supplies.

Structure of digital systems, programmable logic, array logic and technologies; logic minimisation; combinational logic with PLDs; synchronous machines and PLA-based sequences; state machine design; datapath functions, counters and arithmetic; testing and testability; asynchronous design; specification languages and simulation.

Textbooks
To be advised by Electrical Engineering

U3.506 Fundamentals of Biomedical Engineering 4 units
Senior elective course.

Prereq U2.510 Electrical Engineering 2 or U2.504 Electrical and Electronic Engineering
Classes Sem 1: (2 lec & one 2hr lab/tut)/wk
Assessment lab reports and one 2hr exam at end of Sem 1

Assessment
lab reports and one 2hr exam at end of Sem 1


U3.511 Circuit Theory 4 units
Senior core course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Prereq U2.511 Electrical Engineering 2A, U2.512 Electrical Engineering 2B and U2.000 Mathematics 2 or U2.001 Mathematics 2EE
Classes Sem 1: (2 lec & one 2hr tut)/wk
Assessment assignments, one 1hr mid-term exam and one 3hr exam at the end of the Semester

Syllabus summary: Main aim of the course is to teach tools of passive circuit analysis and synthesis. Topics covered include: multi-port networks and their port descriptions such as impedance, admittance, scattering etc.; concepts of passivity and losslessness; state-space descriptions of passivcircuit;positivereal functions; Foster and Cauer realizations for special passive 1-ports; Brune synthesis for general passive 1-ports.

Reference books
Brief notes will be issued. No textbook will be employed.
Numerous references will be given to a wide range of books

U3.512 Signals and Systems 5 units
Senior core course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Prereq U2.510 Electrical Engineering 2; and U2.000 Mathematics 2 or U2.001 Mathematics 2EE
Coreq U3.511 Circuit Theory
Classes Sem 1: (2.5 lec & 2.5hr lab/tut)/wk
Assessment lab reports, assignments and one 2hr exam at end of Sem

Syllabus summary:
Part A—Signals: classification, basic signals and their properties, representation of signals using orthogonal functions. Fourier series: definition, finding the coefficient and basic operation, effects of symmetry. Fourier transform: definition of Fourier integral, properties of Fourier transform, examples. Linear systems: modelling of electrical system, time-invariant, time-varying, causal and non-causal systems, impulse response and frequency response of the linear time-invariant system, convolution theorem, time convolution and frequency convolution, properties of convolution, cross-correlation and linear systems, power signals and linear systems. Filters: types of filters, ideal filters and causality, specifications of filters, phase response and group delay. Linear modulation: type of modulation, amplitude (DSB-LC
Part B—stochastic systems—Introduction to probability and random variables: probabilities of random events, axioms, joint and conditional probability, statistical independence. Cumulative distribution function, probability density function, statistical averages, standard distributions (uniform, binomial, Poisson, Gaussian), transformations or random variables, joint and conditional density functions, correlation between random variables. Power and energy spectral sensitivities. Random processes—stationary and ergodic processes, autocorrelation and power spectra, cross correlation. Statistical representation of random noise.

Introduction to sampled data systems and ideal reconstruction, spectrum of sampled signal, aliasing. Sampled data systems—linear, time-invariant, causal, impulse response, finite difference equations, FIR and HR systems.

U3.522 Power Electronics and Drives 4 units

Senior elective course for the degrees in Electrical Engineering and ISE stream.

Mutually exclusive with U3.474 Electrical Machines and Drives

Prereq U2.510 Electrical Engineering 2

Classes Sem 2: (2 lec & 1hr lab/tut)/wk

Assessment lab reports, assignments and one 2hr exam at end of Sem

Syllabus summary: Applications and historical context, principles of electronic control of power flow, power semiconductors, phase controlled rectifiers and derivatives, AC-AC phase control, DC-DC converters, DC-AC converters.

Electromagnetic transducers, rotating magnetic field principles, synchronous machines, induction machines, electronically controlled machine operation.

U3.523 Topics in Electrical Engineering Design 3 units

Senior elective course for the degrees in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Prereq U2.510 Electrical Engineering 2

Classes Sem 2: (1 lec & 2hr lab)/wk

Assessment assignment and one 1hr exam at end of Sem

Syllabus summary: Illumination concepts, photometric units, the lumen method, lighting design, ferromagnetics, ferrites, magnetic information storage, transformer design. Thermal design, heat loss mechanisms, finned structures. Protection design, the electric arc in circuit interruption, fuses, circuit breakers.

U3.529 Electrical Systems 3 units

Senior elective course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Prereq U2.510 Electrical Engineering 2.

Classes Sem 2: (2 lec & 1hr lab/tut)/wk

Assessment assignments and one 2hr exam at end of Sem 2

Syllabus summary: Systems consisting of electro-mechanical converters (electrical machines), electrochemical converters (batteries, fuel cells) and electronic converters as well as basic circuit elements. An introduction to conventional and alternative renewable/non-renewable energy sources, energy transmission, markets and distribution. Basic techniques of systems modelling and analysis including per unit systems, transformers, lines, interference, power flows, transients, balanced faults, control of real and reactive power. Applications to household, transport, industrial and high voltage systems. Use of MATLAB as a modelling and simulation tool.

Textbook


U3.530 Control 1 4 units

Senior core course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Mutually exclusive with U3.450 System Dynamics and Control

Prereq U2.510 Electrical Engineering 2

Coreq U3.511 Circuit Theory

Classes Sem 2: (2 lec & 2hrs of lab or tut work)/wk

Assessment one 2hr exam at end of sem, plus assessment of lab work

Syllabus summary: History and review of control.

Modelling of physical processes, state variables and differential equations. Dynamic response, review of Laplace transform, transfer functions and block diagrams, poles and zeros, design specifications in the time domain.

Basic feedback principles, closed loop systems, effect of feedback on sensitivity and disturbance rejection, steady state accuracy, stability, the Routh criterion, basic proportional, integral and derivative control.

Design using the root locus, rules for sketching root locus, lead and lag compensators, analogue and digital implementation of controllers.

Frequency response design methods, review of Bode diagrams, design specifications, Nyquist stability criterion, gain and phase margins, closed loop frequency response, compensator design.

Study of some design applications.

An introduction to state space, equations for single input single-output systems, relation to transfer functions, eigenvalues, brief description of state variable feedback.

Textbook

Franklin, Powell and Emami-Naeni Feedback Control and Dynamic Systems 3rd edn (Addison-Wesley, 1994)
U3.540 Electronics 1  10 units
Senior core course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Prereq U2.510 Electrical Engineering 2
Coreq U3.511 Circuit Theory, U3.512 Signals and Systems
Classes Yr: (2 lec & 1 hr lab class or tut)/wk
Assessment lab reports, assignments and one 2hr exam at end of Sem


U3.551 Engineering Electromagnetics  4 units
Senior core course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Prereq U2.510 Electrical Engineering 2
Coreq U3.511 Circuit Theory
Classes Sem 1: (2 lec & 2 hr lab/tut)/wk
Assessment tutorials and assignments plus one 2hr exam at end of Sem

Syllabus summary: Transmission lines (in which circuit theory is used to derive EM wave phenomena in distributed circuits)—revision of circuit elements and static fields; distributed circuits, characteristic impedance, waves, reflections, VSWR, impedance transformation, and matching; use of the Smith chart.

Fields and waves (in which Maxwell's equations are used to derive EM wave phenomena in general and the interaction of EM waves with various materials such as conductors, dielectrics, etc.): revision of vector algebra, static fields and boundary problems; Maxwell's equations, plane EM waves in various media; reflections of waves at boundaries, electromagnetic compatibility, atmospheric wave propagation; waveguides and components (RF and optical); antennas and arrays, numerical methods.

Textbook
Narayana Rao Elements of Engineering Electromagnetics (Prentice Hall)

U3.552 Communications 1  6 units
Senior core course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Prereq U2.510 Electrical Engineering 2
Classes (3 lec & 3 hr lab/tut)/wk in Sem 2
Assessment lab reports, assignments and one 3hr exam at end of Sem

Syllabus summary: Components of communication systems—basic properties of signals, noise and communication channels; analog modulation—amplitude and frequency modulation principles and common applications; baseband transmission of binary digital signals, equalisation, transmission coding and introductory error control coding; introduction to modulated carrier data transmission; digital transmission of analog signals—pulse code modulation and delta modulation; performance of modulation schemes in noise; information theory.

Textbook

Reference books
F.G. Stremler Introduction to Communication Systems 3rd edn (Addison Wesley, 1990)
J. Gibson Principles of Digital and Analog Communications (Macmillan)
B. Sklar Digital Communications—Fundamentals and Applications (Prentice-Hall, 1988)

U3.553 Digital Signal Processing  4 units
Senior core course for the degree in Electrical Engineering (Information Systems Engineering) and Senior elective course for the degree in Electrical Engineering.

Prereq U2.511 Electrical Engineering 2A and U2.512 Electrical Engineering 2B
Coreq U3.512 Signals and Systems
Classes Sem 2: (2 lec & 2hr lab/tut)/wk
Assessment lab reports, assignments and one 2hr exam at end of Sem

U3.554 Speech Processing 3 units
Senior elective course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).
Coreq U3.512 Signals and Systems
Classes Sem 2: (2 lec & 1 hr lab/tut)/wk
Assessment assignments, project work and a 2 hr exam at end of Sem

Syllabus summary: Introduction to speech waveforms and spectra; acoustic phonetics and phonology, the linear speech production model. Speech coding: methods based on the linear production model including LPC and CELP, multi-band coding. Speech synthesis: formant synthesis models; concatenative synthesis; segmental and suprasegmental aspects of text-to-speech conversion. Speech recognition principles: the problems; feature extraction; dynamic time warping and Hidden Markov modelling. Language analysis and representation in computing systems; parsing techniques; application to speech synthesis and recognition systems.

Computer-based laboratory, tutorial and project work will use MATLAB signal processing and special purpose speech processing software packages.

Textbook Holmes Speech Synthesis and Recognition (Van Nostrand Reinhold, 1988)
Comprehensive notes will be provided for the course

U3.560 Digital Systems 1 4 units
Senior core course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).
Mutually exclusive with U3.476 Industrial Electronics
Prereq U2.510 Electrical Engineering 2
Classes Sem 1: (2 lec & 2 hrs of lab or tut)/wk
Assessment lab reports and one 2 hr exam at end of Sem 1

Syllabus summary: Structure of digital systems, programmable logic, array logic and technologies; logic minimisation; combinational logic with PLDs; synchronous machines and PLA-based sequences; state machine design; datapath functions, counters and arithmetic; testing and testability; asynchronous design; specification languages and simulation.

U3.561 Computer Architecture 3 units
Senior core course for the degree in Electrical Engineering (Information Systems Engineering) and Senior elective course for the degree in Electrical Engineering.
Mutually exclusive with U2.043 Computer Science 2B, U2.041 Computer Science 2EE and U2.040 Computer Science 2
Prereq U2.042 Computer Science 2A or U2.504 Electrical and Electronic Engineering
Coreq U3.560 Digital Systems 1 or U3.476 Industrial Electronics
Classes Sem 2: (2 lec & one 1 hr tut)/wk
Assessment assignments; and one 2 hr exam at end of the course


U3.562 Engineering Software 3 units
Senior core course for the degree in Electrical Engineering (Information Systems Engineering).
Prereq U2.510 Electrical Engineering 2, U2.042 Computer Science 2A
Classes Sem 2: (1 lec & one 2 hr tut/lab)/wk
Assessment one 2 hr exam at the end of the course plus assignment(s)

Syllabus summary: Introduction to Software Engineering; software design process; software testing and maintenance; configuration management. Software techniques: software prototyping; numerical methods; table driven routines; optimisation; multitasking; parallel programming. Software/hardware interfaces.

U3.571 Management for Engineers 3 units
Senior core course for the degree in Electrical Engineering and also the ISE stream.
Classes Sem 1: (2 lec & one 1 hr tut)/wk
Assessment tutorials, assignments and one 2hr exam at the end of Sem 1

Syllabus summary: Engineers and management, microeconomics, macroeconomics, managerial decisionmaking. Behaviour of people in organisations, human resource management for engineers, strategic management, accounting and management, operations management, marketing for engineers, the legal environment of business, industrial relations, engineering project management.

Chemical Engineering—Core requirements for Senior and Senior Advanced students

Chemical plant inspection tour
For one week of a vacation period during the Senior Year, students visit a number of chemical plants outside the Sydney area. Tours in the past years have been to south-eastern Queensland, Tasmania, Victoria and the Hunter Valley.

Mid-semester week exercises
One or two one-week exercises are organised during the teaching periods of the Senior Year. Normal classes are suspended during these weeks.

Senior students spend a week working on selected plant problems on major chemical plants in the Sydney area. In these exercises the students work in small groups in cooperation with plant engineers and academic staff to investigate chemical engineering problems in a plant environment.
U3.610 Unit Operations 1 12 units

*Senior core course* for the degree in Chemical Engineering.

**Prereq** U2.610 Chemical Engineering 2.

**Classes** Yr: (3 lec & 3hrs tut)/wk

**Assessment** tut assignments and exams at end of each sem

**Syllabus summary:** The course is conducted in four main parts. Two parts will be taught and examined each semester.

(a) **Mass transfer**—
Distillation: history and introduction; VLE in ideal systems; VLE in non-ideal systems; Tx, Hx diagrams; theoretical single stage; thermodynamic efficiency; flash distillation; Ponchon-Savarit, reflux; minimum reflux, total reflux; McCabe-Thiele; overall column efficiency; heat loads, cost, short cuts; flooding; Naphtali-Sandholm method, computer methods.

Extraction: immiscible systems; McCabe-Thiele construction; partially miscible; packed columns; application in processing industries.

Gas absorption: packed columns; volumetric MT coefficients; depth of packing; flooding.

(b) **Heat transfer**—
Forced convection: dimensionless groups, correlations.


(c) **Particle mechanics**—
Introduction to particulate systems, particle size and shape parameters, size distributions and statistical properties, test sieve analysis. Screening, particle-screen mechanics, efficiency of screening. Size reduction, energy requirements, classical laws, product size distribution. Motion of a particle in a fluid, terminal velocity, hindered settling. Phase separations, classification, elutriation, thickening, gas and liquid cyclones, centrifuging. Motion of fluids in particle beds, two-phase flow in packings, filtration, batch and rotary filters, fluidisation concepts. Methods of sub-sieve size mgclmdsedimentation, photo-extinction, direct counting and gas absorption methods.

(d) **Fluid mechanics**—
Compressible flow: isothermal and adiabatic flow in pipes; choking. Non-Newtonian flow: classification of fluids; measurement of model parameters; application to laminar and turbulent flow. Mixing and agitation: dimensional analysis; power curves; mixing time. Two-phase flow: flow regimes; models of two-phase flow; calculations for two-phase flow in pipelines.

Textbooks

for (a)
Furzer *Distillation for University Students* (published by the author, Department of Chemical Engineering, The University of Sydney)

for (b)

Coulson, Richardson and Sinnott *Chemical Engineering, Vol. 6* (Pergamon, 1985)

for (c)
Coulson and Richardson *Chemical Engineering, Vol. 2* (Pergamon, 1983)

for (d)

Reference books
for (a)
Kister *Distillation Design* (McGraw-Hill, 1990)

for (b)

for (c)
Allen *Particle Size Measurement* (Chapman and Hall, 1981)

Svarovsky *Solid-Liquid Separation* (Butterworths, 1977)

for (d)

Wallis *One Dimensional Two-Phase Flow* (McGraw-Hill, 1969)

U3.621 Thermodynamics 8 units

*Senior core course* for the degree in Chemical Engineering.

**Classes** Yr: (2 lec & one 1hr tut)/wk

**Assessment** tut assignments and one 3hr exam at the end of each sem

**Syllabus summary:**
First and Second Law applications; energy equations for steady flow and transients in process systems; thermochemistry; compressible flow; heat engines; refrigeration cycles, liquefaction processes; availability; isentropic and polytropic efficiencies for compressions and turbines.

Estimation of thermodynamic properties: (i) using simple fluid models (ideal gas, incompressible liquid), (ii) using charts and tables, (h) using equations of state.

P-V-T relationships for real gases; relationship between thermodynamic properties; calculation of residual enthalpies, entropies, etc. based on a V-explicit equation of state; application of P-explicit equations of state in computer methods for property prediction.

Partial molar properties; fugacity. Solution properties; chemical potential; activity; solution models.
Equilibrium criteria. Phase equilibrium: cases involving fluids for which a single equation of state is valid; cases where separate liquid and gas models are used. Computer methods.

Chemical equilibrium: homogeneous and heterogeneous reactions.

Textbook
Smith and Van Ness *Introduction to Chemical Engineering* (McGraw-Hill, 1987)

U3.626 Reaction Engineering 1 4 units
*Senior core course* for the degree in Chemical Engineering.

Coreq U3.620 Thermodynamics
Classes Sem 2: (12 lec & 6 tut)/9wks
Assessment tut assignments, project and one 3hr exam at end of course


Textbook
Fogler *Elements of Chemical Reaction Engineering* (Prentice-Hall, 1990)

U3.631 Computations and Statistics 4 units
*Senior core course* for the degree in Chemical Engineering.

Prereq U2.000 Mathematics 2
Classes Sem: (6hrs lec/tut)/wk
Assessment tut assignments and one 3hr exam


Textbooks
Walpole and Myers *Probability and Statistics for Engineers and Scientists* 4th edn (Collier Macmillan)
Gerald and Wheatley *Applied Numerical Analysis* 3rd edn (Addison-Wesley, 1984)

Reference books
As indicated during classes

U3.645 Project Economics 4 units
*Senior core course* for the degree in Chemical Engineering.

Prereq U1.610 Chemical Engineering 1
Classes Sem 1: (4hrs lec/tut)/wk
Assessment one 3hr exam at end of course plus assignments

Syllabus summary: Project evaluation—cashflows, time value of money, economic criteria, depreciation and taxation, capital and operating costs, comparison of alternatives, risk and uncertainty, project finance.

Reference book
Helfert *Techniques of Financial Analysis* (Irwin, 1982)

U3.646 Transport Phenomena 4 units
*Senior elective course* for the degree in Chemical Engineering.

Prereq U2.610 Chemical Engineering 2; plus second year WAM > 60%
Classes Sem 2: (4hrs lec/tut)/wk
Assessment assignments plus one 3hr exam at end of course


Reference books
Cussler *Diffusion: Mass Transfer in Fluid Systems* (C.U.P., 1984)

U3.647 Laboratory Projects in Unit Operations 4 units
*Senior elective course* for the degree in Chemical Engineering.

Prereq U2.610 Chemical Engineering 2
Coreq U3.610 Unit Operations 1
Classes Sem 2: 5hr/fn
Assessment lab reports, oral presentation and general skill shown in planning and executing lab experiments

Syllabus summary: This laboratory course extends the range of experiments illustrating the principles of mass transfer, heat transfer and particle mechanics. Three lab experiments will be undertaken by students during the semester. Two written reports and one oral presentation will be required from each student. Each student will carry out a laboratory class every two weeks. The same level of preparation is required for this course as for U3.670 Chemical Engineering Laboratory. Specifically, students are required to: (1) familiarise themselves with the background theory; (2) understand the operation of the experimental apparatus and the correspondence between the apparatus and that described in the background theory; and (3) define the experimental aim, range of measurements to be made and how these measurements will be processed in the light of the background theory and the aim.
The analysis and interpretation of the experimental data are of great importance in the assessment, as is the ability to present the results clearly/logically and precisely either as a technical report or an oral presentation.

Textbook
Printed laboratory notes

Reference books
Reference documentation appropriate to each laboratory exercise is available for borrowing

**U3.651 Materials and Corrosion 2** 2 units

*Senior core course* for the degree in Chemical Engineering.

*Classes* Sem: 2hr of lec & tut/rut/wk
*Assessment* one 2hr exam


Textbook

Reference books
*Uhlig and Revie* *Corrosion and Common Control* 3rd edn (Wiley, 1985)

*Pourbidx* *Atlas of Electrochemical Equilibria in Aqueous Solutions* (NACE, 1974)

**U3.660 Process Control 1** 4 units

*Senior core course* for the degree in Chemical Engineering.

*Prereq* U2.000 Mathematics 2

*Coreq* U3.630 Computations and Statistics

*Classes* Sem: 4hrs of lec, tut and lab work/wk
*Assessment* tut assignments, lab reports and one 3hr exam


Textbook

Reference books
As indicated during lectures

**U3.671 Chemical Engineering Laboratory** 6 units

*Senior core course* for the degree in Chemical Engineering.

*Prereq* U2.610 Chemical Engineering 2

*Coreq* U3.610 Unit Operations 1

*Classes* Sem 1: 7hr/fit

*Assessment* lab reports and oral presentation, plus general skill shown in planning and executing lab experiments

**Syllabus summary:** This laboratory course complements the course U3.610 Unit Operations 1 on the principles of mass transfer, heat transfer and particle mechanics.

As part of the preparation for an experiment, the student will be expected specifically to:
1. familiarise himself or herself with the background theory;
2. understand the operation of the experimental apparatus; and
3. define the experimental aim, range of measurements to be made and how these measurements will be processed.

Considerable importance is attached to the analysis and interpretation of the experimental data and to the writing of a clear, logical and concise technical report.

Textbooks

Printed laboratory notes

Reference books
As indicated during classes

**U3.720 Aerodynamics 1** 4 units

*Senior core course* for the degree in Aeronautical Engineering.

*Prereq* U2.000 Mathematics 2 and U2.710 Huid Mechanics

*Coreq* U3.725 Aerodynamics 2

*Classes* Sem 1: 4lec/wk and associated tut

*Assessment* written exam at end of sem

**Syllabus summary:** An introduction to the technology of aeronautics. Aerodynamic characteristics of aircraft components. Lift, drag and pitching moment behaviour of fuselage, wings and aerofoils. Two-dimensional aerofoil theories; conformal mapping; Joukowski transformation; thin aerofoil theory.


Basic equations governing aerodynamics. Reynolds and Mach numbers; dimensional analysis; continuity; momentum and energy equations; Bernoulli, Euler and Navier-Stokes equations.


Reference books


Houghton and Brock *Aerodynamics for Engineering Students* (Edward Arnold)

Dommasch *Airplane Aerodynamics* (Pitman)

Hale *Aircraft Performance Selection and Design* (Wiley, 1987)

Milne-Thomson *Theoretical Aerodynamics* (Macmillan, 1966)

U3.725 Aerodynamics 2 4 units

_Senior core course_ for the degree in Aeronautical Engineering.

**Prereq** U2.000 Mathematics 2 and U2.710 Fluid Mechanics

**Coreq** U3.720 Aerodynamics 1

**Classes** Sem 2: 4 lec/wk plus associated tut

**Assessment** written exam at end of Sem 2

**Syllabus summary:** Introduction to three-dimensional flow; Biot-Savart law; horse-shoe vortex.

- Basic gas dynamics; steady one-dimensional flow including friction and heat transfer; shock waves. Introduction to steady two-dimensional supersonic flow.
- Viscous effects; introduction to boundary layer theory; heat transfer and skin friction. Prediction of aerodynamic drag.
- Energy approach to general aircraft performance; climb rates; energy envelope; cruise performance. Excess power and specific energy calculation. Range calculations. Maneuvering flight with increased load factor. Aircraft excess power comparisons.
- The aerodynamics of control surfaces; introduction to aerodynamic derivatives; theory and applications.

**Reference books**

McCormick, _Aerodynamics, Aeronautics and Flight Mechanics_ (Wiley, 1979)

Liepmann and Roskoff, _Elements of Gasdynamics_ (Wiley, 1957)

Houghton and Brock, _Aerodynamics for Engineering Students_ (Edward Arnold)

Schlichting, _Boundary Layer Theory_ (McGraw-Hill, 1960)

Hale, _Aircraft Performance, Selection and Design_ (Wiley, 1987)

Bertin and Smith, _Aerodynamics for Engineers_ (Prentice Hall, 1979)


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U3.730 Aircraft Structures 1 4 units

_Senior core course_ for the degree in Aeronautical Engineering.

**Mutually exclusive with** U3.430 Mechanics and Properties of Solids 2 and U4.432 Mechanics and Properties of Solids 2A

**Prereq** U2.000 Mathematics 2 and U2.700 Mechanics and Properties of Solids 1

**Classes** Sem: 3 lec/wk with associated tut

**Assessment** course assignments and written exam at end of sem

**Syllabus summary:**


**Reference books**

Timoshenko, _Strength of Materials, Partsland II_ (VanNostrand)

Langtiaar, _Energy Methods in Applied Mechanics_ (Wiley)

Bruhn, _Analysis and Design of Flight Vehicle Structures_ (Tri-State Offset)

Megson, _Aircraft Structures for Engineering Students_ (Arnold, 1972)

**Library classification:** 620.11, 628.13, 629.13, 630.1

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U3.735 Aircraft Structures 2 4 units

_Senior core course_ for the degree in Aeronautical Engineering.

**Coreq** U3.730 Aircraft Structures 1

**Classes** Sem: 3 lec/wk plus associated tut

**Assessment** course assignments and written exam

**Syllabus summary:**

(a) SoHd mechanics: thermal stresses and plasticity; applications in plane stress systems.
(b) Structural analysis: elementary analysis of plates and stiffened panels and shells. Analysis of complex frameworks: introduction to displacement methods of analysis.

**Reference books**

Drucker, _Introduction to the Mechanics of Deformable Bodies_ (McGraw-Hill)

Bruhn, _Analysis and Design of Flight Vehicle Structures_ (In-state Offset)

**Library classification:** 620.11, 629.13, 630.1

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U3.740 Aircraft Design 1 6 units

_Senior core course_ for the degree in Aeronautical Engineering.

**Prereq** U2.441 Mechanical Design IA and U2.700 Mechanics and Properties of Solids 1

**Coreq** U3.431 Mechanical Properties of Materials, U3.720 Aerodynamics 1 and U3.730 Aircraft Structures 1

**Classes** Yr: (1 lec & 2 or 3hrs of tut and design activity)/wk

**Assessment** tut assignments plus minor and major design projects

**Syllabus summary:**

(a) Introduction to design: the process of aircraft design; safety and its implications; component design; structural analysis.
(b) Optimisation; design for manufacture; joints and fasteners; vibration; fatigue; human factors, the art of design; social responsibilities.

**Reference books**


Bruhn, _Analysis and Design of Flight Vehicle Structures_ (Tri-State Offset)

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U3.750 Flight Mechanics 1 4 units

_Senior core course_ for the degree in Aeronautical Engineering.

**Mutually exclusive with** U3.450 System Dynamics and Control

**Prereq** U2.000 Mathematics 2 and U2.412 Engineering Dynamics

**Classes** Sem 1: (3 lec & 2 tut)/wk

**Assessment** written exam at end of sem and course assignments

**Syllabus summary:**

(a) Dynamics component of course U3.450 System Dynamics and Control, delivered by Mech Eng Dept
(b) Static and maneuvering longitudinal stability, equilibrium and control of rigid symmetric aircraft.

**Library classification:** 620.11, 628.13, 629.13, 630.1

**Aerodynamic load effects of wings, stabilisers, fuselages and powerplants. Trailing edge aerodynamic controls.**
Trained equilibrium condition. Effects on performance and static stability of trimmed equilibrium.

The concept of static margin. Effects on static stability of free and reversible controls.

Manoeuvring longitudinal stability and the concept of manoeuvre margin. Effects on manoeuvring stability of free and reversible controls.

Reference books
Etkin Dynamics of Atmospheric Flight (Wiley, 1972)
Roskam Airplane Flight Dynamics and Automatic Flight Controls (Roskam Air&EG, 1979)

U3.755 Flight Mechanics 2 4 units
Senior core course for the degree in Aeronautical Engineering.

Coreq U3.750 Flight Mechanics 1
Classes Sem 2: 4 lec/wk with associated tut
Assessment written exam at end of sem and course assignments


Laplace transforms and their application to aeronautical dynamic system analysis. Eigenvalues and eigenvectors and their relation to the stability and behaviour of aeronautical systems.

Static lateral-directional equilibrium and stability. Introduction to lateral-directional control.

Linear approximation of aerodynamic derivatives and the influence of aircraft components on stability derivatives.

Longitudinal and lateral-directional dynamic stability. Frequency domain dynamic stability analysis. Time domain analysis and solutions for the flight path of a rigid-body aircraft; response to control inputs.

Reference books
Etkin Dynamics of Atmospheric Flight (Wiley, 1972)
Roskam Airplane Flight Dynamics and Automatic Flight Controls (Roskam Air&EG, 1979)

U3.760 Laboratory 4 units
Senior core course for the degree in Aeronautical Engineering.

Coreq U3.725 Aerodynamics 2 and U3.730 Aircraft Structures 1
Prereq U2.770 Engineering Computation
Classes approx. twenty-five 3hr lab sessions
Assessment lab assignments

Syllabus summary: A series of laboratory experiments are arranged in conjunction with the Senior courses. Students are evaluated orally during each experiment and are required to complete several detailed reports.

The course also involves a computer laboratory section where students are expected to develop a piece of useful engineering software.

Reference books
Bradshaw Experimental Fluid Mechanics (Pergamon, 1964)
Pankhurst and Holder Wind Tunnel Techniques (Pitman, 1965)

Library classification: 532; 532.54; 629.130725

U3.770 Flying Operations 2 units
Senior core course for the degree in Aeronautical Engineering.

Coreq 36 units of Senior courses
Classes part-week course held mid-semester vacation
Assessment written report

Syllabus summary:
Students are given flying instruction on powered aircraft and gliders, as well as experience of cross country flight and night flight. The flying experience is linked in with the Mechanics of Flight course.

U3.780 Aviation Technology 4 units
Senior core course for the degree in Aeronautical Engineering.

Prereq 96 units of Junior and Intermediate coursework
Classes Yr: 2 lec/wk & associated tut and lab work
Assessment based on assignments submitted during the year, plus one 2hr exam in Sem 1 and Sem 2

Syllabus summary: Survey of current practice in aviation measurement and instrumentation. Introduction to pressure, force, velocity and displacement transducers; accelerometers; electronic anemometers; temperature sensors; strain gauges. Use of electronic sensors as part of computer data logging system; signal generation; amplification; filtering; analogue to digital conversion. Digital data formats; storage requirements and accuracy limitations. Post-processing; calculation of mean and standard deviation for dynamic signals; analysis using fast Fourier transforms; random decrement. Calibration of sensors.

Manufacturing processes; automated machining processes; techniques for manufacture of non-metal components; composite materials; sealants and adhesives. Aeronautical fastening techniques. Introduction to CAD and NC machining.


Reference books
Students taking this course should become familiar with the Australian Civil Aviation Authority’s Civil Aviation Orders, Parts 100 through 103, as well as the related British and United States Aviation authority documents
Cutler Understanding Aircraft Structures (PSP Professional, 1988)

U3.790 Industrial Organisation and Management 4 units
Senior core course for the degree in Aeronautical Engineering.

Classes to be announced
Assessment to be announced
**Syllabus summary (Preliminary):**
Microeconomics, the Australian business environment, the role of government, accounting systems and procedures, the accounting cycle, financial statements, internal performance, financial structures, intellectual property, contract law, legal obligations of business, capital budgeting and investment analysis, introduction to contract administration.

Reference books
- Stanley How to Read and Understand a Balance Sheet (Schwartz & Wilkinson, Melbourne)
- The Small Business Handbook (Small Business Development Corp., Victoria)
- Eyre Mastering Basic Management (Macmillan)
- Stoner, Collins and Vetton Management in Australia (Prentice-Hall)
- Blank and Tarquin Engineering Economy (McGraw-Hill)

**U3.801 Engineering Construction 2**  4 units
*Senior core course* for the degree in Civil Engineering and in Project Engineering and Management (Civil).

**Prereq** U2.800 Engineering Construction 1
**Classes** Sem: 26hrs lec & 26hrs tut
**Assessment** one 3hr exam at end of course and assignments

**Syllabus summary:** Synthesis of systems for the construction of building and civil engineering projects. Advanced techniques for the evaluation of productivity and cost in production systems such as for concrete and asphalt. Economic analysis in planning the execution of heavy construction projects such as tunnelling and marine projects.

Library classification: 624.068

**U3.810 Network Planning**  4 units
*Senior core course* for the degree in Project Engineering and Management (Civil). Elective course for other branches.

**Assessment** coursework, project submission and written exam

**Syllabus summary:** Fundamentals of project planning and control, simplified and manual methods for planning: bar charts, S-curves and other graphics, work breakdown structure, precedence and arrow networks; PERT/CPM methods, resource allocation/levelling, integrated cost/schedule techniques and network-based schedule and cost control.

**U3.811 Contracts Formulation and Administration**  6 units
*Senior core course* for the degree in Project Engineering and Management (Civil). Elective course for other branches.

**Assessment** essay, coursework, assignments and written exam

**Syllabus summary:** The making of a contract, precontract negotiation, nature and purpose of model conditions of contract, standard forms; contract administration and performance, enforcing liabilities and obligations, dispute resolution through effective negotiation, mediation, arbitration and litigation, claims preparation and investigation.

**U3.900 Innovation and International Competitiveness**  4 units
*Senior elective course* for the degree in all branches of Engineering.

**Classes** Sem: (1 lec/1 seminar)/wk
**Assessment** essay, group-project case study, assignments and written exam

**Syllabus summary:** The course is designed to provide students with an understanding of the forces of international competition that are setting the rules for the future of private and public sector organisations in which engineers are employed. Introduction to 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 on the engineer; the engineer as manager and strategist; the role of innovation in business management; product innovation and commercialisation.

Text and reference books
See list supplied by lecturer

**U4.005 Partial Differential Equations**  2 units
*Senior Advanced elective course* for the degree in Mechanical Engineering.

**Mutually exclusive with** some options in the Senior Mathematics courses in the Faculty of Science
**Prereq** U2.000 Mathematics 2
**Classes** Sem: 2 hrs/wk
**Assessment** assignments and one 2hr exam at end of course

**Syllabus summary:** Occurrence of partial differential equations in engineering problems; types. Solution methods: separation of variables; series expansions; transform methods. Special functions. Applications of computer algebra.

Reference books
Consult lecturer

**U4.070 Industrial Ergonomics**  2 units
*Senior Advanced elective course*

**Mutually exclusive with** U4.460 Industrial Engineering
**Classes** Sem: 2 lec/wk plus associated lab work
**Assessment** course assignment

**Syllabus summary:**
(a) Lectures—History and scope of ergonomics; biomechanics; receiving and processing information; presentation of information; anthropometry and seating; ergonomic aspects of noise; human factors in safety; selection, skill and training; industrial lighting; fatigue, shiftwork and the organisation of work; absenteeism; mental health and automation; design of equipment and workspace; biomechanics of handling materials; ergonomic job analysis; personal factors in work performance.

(b) Laboratory—Demonstration of protective clothing and equipment. Methods of measurement of work environment. Climatic chamber.

Reference books
As advised during classes
Library classification: 150,331.1,611,612,620,658
U4.080 Computer-based Design 2 units

Senior Advanced elective course for the degree in Civil Engineering and in Project Engineering and Management (Civil). The course is provided by the Key Centre of Design Quality.

Classes: Sem: (1 lec & 1 tut)/wk

Assessment: semester-long project completed by an interdisciplinary group of students using various computer-based design tools

Syllabus summary: This course addresses the various roles and types of computer-based tools used during design. The aim of this course is to broaden the student's understanding of computer-based tools beyond the software available in the individual departments and to introduce the needs and tools for integrated computer-based design. Topics include: computer-based analysis, modelling, synthesis, data exchange standards, database management systems, integrated design environments in industry.

Reference books:
As indicated during classes

U4.090 Asian Studies 3 8 units

Senior Advanced elective course.

Prereq: U3.090 Asian Studies 2

Classes: Yr: two 2hr classes/wk, one on language and general culture and the other on business culture. Attendance is required at all lectures and classes.

Assessment: oral tests, written assignments and one 2hr written exam in June and November.

Syllabus summary: language (40%), general culture (10%), business culture (50%) for the country chosen.

U4.202 Thesis 1 6 units

Senior Advanced core course for the degree in Civil Engineering and in Project Engineering and Management (Civil). The course U5.204 Thesis. Honours (10 units) may be substituted for this core course.

Coreq: a senior core course in the field of the thesis

Classes: literature survey and experimental work

Assessment: submitted typed thesis and oral presentation

Syllabus summary: A study, in groups of 2 or 3 students, of a selected topic in Civil Engineering. Detailed information sheets are available from the School of Civil and Mining Engineering at the beginning of Semi.

U4.203 Thesis 2 4 units

Senior Advanced elective course for the degree in Civil Engineering and in Project Engineering and Management (Civil).

Coreq: U4.202 Thesis 1

Classes: Sem 2: 52hrs of study

Assessment: submitted typed thesis and oral presentation


U4.205 Practical Experience 4 units

Senior Advanced core course for the degree in Civil Engineering and in Project Engineering and Management (Civil).

Prereq: 28 units of Senior courses

Classes: 12wks practical work experience (375hrs minimum)

Assessment: a written report

Syllabus summary: Each student is required to work as an employee of an approved engineering organisation and to submit a satisfactory written report of his or her work. Normally 12 weeks of practical work experience (375 hours minimum) is required and this is undertaken after the completion of some or all of the prescribed Senior core courses and before enrolment in the final year of study. The University Careers and Appointments Service is available to assist students to obtain suitable employment.

Reference book:
Eagleson Writing in Plain English (Aust. Govt Publishing Service)

U4.214 Materials Aspects in Design 4 units

Senior Advanced core course for the degree in Civil Engineering.

Mutually exclusive with U4.212 Materials 3

Prereq: U3.212 Properties and Materials

Classes: 40hrs lec, 12hrs lab

Assessment: one 3hr exam covering the whole syllabus

Course objectives: To relate the mechanical properties of metals and cement-based materials to the design of structures made from these materials.

Course outcomes: Ability to predict the influence of material properties upon the response of the structure under service conditions.

Syllabus summary: Fracture aspects in the design and use of concrete and reinforced concrete structures. Fracture, fatigue, fire and corrosion aspects in the design and use of metal structures. Durability and serviceability aspects in the design and use of concrete and reinforced concrete structures. Two laboratory sessions on failure modes of RC beams, one laboratory session on electron microscopy, one field trip.

Text and reference books:
As for U3.212 Properties of Materials

U4.223 Finite Element Methods 4 units

Senior Advanced core course for the degree in Civil Engineering.

Prereq: U3.222 Structural Analysis

Classes: Sem: 26hrs lec & 26hrs tut

Assessment: classwork, assignments and one 3hr exam


Textbooks:
As prescribed during the course

Reference books:
U4.232 Bridge Engineering  4 units
*Senior Advanced elective course* for the degree in Civil Engineering.

**Coreq** U4.222 Structural Analysis 2 and U4.231 Structural Behaviour 2
**Classes** 26hrs lec & 26hrs tut
**Assessment** based on submitted work, seminar presentations and one 3hr exam

**Syllabus summary:** Highway and railway bridge loading; influence lines; analysis; traverse load distribution; computer modelling of bridges; effects of movements due to temperature. Elastic shortening and concrete creep and shrinkage; bridge bearings; selection of structural forms; standardised bridge systems, skew and curved bridges, bridge foundations; construction methods; case studies of significant bridges.

Reference books
- NAASRA Bridge Design Specification
- Australian and New Zealand Railway Conferences Railway Bridge Design Manual

Library classification: 624.2-8

U4.236 Concrete Structures 2  4 units
*Senior Advanced elective course* for the degree in Civil Engineering.

**Mutually exclusive with** U5.233 Concrete Structures Honours
**Prereq** U3.235 Concrete Structures 1
**Classes** 28hrs lec, 28hrs tut
**Assessment** one 3hr exam plus assessment of selected assignments

**Course objectives:** To develop a depth understanding of the fundamental behaviour and design of concrete and composite members and structures.

**Expected outcomes:** The development of design skills that will lead to reliable and economical designs of both practical and more complex structures.

**Syllabus summary:** Practical aspects of reinforced concrete, prestressed concrete and composite steel-concrete members and structures—non-linear behaviour, load-moment-curvature relationships, strength of beams, columns and beam columns, moment redistribution, ultimate strength of concrete slabs, yield line analysis of slabs, strip equilibrium analysis of slabs, the analysis of time-dependent effects in concrete structures, models of concrete creep and shrinkage, design of composite T-beams, design of composite slabs incorporating profiled steel sheeting, design of composite columns.

Textbooks
- Warner *et al.* Reinforced Concrete (Pitman)
- Warner and Faulkner Prestressed Concrete (Longman Cheshire)
- Standards Australia Specifications—current editions
- AS2327 Part 1 Composite Structures Code
- AS1170 Parts 1 and 2 Loading Code, and
- AS3600 Concrete Structures Code, or
- AS HB2.2 Structural Engineering Standards

Reference books
- Lin and Burns Design of Prestressed Concrete Structures (Wiley)
- Park and Gamble Reinforced Concrete Slabs (Wiley)
- Other books as indicated in classes

Library classification: 624.176,624.171

U4.237 Structural Dynamics  4 units
*Senior Advanced elective course* for the degree in Civil Engineering.

**Prereq** U3.222 Structural Analysis
**Mutually exclusive with** U3.234 Structural Dynamics Honours
**Classes** 26hrs lec, 26hrs tut
**Assessment** one 2hr exam and assignments

**Course objectives:** To provide an understanding of the dynamic behaviour of structural systems and wind loads on structures.

**Expected outcomes:** To be able to determine the natural frequency of simple structural systems manually and complex systems using computer analyses; to be able to perform analyses for the effects of forced vibration and structural damping; to be able to perform wind analyses on low and high rise structures.

**Syllabus summary:** Introductory structural dynamics, natural frequency, free and forced vibration, structural damping, single and multi-degree of freedom systems, finite element dynamic analysis, consistent mass matrix, damping matrix, free vibration, forced vibration, wind loading on structures.

**Course objectives:** To develop a working knowledge of the behaviour and design of steel structures beyond a basic competency.

**Expected outcomes:** Proficiency in the design of steel structures.

**Syllabus summary:** Three of the 4 subjects will be available: (1) Bending and torsion in steel structures—behaviour, analysis and design; (2) Local buckling behaviour and design; (3) Flexural-torsional buckling—behaviour and design of beams; (4) Shell structures—behaviour and membrane analysis.

Textbooks
- Trahair and Bradford Behaviour and Design of Steel Structures (Chapman & Hall, 1991)
- Trahair Flexural-Torsional Buckling of Structures (Spon, 1993)
- Standards Australia AS4100—Steel Structures (1990)
- Gibson Thin Shells (Pergamon, 1980)
- Vinson The Behaviour of Plates and Shells (Wiley, 1974)

Reference books
- Bulson Stability of Flat Plates (Chatto & Windus, 1970)
U4.246 Environmental Geotechnics 4 units  
Senior Advanced elective course for the degree in Civil Engineering.

**Course objectives:** To develop an understanding of: the role of geotechnics in the design of waste management systems; current design methods and technologies. In particular, they should be able to predict likely interactions between waste and soil, and pollutant movement in the ground, and should be able to evaluate strategies for the containment of industrial and domestic wastes and mine tailings.

**Expected outcomes:** Students should gain an understanding of: the role of geotechnics in the design of waste management systems; current design methods and technologies. In particular, they should be able to predict likely interactions between waste and soil, and pollutant movement in the ground, and should be able to evaluate strategies for the containment of industrial and domestic wastes and mine tailings.

**Syllabus summary:** Landfill design, including clay mineralogy, effects of chemicals on soil permeability, flow rates through membranes, effects of punctures, composite liners, mechanisms of mass transport, diffusion, dispersion, advective transport, sorption, predicting transport time, solutions to advection-dispersion equation, design of liners, stability of clay liners on slopes, design of covers, infiltration rates. Tailings disposal, including types of tailings dams, design of dams, water balances, rehabilitation.

**Reference books**
To be advised

**Library classification:** 624.15, 624.16

U4.247 Foundation Engineering 4 units  
Senior Advanced elective course for the degree in Civil Engineering.

**Course objectives:** To develop understanding of current methods used in the investigation and design of foundations on soils and rocks; the limitations of these methods.

**Expected outcomes:** Students should gain an understanding of: the design process in foundation engineering; the role of site investigation and field testing; the need to deal with uncertainty. In particular, they should develop the ability to: interpret the results of a site investigation; use soils data to design simple foundations; and develop an appreciation of the interaction between soils, the foundation system and the supported structure.


**Reference books**
Tomlinson *Foundation Design and Construction* (Pitman)
Peck *et al.* *Foundation Engineering* (Wiley)
Poulos and Davis *Pile Foundation Analysis and Design* (Wiley)
Fleming *et al.* *Piling Engineering* (Halstead Press)
Das *Principles of Foundation Engineering* (PWS—Kent)

**Library classification:** 624.15, 624.16

U4.251 Surveying 2 4 units  
Senior Advanced elective course for the degree in Civil Engineering.

**Mutually exclusive with U4.250 Surveying**

**Prereq** U3.250 Surveying 1

**Classes** 32hrs lec, 20hrs fieldwork and tut

**Assessment** fieldwork, reports, tutorials, and one 3hr exam at the end of the course

**Course objectives:** To introduce students to precise measurement technologies, processes, computational procedures, and interpretive skills; to give students a high level of understanding of automated electronic measuring systems; to introduce students to data handling, manipulation, and presentation at a project level.

**Expected outcomes:** Students should gain the ability to: undertake precise measurement procedures for determining position, extent and stability of points and structures; use advanced electronic measurement equipment; handle and manipulate data in electronic form; analyse data and determine the magnitude of errors.

**Syllabus summary:** CAD and database applications, horizontal and vertical curves, electronic distance measurements, precise angle measurement, high precision engineering surveys, geodetic surveying, global positioning systems, geographic information systems, photogrammetry.

**Textbooks**
Fryer and Elfick *Elementary Surveying* 7th edn (Harper & Row) or
Uren and Price *Surveying for Engineers* 2nd edn (Macmillian)

**Library classification:** 526.9

U4.253 Civil Engineering Camp 4 units  
Senior Advanced core course for the degree in Civil Engineering.

**Prereq** U3.250 Surveying 1

**Classes** the civil engineering camp is carried out over a 10-day period at a nominated location off-campus

**Assessment** no formal exam; assessment is based on field work activities, oral presentations and reports which are submitted during the camp period

**Course objectives:** To give students experience at gathering dimensional information and using that information in design considerations; to give students experience in project design in a practical situation; to
give students the opportunity to experience project management in a practical situation; to develop student skills in working as a group member on an engineering project team; to develop oral and written presentation skills.

**Expected outcomes:** Students should develop an understanding of: dimensional control in a project situation; total project management considerations; real-world design problems; project presentation skills; group relationships; time management skills.

**Syllabus summary:** The activities involve work directed towards an integrated civil engineering project. A number of survey tasks are carried out to provide the necessary design information. At the camp, each group will be given responsibility for one component of an overall project. Oral presentation and design submissions form an integral part of the camp activities.

**U4.260 Environmental Fluids 1** 4 units  
*Senior Advanced elective course* for the degree in Civil Engineering.

**Mutually exclusive with** U2.260 Engineering Hydrology  
*Classes* 26hrs lec, 26hrs tut  
*Assessment* one 3hr exam covering the whole syllabus at the end of the semester. Satisfactory performance in tutorials is also a requirement. Credit will be given for tutorial submissions, as indicated at the beginning of the course.

**Course objectives:** To develop an understanding of: basic meteorological principles; the principles of hydrology; the importance of flood routing; the principles of flood mitigation; irrigation requirements; evaporation and reservoir design.

**Expected outcomes:** Students will be able to: list the key factors which affect the climate of Australia; describe intensity-frequency-duration curves and explain their use; calculate design rainfall intensities; calculate peak flows from catchments; determine runoff hydrographs for various storm durations and intensities; state the principles of flood routing and perform flood routing calculations; assess surface runoff and infiltration in catchments; list and utilise design procedures for storage and service reservoirs; calculate reservoir safe yield; determine evaporation from reservoirs and evapo-transpiration from catchments.

**Syllabus summary:** Elements of meteorology; precipitation measurement and analysis; design rainfall intensities; hydrographs; peak discharge calculations; evaporation and transpiration; infiltration and groundwater; surface runoff; flood routing.

**Textbook**  
*Australian Rainfall and Runoff* (I.E. Aust, 1987)

**Reference books**  
Raudkivi *Hydrology* (Pergamon)  
Raudkivi and Callander *Analysis of Groundwater Flow* (Edward Arnold)  
Library classification: 551.48

**U4.265 Environmental Fluids 2** 4 units  
*Senior Advanced elective course* for the degree in Civil Engineering.

**Mutually exclusive with** U4.263 Fluids Engineering  
*Classes* 26hrs lec, 26hrs tut  
*Assessment* one 3hr exam covering the whole syllabus at the end of the semester. Satisfactory performance in class assignments is also a requirement. Credit will be given for assignment submissions, as indicated at the beginning of the course.

**Course objectives:** To develop an understanding of: ocean wave generation, transmission and coastal effects; the principles of sediment transport; breakwater design, fluid-structure interaction; flood detention basins and advanced flood routing techniques.

**Expected outcomes:** Students will be able to: list and describe the major parameters affecting ocean wave generation; describe the processes of ocean wave transmission; calculate energy transfer by waves; describe the behaviour of waves in shallow water; explain the fundamental principles of sediment transport; describe sediment transport processes in rivers; describe coastal sediment transport processes; explain basic requirements for breakwaters, and factors considered in their design; describe several fluid structures, together with associated fluid-structure interaction, including, but not limited to, spillways, stilling basins, bridge piers, water supply intakes; describe design considerations for flood detention basins; explain the principles of river routing and discuss the applications of flood modelling techniques and programs.

**Syllabus summary:** Coastal processes. Sediment transport. Breakwater design. Fluid structure interaction. Flood effects.

**Reference books**  
To be advised during the course  
Library classification: 627.58, 551.36

**U4.266 Water Resources Engineering** 4 units  
*Senior Advanced elective course* for the degree in Civil Engineering.

**Classes** Sem: 26hrs lec, 26hrs tut  
*Assessment* one 3hr exam covering the whole syllabus at the end of the semester. Satisfactory performance in class assignments is also a requirement. Credit will be given for assignment submissions, as indicated at the beginning of the course.

**Course objectives:** To develop an understanding of: the assessment methods for water quality; physical, biological and chemical treatment methods; water storage and distribution systems; management principles for water resources, including water reuse; irrigation techniques and demands; hydro-power systems.

**Expected outcomes:** Students will be able to: state the requirements of water quality for various purposes; detail the physical methods of water treatment; detail the biological methods used in water treatment; detail the chemical methods used in water treatment; design multi-node water distribution networks; explain the design principles of water Supply for high-rise
buildings; describe water conservation methods and management principles for water use, including storm water detention and treatment; explain 'grey water' re-use techniques and their applications; describe various irrigation methods and associated hydraulic design; design small-scale hydro-power installations.

**Syllabus summary**: Water quality; water purification methods; water reticulation, water resource management; irrigation and hydro-power.

Reference books
As indicated during classes
Library classification: 628.1

U4.273 Engineering Management 4 units
*Senior Advanced core course for the degree in Civil Engineering.*

**Classes** 26hrs lec, 26hrs tut
**Assessment** one 3hr written examination at the end of the semester, covering the whole syllabus; a major project assignment covering the project planning and documentation segment; class test during the semester and credit which may be given for any coursework as advised at the commencement of the course

**Course objectives**: To develop an understanding of conceptualisation and management of engineering and construction projects including: economic modelling, appraisal and optimisation; economic analysis of public sector projects; project sensitivity and risk analysis and risk management techniques; value engineering; work study and related techniques; planning, scheduling and cost engineering of project; project documentation design and presentation.

**Expected outcomes**: Students should develop an understanding of the fundamentals of project conceptualisation, appraisal, planning and optimisation plus ability to: model and analyse basic economic problems in engineering and construction projects including formulation of objective criteria; analyse, interpret and present the results; quantitatively evaluate field productivity and method study, aspects of team management and design and presentation of professional documentation.

**Syllabus summary**: Introduction to project conceptualisation and development; stages in project life cycle; techniques of project appraisal including comparison of alternatives, valuation, depreciation and capitalisation method; sensitivity and risk analysis and management of risks; value engineering; work study and related concepts and techniques; pre- and post-tender planning, cost engineering, critical path method of scheduling; resource levelling and associated project management techniques.

Textbook
*Organisation and Management of Construction* (School of Civil and Mining Engineering, University of Sydney)

Reference books
Grant, Ireson and Leavenworth *Principles of Engineering Economy* (J. Wiley & Sons)
Thompson *Organisation and Economics of Construction* (McGraw-Hill)
Turner *Handbook of Project-based Management* (McGraw-Hill)

Library classification: 624.068,658.01518,692.5-8

U4.274 Project Procedures 4 units
*Senior Advanced elective course for the degree in Civil Engineering.*

**Classes** 26hrs lec & 26hrs tut
**Assessment** based on submitted work and one 3hr exam

**Syllabus summary**: (a) Cost engineering and estimating—Elemental estimating for cost planning and value engineering, work measurement and bills of quantities; computer aided estimating; cost monitoring of construction projects; tender preparation and documentation. (b) Industrial legislation and awards. (c) Contract law and documentation.

Library Classification: 692.5

U4.276 Professional Practice 4 units
*Senior Advanced core course for the degree in Civil Engineering.*

**Classes** 26hrs lec, 26hrs tut
**Assessment** project and assignment work including an oral presentation

**Course objectives**: To provide final year students with an appreciation of professional matters which will influence the way they will work as professional engineers.

**Expected outcomes**: Knowledge of occupational health and safety act; knowledge of procedures for quality assurance both in design and construction; understanding of industrial relations issues; understanding of basic civil engineering contracts; awareness of social responsibility of engineers; understanding of the importance and means of preparation of environmental impact statements; awareness of ethical issues related to the engineering profession.

**Syllabus summary**: The lectures will be delivered by practising engineers and other experts in the following subject areas: (a) Social responsibility in engineering, social and environmental issues and ethics of engineering practice; (b) Industrial relations, legal contracts and law; (c) Occupational health and safety, and quality assurance.

Reference material
As advised during course and
Tagg *et al. Civil Engineering Procedure* (Thomas Telford)
Wearne *Civil Engineering Contracts* (Thomas Telford)
Library classification: 331,343, 346,347

U4.292 Civil Engineering Design 4 units
*Senior Advanced core course for the degree in Civil Engineering.*

**Prereq** U3.291 Structural Design 2, U3.211 Materials 2, U3.221 Structural Analysis 1 and U3.230 Structural Behaviour

**Classes** 13hrs lec & 39hrs of drawing office work
**Assessment** no formal exam; assessment will be based on submissions

**Syllabus summary**: The design sequence 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.

The course is under the direction of engineers in professional practice in cooperation with members of the academic staff. Lectures on specific aspects of design are supplemented by visits to construction, testing and manufacturing sites. Lectures and exercises on architectural design and practice and their relationship to civil engineering are included in the course.

Reference books
The course is of a wide-ranging nature, and all text and reference books previous and current courses have relevance. In addition, reference will be made to many codes and guides to practice, of which the following list covers only the structural field:

Current SAA Codes, Manuals and Specifications, particularly
- AS4100—Steel Structures Code
- AS3600—Concrete Structures Code
- AS1554—Manual Welding, Part I
- AS170—Loading Code, Parts I and 11
- AS1511—High Strength Structural Bolting Code
- MAI Steel Structures
- NAA.S.R.A. Bridge Design Specification
- AS1720—Timber Engineering Code

(Purchase of separate codes is recommended)

Library classification: 624.15, 624.177, 624.18, 624.25, 625.72, 627.2, 627.3, 627.8

U4.293 Project Formulation 4 units
Senior Advanced elective course for the degree in Civil Engineering.


Classes 13hrs lec & 39hrs drawing office work
Assessment no formal exam; assessment will be based on submitted work and oral presentation

Syllabus summary: This course will integrate the technical, commercial and managerial aspects of the civil engineering project.

Students will be cast in the role of entrepreneurs faced with the exploitation of a civil engineering business opportunity. They will assess the technical and financial feasibility of the project and appropriate legal and managerial arrangements and corporate structure for the enterprise.

Engineering design of the project will be carried to the point where it can be shown that the concept is technically sound.

The course will culminate with the presentation of a project to a board of review.

U4.421 Fluids Engineering 4 units
Senior Advanced elective course.

Prereq U3.420 Thermo-fluid Engineering
Classes Yr: 2hrs lec & tut/wk
Assessment tut work, projects and one 2hr exam at end of each sem

Syllabus summary: This course will comprise one or more of the following components dependent on the availability of lecturers from year to year:

Computational fluid dynamics—Conservation equations of fluid flow; boundary conditions; classification of flow problems. Numerical solution schemes based on pressure correction; the SIMPLE algorithm and its variants, convection schemes. Solution of the resulting algebraic equations. Turbulence modelling; implementation of boundary conditions in turbulent flow. Coupled heat transfer: convection, combustion, radiation heat transfer. Multiphase flow. Introductions to compressible flow, the physical significance of hyperbolic equations; characteristic based methods; FCT and TVD schemes. Pitfalls to avoid in CFD.

Fans and pumps—The design of incompressible fluid machines; specific speed; cavitation; mechanical construction.

Industrial aerodynamics—Practical flow categories; building aerodynamics; wind characteristics; wind loading; Australian wind code and design; vehicle aerodynamics; drag and stability; wind tunnel testing.

Expected outcomes: Students should be able to (i) perform analyses of simple reacting systems and predict temperatures and species concentrations, and (ii) perform a complete design of air conditioning systems including thermal load calculations, ducting, control and equipment selection.

Syllabus summary: The course will comprise two or three of the following components dependent on the availability of lecturers from year to year:


Air conditioning technology—Heat load estimation, applied psychometrics, air handling equipment, refrigeration equipment, systems, control, energy conservation and management in buildings.


Combustion engineering—Mass and energy balances, equilibrium, partial equilibrium and non-equilibrium products, simple reactor theory, chemical kinetics, premixed and diffusion flames, heterogeneous combustion, pollutant formation, combustion systems.

Reference books
U4.422 Computational Methods for Partial Differential Equations 4 units

Senior Advanced elective course.

Prereq U2.000 Mathematics 2
Classes Sem: 2 lec/wk with associated tut and prac sessions

Assessment assignments

Course objectives: To give students practise in writing programs to solve linear PDEs. To provide sufficient theory so they understand why their programs (or commercial software) sometimes may not give the ‘right’ answer.

Expected Outcomes: Students will be able to set up and solve the common PDEs arising in Mechanical Engineering, using several of the following methods: finite differences, finite elements, boundary elements, finite volumes, weighted residuals. Students will appreciate the commonalities linking the equations in different fields, and linking the various solution methods.

Syllabus summary: Finite difference techniques for elliptic, parabolic and hyperbolic partial differential equations. Method of weighted residuals (Galerkin, least-squares), etc.). The use of the finite element, boundary element and finite difference methods in the effective computer solution of engineering problems in fluid dynamics, heat transfer and other areas.

Reference books
Zienkiewicz and Morgan Finite Elements and Approximations (Wiley, 1983)

Library Classification: 515.35,532.05,620.0042

6 units

U4.430 Applied Numerical Stress Analysis

Senior Advanced elective course.

Mutually exclusive with U4.730 Aircraft Structures 3
Prereq U3.430 Mechanics and Properties of Solids 2
Classes Sem: 1.2 lec/wk plus prac classes
Assessment one 2hr exam at end of course, class work is assessed


Reference books
Ashby Materials Selection in Mechanical Design (Pergamon, 1993)
Atkins and Mai Elastic and Plastic Fracture (Ellis Horwood, 1985)
Brook Elementary Fracture Mechanics 3rd edn (Martinus Nijhoff, 1982)
Chawala Composite Materials (Springer-Verlag, 1987)
Davidge Mechanical Behaviour of Ceramics (C.U.P., 1979)
Eckold Design and Manufacture of Composite Structures (McGraw-Hill, 1994)
Harris Engineering Composite Materials (Institute of Metals, 1986)
Richerson Modern Ceramic Engineering (M. Dekker, 1982)

Library classification: 620, 624, 666-679

6 units

U4.433 Advanced Engineering Materials 6 units

Senior Advanced elective course.

Mutually exclusive with U4.434 Aerospace Materials Engineering
Prereq U3.430 Mechanics and Properties of Solids 2 or U3.431 Mechanical Properties of Materials
Classes Sem 2: (3 lec & 3 tut & lab)/wk
Assessment one 2hr exam at the end of Sem 2, one project report, assignments and lab reports as specified at the commencement of the semester

Course objectives: To understand (a) how to conduct failure diagnosis of engineering structures, (b) how to define the relationship between properties and microstructures of advanced engineering materials, and (b) how to improve mechanical design with the knowledge of mechanics and properties of materials.

Expected outcomes: Students should gain the capabilities: (a) to conduct failure diagnosis of simplified failure cases of engineering structures, (b) to define structure-property relationships of advanced engineering materials, and (c) to improve the performance of engineering structures through tailoring materials microstructure and manufacturing processes.

Syllabus summary: Postyield fracture mechanics, embrittlement, creep rupture, damage tolerance, structure integrity and reliability, thin film science and technology, advanced polymer matrix composites, toughening mechanisms, processing and manufacturing, superalloys, advanced joining methods.

Textbooks
Lecture notes

Reference books
Ashby Materials Selection in Mechanical Design (Pergamon, 1993)
Atkins and Mai Elastic and Plastic Fracture (Ellis Horwood, 1985)
Brook Elementary Fracture Mechanics 3rd edn (Martinus Nijhoff, 1982)
Chawala Composite Materials (Springer-Verlag, 1987)
Davidge Mechanical Behaviour of Ceramics (C.U.P., 1979)
Eckold Design and Manufacture of Composite Structures (McGraw-Hill, 1994)
Harris Engineering Composite Materials (Institute of Metals, 1986)
Richerson Modern Ceramic Engineering (M. Dekker, 1982)

Library classification: 620, 624, 666-679
U4.434 Aerospace Materials Engineering  
4 units  
Senior Advanced elective course for the degree in Aeronautical and Mechanical Engineering.  

Mutually exclusive with U4.433 Aerospace Materials Engineering  
Prereq U3.430 Mechanics and Properties of Solids 2 or U3.431 Mechanical Properties of Materials  
Classes Sem 2: 3 lec & 3 tut & lab)/wk  
Assessment one 2hr exam at the end of Sem 2 plus assignments and lab reports as specified at the commencement of the semester  

Course objectives: To understand (a) how to conduct failure diagnosis of engineering structures, (b) how to define the relationship between properties and microstructures of advanced engineering materials, and (b) how to improve mechanical design with the knowledge of mechanics and properties of materials.  

Expected outcomes: Student should gain the capabilities: (a) to conduct failure diagnosis of simplified failure cases of engineering structures, (b) to improve the performance of engineering structures through tailoring materials microstructure and manufacturing processes.  

Syllabus summary: Postyield fracture mechanics, embrittlement, creep rupture, damage tolerance, structure integrity and reliability, thin film science and technology, advanced polymer matrix composites, toughening mechanisms, processing and manufacturing, superalloys, advanced joining methods.  

Textbooks  
Lecture notes  
Reference books  
Ashby Materials Selection in Mechanical Design (Pergamon, 1993)  
Atkins and Mai Elastic and Plastic Fracture (Ellis Horwood, 1985)  
Broek Elementary Fracture Mechanics 3rd edn (Martinus Nijhoff, 1982)  
Chawla Composite Materials (Springer-Verlag, 1987)  
Davidie Mechanical Behaviour of Ceramics (C.U.P., 1979)  
Eckold Design and Manufacture of Composite Structures (McGraw-Hill, 1994)  
Harris Engineering Composite Materials (Institute of Metals, 1986)  
Richerson Modern Ceramic Engineering (M Dekker, 1982)  
Library classification: 620, 624, 666-679  

U4.438 Biomaterials and Biomechanics  
4 units  
Senior Advanced elective course for the degree in Mechanical Engineering.  

Prereq any Intermediate Year Materials course or Physics.  
U3.450 System Dynamics and Control, or U3.750 Mechanics of Flight 1 or U3.530 Control 1 or U3.660 Process Control 1  
Classes (4hrs lec/tut/lab)/wk  
Assessment continual assessment and exam at end of Sem  

Course Objectives: To gain a basic understanding of the major areas of interest in both the biomaterials and biomechanics fields, learn to apply basic engineering principles to biomedical systems, and understand the challenges and difficulties of biomedical systems.  

Desired Outcomes: Students should be able to:  
- Apply static and dynamic mechanical analyses to the human body to describe motion.  
- Understand the mechanical behaviour of biological tissues and the types of models used to describe this behaviour.  
- Understand all the factors involved in the selection of a biomaterial for tissue replacement, including mechanical, biocompatibility, material property and fixation factors.  
- Improve their written and oral communication skills in a technical setting.  

The students should gain a basic understanding of the major areas of current research in both the biomaterials and biomechanics fields, learn to apply basic engineering principles to biomedical systems, and understand the challenges and difficulties of biomedical systems.  

Syllabus summary: Introduction to biomaterials, characteristics of materials, including mechanical testing and advanced analysis techniques, metallic, polymeric, ceramic, composite implant materials and their properties; structure/property relationships to biological materials and the study of 'biomimetics'(mimicry of biological materials), tissue response to implants, soft tissue replacement, hard tissue replacement and laboratory testing of biomaterials and biological materials.  

Introduction to biomechanics, modelling the human body from the macroscopic level to the microscopic level, soft tissue mechanics—non-linear and viscoelastic descriptions, 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.  

Reference books  
J. Black Orthopaedic biomaterials in research and practice (Churchill Livingstone, 1988)  
Y.-C. Fung Biomechanics of Living Tissues (Springer-Verlag)  

U4.440 Advanced Design  
6 units  
Senior Advanced elective course for the degree in Mechanical and Mechatronic Engineering.  

Prereq U3.440 Mechanical Design 2  
Classes Yr: 3hrs/wk  
Assessment assessment is based upon one major design project and several minor design tasks, complemented by one-on-one discussions during the year with each student in relation to these design activities  

Course objectives: To develop a fuller understanding of and familiarity with the practical design processes expected in industry, including application of the knowledge obtained from other courses studied.
Expected outcomes: Students should be able to undertake with a measure of confidence basic design tasks likely to be encountered in early industrial employment, and should have an appreciation of and some familiarity with the many aspects associated with such an activity.

Syllabus summary: The course draws together the various subjects studied and introduces the student to the practical aspects of design in the commercial environment, with the encouragement of direct industry contacts. As well as design for function and mechanical and structural integrity, consideration is given to manufacturing possibilities, to economic, environmental and human aspects, and to professional responsibility and liability.

U4.441 Orthopaedic Engineering 4 units
Senior Advanced: elective course for the degree in Mechanical Engineering.
Prereq 36 units of Senior year subjects
Classes Sem 1: 4hrs tut/lab classes/wk
Assessment one 2hr exam at the end of Sem 1

Course objectives: To introduce students to a number of applications of mechanics and system theory in machinery and instrumentation. To develop an understanding of dynamics analysis techniques and dynamics of common machinery.

Expected outcomes: Students will be able to measure machine vibration and diagnose its likely cause. They will understand the rationale of vibration condition monitoring and know how it is carried out. They will be able to analyse and design machinery involving planar and spatial mechanisms. They will understand and be able to use techniques of signal analysis in the frequency and time domains.

Syllabus summary: Musculoskeletal anatomy, physiology and function, including basic medical terminology, anatomy and physiology, normal and abnormal joints, bones, cartilage, ligaments and tendons. Introduction to orthopaedic injuries, including fractures, bone healing, fracture fixation, electrical stimulation of bone healing. Overview of the design, manufacture and use of artificial ligaments, hip, knee and shoulder joint prostheses, bone cement, finite element modelling of prostheses, material considerations, testing of orthopaedic implants, failure of implants.

Library classification: 620.1, 620.101, 620.3, 620.7

U4.451 Dynamics and Systems Engineering 6 units
Senior Advanced elective course for the degree in Mechanical and Mechatronic Engineering.

Prereq 36 units of Senior year subjects
Prereq U3.450 System Dynamics and Control and either U3.500 Industrial Electronics or U2.504 Electrical and Electronic Engineering
Classes Sem 6hr/wk including associated prac sessions
Assessment one 3hr exam or two 2hr exams plus assignments

Syllabus summary: Review of dynamics, including modal analysis of lumped and continuous systems, aspects of applied problems, especially the dynamics of rotating machinery, the measurement of vibration and condition monitoring of machines. Some aspects of random vibrations, including measurement and prediction of failure.


Reference books
Franklin, Powell and Emami-Naeini Feedback Control of Dynamic Systems (Addison-Wesley, 1986)

U4.455 Microprocessor Control of Machinery 6 units
Senior Advanced elective course for the degree in Mechanical Engineering.

Mutually exclusive with U3.476 Industrial Electronics A
Prereq U3.500 Industrial Electronics or U2.504 Electrical and Electronic Engineering
Classes Sem 1: (2 lec & 3hrs lab work)/wk
Assessment one 2hr exam at end of Sem 1; plus assignment and project work

Syllabus summary: An overview of some topics central to industrial automation, with emphasis on the use of single-board computers for embedded control of machinery and other products.

Sensors: inductive proximity sensors; optoelectronics and optical proximity sensors, optical encoders; synchro resolver; LVDT; tachogenerator; sensors for pressure and temperature measurement, including monolithic devices.

Actuators: overview of industrial pneumatics and hydraulics; review of some types of electric motors and their drives.

Basic interface electronics, and special-purpose interface ICs.

Design of a standard 8-bit microprocessor system will be discussed in detail: CPU; ROM and RAM, and address decoding; I/O interface chips; interrupts. The Zilog Z80 family will be used as an example system. Assembly language programming; problem definition, program design, project documentation; development systems; man-machine and machine-machine communication.

The course will involve considerable laboratory work, including a major project. The project will entail some assembly language programming, together with the design and bread boarding of simple interface circuitry to allow a single board computer to control external mechanical hardware.

Reference books
An extensive list of references will be distributed in class
U4.456 Sensors and Signals 6 units
Senior Advanced elective course.
Prereq U3.450 System Dynamics and Control and U3.476 Industrial Electronics
Classes Sem 1: (3hrs lec, 1hr tut & 2hrs lab)/wk
Assessment exam, assignments and laboratory work

Syllabus summary: This course comprises three equal parts: Devices, Signals and Systems. Devices deals with sensors and the interfacing of sensors to computers and machines. Signals deals with the modeling, conditioning and analysis of sensor signals. Systems deals with the use of sensor signals in control and systems design, with reference to key mechatronics applications:

(a) Devices
Process and machine instrumentation: sensor types (temperature, pressure, force, proximity) and properties; interfacing considerations, hardware and applications.
Automotive, aerospace and robotic sensors: sensor types (accelerometers, gyroscopes, lasers, ultrasonics, radar) and measurement principles; interfacing considerations, hardware and applications.

One 6-hour laboratory on sensor interfacing example.

(b) Signals
Introduction to signals and noise as stochastic processes; signal characterisation, signal conditioning. Signal analysis in the time domain; signal analysis in the frequency domain; modeling and processing of signals; introduction to estimation theory.

Two 2-hour computer laboratories; signal characterisation and signal modeling.

(c) Systems
Signal processing systems, hardware and software; special purpose and digital signal processing hardware; introduction to data fusion theory. Condition monitoring; reliability and fault detection.

Example applications; process monitoring and automotive systems.

One 10-hour computer laboratory on system design.

U4.457 Computational Fluid Dynamics 4 units
Senior Advanced elective course.
Prereq U3.420 Thermo Fluid Engineering
Classes Yr: (1hr lec & 0.5 tut)/wk
Assessment tut work, projects and one 2hr exam at the end of each Sem

Syllabus summary: The course will provide the student with an understanding of the structure of a modern CFD package. At the end of the course the student will be able to write a simple code to solve the Navier-Stokes equations as well as use a state of the art CFD package. Specific topics covered will include:

• Conservation equations of fluid flow
• Finite difference solution methods for advection diffusion and Poisson’s equations
• Solution of algebraic systems
• SIMPLE algorithm and its variants
• High order advection schemes
• Turbulence modelling

• Implementation of boundary conditions
• Coupled heat transfer: convection radiation heat transfer
• Pitfalls to avoid in CFD.

Reference books
Fletcher Computational Techniques for Fluid Dynamics Vols 1 and 2 (Springer, 1988)

U4.458 Advanced Topics in Mechanical Engineering A 2 units
Senior Advanced elective course.
Prereq 24 units of Senior courses
Classes Sem 1: (1hr lec & 0.5 tut)/wk

Syllabus summary: The course is designed to provide students with knowledge in a specialised topic that is of relevance to Mechanical or Mechatronic Engineering. The details of the course will vary depending on the topic being taught.

Textbook
To be advised

U4.459 Advanced Topics in Mechanical Engineering B 4 units
Senior Advanced elective course.
Prereq 24 units of Senior courses
Classes Sem 1: (1hr lec & 0.5 tut)/wk

Syllabus summary: The course is designed to provide students with knowledge in a specialised topic that is of relevance to Mechanical or Mechatronic Engineering. The details of the course will vary depending on the topic being taught.

Textbook
To be advised

U4.460 Industrial Engineering 6 units
Senior Advanced elective course.
Prereq U2.000 Mathematics 2 and U3.460 Manufacturing Engineering and Management and completion of industrial experience period
Classes Sem 1: 3 lec/wk plus associated tut and lab work and industrial visits
Assessment assignments plus one 3hr exam

Course objectives: To develop an understanding of:

• principles and practices of industrial and engineering management,
• effects of globalisation on Australia’s economic performance, and the competitiveness of Australian firms,
• insight into the importance of innovation,
• roles appropriate to governments,
• ergonomics,
• information handling,
• safety,
• training,
• work performance,
• the role of operations research in modern industry,
• problem formulation and analysis techniques for operations research problems,
• the importance of reliability analysis in part and system designs, and
• the use of maintenance and repair to extend the useful life of systems.

Expected outcomes: Students should develop skills and abilities in:
• the application of problem solving solutions to management issues,
• an appreciation of the interrelationships and complexities associated with the management of a modern industrial organisation,
• the development of logical, thoughtful and creative presentations concerning industrial management,
• ergonomic analysis,
• information processing,
• consideration of the workspace,
• consideration of the workers and their skills, and
• the solution of a range of operations research and reliability problems.

Syllabus summary:
Industrial ergonomics—refer to syllabus summary for U4.070 Industrial Ergonomics.
Operations research—refer to syllabus summary for U4.461 Introduction to Operations Research.
Industrial and Engineering Management—total quality management, production planning and control, costing and pricing, inventory management and control, management reporting systems, value analysis, problem resolution strategies, dispute-management, project management, contract administration, marketing management, business planning, the management of engineering enterprises, professional engineering skills.

Textbook
Samson Management for Engineering (Longmans)
Reference books
As for U4.070 and U4.461
Hicks Introduction to Industrial Engineering and Management Science (McGraw-Hill, 1977)
Harding Production Management 2nd edn (MacDonald & Evans, 1974)
Hussey Introducing Corporate Planning (Pergamon, 1972)
Currie Work Study 4th edn (Pitman, 1977)
Heyde Concise MODAPTS (AAPTS&R, 1975)
Hunt Managing People at Work (McGraw-Hill, 1979)
Blakemore The Quality Solution (Australian Business Library, Vic.,)
Kotler, Fitzroy and Shaw Australian Marketing Management (Prentice-Hall)
Macnamara Australian Marketing and Promotion Handbook (Australian Business Library)
Case Studies in Australian Strategic Management
Other books may be advised during the course

U4.461 Introduction to Operations Research
2 units

Senior Advanced elective course. A component of the course U4.460 Industrial Engineering.

Mutually exclusive with U4.460 Industrial Engineering
Prereq U2.000 Mathematics 2
Classes Sem 1: (1 lec & 1 tut)/wk
Assessment one 2hr paper at end of course plus assignments

Course objectives: To develop an understanding of:
• the role of operations research in modern industry
• problem formulation and analysis techniques for operations research problems,
• the importance of reliability analysis in part and system designs, and
• the use of maintenance and repair to extend the useful life of systems.

Expected outcomes: Students should develop skills in
the solution of a range of operations research and reliability problems.

Syllabus summary: Method and history of operations research: broad aims; general problem approach.
Inventory control problems, with constant and random demand. Allocation problems; linear programming; transportation problem. Introduction to reliability analysis; component and system reliability; effect of maintenance and repair. Discrete event simulation with applications to inventory control and maintenance.

Reference books
Daellenbach, George and McNickle Introduction to Operations Research Techniques (Allyn and Bacon, 1984)
or
Lewis Introduction to Engineering Reliability (Wiley, 1987)
Library classification: 658

U4.462 Industrial and Engineering Management
2 units

Senior Advanced elective course for the degree in Mechanical and Mechatronic Engineering.

Mutually exclusive with U4.460 Industrial Engineering
Prereq U3.460 Manufacturing Engineering and Management or U3.571 Management for Engineers or U3.790 Industrial Organisation and Management; together with completion of the industrial experience period
Classes Sem 1: 2hrs of lec & tut/wk plus industrial visits
Assessment assignments and one 2hr exam

Course objectives: To develop an understanding of:
• principles and practices of industrial and engineering management,
• effects of globalisation on Australia’s economic performance, and the competitiveness of Australian firms,
• insight into the importance of innovation, and
• roles appropriate to governments.

Expected outcomes: Students should develop skills and abilities in:
• the application of problem solving solutions to management issues,
• an appreciation of the interrelationships and complexities associated with the management of a modern industrial organisation, and
• the development of logical, thoughtful and creative presentations concerning industrial management.

Syllabus summary: Total quality management, production planning and control, costing and pricing, inventory management and control, management reporting systems, value analysis, problem resolution strategies, dispute management, project management,
contract administration, marketing management, business planning, the management of engineering enterprises, professional engineering skills.

Textbook
Samson Management for Engineering (Longmans)

Reference books
AsforU4.460

U4.470 Robotic Systems 4 units
Senior Advanced elective course for the degree in Mechanical Engineering (Mechatronics).
Prereq U3.450 System Dynamics and Control Classes Sem 1: (2 lec & one 3hr lab/tut)/wk
Assessment one 3hr exam at end of Sem 1; plus assignment, project and lab work

Course objectives: To introduce aspects of design, control and use of industrial robots.

Expected outcomes: Students should gain an appreciation for the important factors that need to be considered in the selection and use of robots for industrial applications.


U4.471 Machine Tool Technology 4 units
Senior Advanced elective course for the degree in Mechanical Engineering (Mechatronics).
Prereq U3.470 Mechatronics 2 or U3.450 System Dynamics and Control Classes Sem 1: (3 lec & one 2hr lab/tut)/wk
Assessment one 2hr exam at end of Sem 1; plus assignment and project work

Syllabus summary: The first part of the course will concentrate on tools for metal cutting.
Installation techniques; communication.
Non-conventional machining processes: EDM, ECM, ultrasonic machining, laser cutting and welding.

U4.472 Design of Automatic Machinery 4 units
Senior Advanced elective course for the degree in Mechanical Engineering (Mechatronics).
Prereq U3.440 Mechanical Design 2 Classes Sem 1: (3 lec & one 2hr lab/tut)/wk
Assessment one 2hr exam at end of Sem 1; plus assignment and project work

Syllabus summary: Automatic machinery: classification by function and configuration. The design process. Actuator and drive system principles; sensing. Work stations: design of machinery for parts feeding, clamping, machining, assembly, and inspection. Machine control systems; pneumatic logic; relay logic; programmable logic controllers. Practical aspects of design for automated manufacture: machining, assembly, materials handling. A number of case studies will be presented to illustrate common problems and their solutions.

U4.474 Computer Integrated Manufacturing 4 units
Senior Advanced elective course for the degree in Mechanical Engineering (Mechatronics).
Prereq U3.460 Manufacturing Engineering and Management Classes Sem 1: (3 lec & one 2hr lab/tut)/wk
Assessment one 2hr exam at end of Sem 1; plus assignment and project work


U4.477 Computers in Real Time Control and Instrumentation 6 units
Senior Advanced elective course for the degree in Mechanical Engineering (Mechatronics).
Prereq U3.476 Industrial Electronics Classes Sem 1: (3 lec & one 2hr lab/tut)/wk
Assessment project and assignment work, plus 2hr exam at the end of Sem. Satisfactory performance in project and assignment work is required

Course objectives: Microcomputer and microprocessor system, operating in real time have become very common components in today's engineering applications. The objective of this course is to teach the fundamentals of real time software and to build competence in the engineering use of such systems through lectures emphasising standard computer architectures, programming, and through intensive laboratory work with microcomputer systems interacting with experimental mechatronic processes.

Expected outcome: The student will have a basic knowledge of the hardware components available in a microcomputer system and a detailed knowledge of facilities and capabilities typically present in a professional real time operating system. The student will have the competence to design, implement and debug interrupt-driven multitasking systems with graphical user interfaces.


Textbook

Reference book
A reference list will be distributed
Library reference number: 629.8955133 1, Engineering Reserve
U4.478 Microprocessors in Engineered Products

6 units

Senior Advanced elective course for the degree in Mechanical Engineering (Mechatronics).

Prereq U3.476 Industrial Electronics

Classes Sem 1: (3 lec & one 2hr lab/tut)/wk

Assessment project and assignment work, plus one 2hr exam at the end of Sem. Satisfactory performance in project and assignment work is required

Course objectives: To provide experience, confidence and basic 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. To give experience with modern cross-development tools. To provide experience of working in a project team to prototype a realistic product to meet a specification.

Expected outcomes: 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.

Syllabus summary: Specific requirements for microprocessor-based products. Problem definition and system design. CPU, memory and interface circuits. Tools for design, development and testing of prototype systems. The course will include a major project, where groups of students design, develop and commission a microprocessor-based product.

Textbook

Peatman Design with microcontrollers (McGraw-Hill)

Reference books

An extensive reference list will be distributed

Library classifications: 629.398, 629.895, 621.3815, 621.38195, 001.6425, 005.1

U4.480 Manufacturing Engineering and Management

4 units

Prereq U3.460 Manufacturing Engineering and Management

Syllabus summary: Project management: specific aspects of project management including initial establishment of projects and design criteria, and capital cost estimating. Design management: topics will cover design integration, codes and standards, specification preparation, and sources of information. Plant engineering management: the areas will include decision making, computerised maintenance, understanding unit operations, environment protection measures, engineering as an element in the cost of production, continuous improvement, provision of plant and ancillary services, and the engineer as a trainer.

U4.485 Professional Communication

4 units

Senior Advanced core course for the degree in Mechanical and Mechatronic Engineering.
**Prereq** completion of industrial experience (see U4.486)

*Classes* some instructional sessions will be arranged to provide vocational techniques for preparation and presentation of technical material to an audience by audio-visual means and in report writing.

**Assessment** satisfactory performance in the seminar as assessed by the participants and in a written report on industrial experience.

**Course objectives:** To improve student competence and confidence in developing and presenting a formal technical presentation, and enhance student abilities and experience in technical report writing.

**Expected outcomes:** (i) the ability to structure and deliver a competent and informative technical presentation; (ii) the ability to present structured observations and reflections in the mode of a formal written report.

**Syllabus summary:** During the latter part of the year, one or two whole days are set aside for the presentation of student addresses at a public conference. Each final year student, usually in consultation with his or her thesis supervisor, prepares an abstract of the seminar for distribution one week in advance of the conference. Although not obligatory, the subject for the seminar is normally closely related to the student's thesis work; thus it tends to deal in depth with some relatively narrow technical field. At the conference (where the audience comprises senior, senior advanced and postgraduate students, departmental staff and visitors), oral presentation of the thesis followed by critical discussion under formal chairmanship.

The industrial experience report must be submitted early in Semester 1. The report is assessed on content and presentation in accordance with details that are distributed in the previous semester. The report should contain a section on management.

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**U4.486 Practical Experience** 6 units

*Senior Advanced core course* for the degree in Mechanical and Mechatronic Engineering.

**Prereq** 28 units of Senior courses

*Classes* 12wks prac work experience

**Assessment** will be on a Pass/Fail basis. Marks will not be given. (Course will not contribute to the weighted averages used to determine Honours)

**Syllabus summary:** Each student is required to work as an employee of an approved engineering organisation and to submit a satisfactory written report of his or her work. Normally 12 weeks of practical work experience (375 hours minimum) is required and this is undertaken after the completion of some or all of the prescribed Senior core courses and before enrolment in the final year of study. The University Careers and Appointments Service is available to assist students to obtain suitable employment. This course must be passed in order to graduate.

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**U4.490 Environmental Engineering** 6 units

*Senior Advanced elective course.*

**Mutually exclusive with** U4.491 Environmental Acoustics and Noise Control if Acoustics forms part of U4.490; mutually exclusive with U4.694 Pollution Control Engineering if Environmental Impact Assessment forms part of U4.490

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**U4.491 Environmental Acoustics and Noise Control** 2 units

*Senior Advanced elective course.*

**Mutually exclusive with** U4.490 Environmental Engineering if Acoustics forms part of U4.490

**Prereq** 36 units of Senior courses

*Coreq* U4.486 Practical Experience

*Classes* Sem 1: 1.5hrs/wk plus 2 Saturday field-trips

**Assessment** one 2hr and one 1.5hr exam at end of Sem 1, plus assignments

**Course objectives:** To acquaint students with the methods engineers use to assess and deal with the environmental consequences of industry and other human activities, with particular emphasis on impact assessment and noise.

**Expected outcomes:** Students will appreciate the social, economic, and legislative aspects of environmental protection. They will understand the requirements of an environmental impact statement. They will be able to make the calculations and measurements necessary to estimate acoustic noise levels in machinery, buildings and the outside environment and to make recommendations as to how best to reduce them.

**Syllabus summary:** The course will consist of the following components depending on availability of lecturers.

- **Environmental acoustics and noise control**—Basic acoustics theory, sound generation and propagation, impendence, absorbing materials, industrial noise sources, isolation methods of noise control, enclosures, instrumentation and measurement, frequency analysis, noise regulations. Computational methods in acoustics.
- **Environmental impact assessment**—The nature of environment protection, fundamentals of air, water and noise pollution, solid waste disposal, limnology, marine and terrestrial ecology, aesthetics, urban and regional planning. Social and economic factors, legislation and its administration, preparation of environmental impact reports. Air pollution and its control — sources, dispersion, meteorology, photo-chemical smog formation, measurements, introduction to modelling, particles and aerosols, control equipment.

**Textbooks**

- Environmental Planning and Assessment Act 1979, No. 203
- Environmental Planning and Assessment Regulation, 1980

**Reference books**

- Bies and Hansen *Engineering Noise Control* (Allen and Unwin, 1986)
- G. Kiely *Environmental Impact Assessment*
- Other books as advised during classes

**Library classification:** 534.8, 620.23, 620.8, 628.1

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**U4.486 Practical Experience** 6 units

*Senior Advanced core course* for the degree in Mechanical and Mechatronic Engineering.

**Prereq** 28 units of Senior courses

*Classes* 12wks prac work experience

**Assessment** will be on a Pass/Fail basis. Marks will not be given. (Course will not contribute to the weighted averages used to determine Honours)

**Syllabus summary:** Each student is required to work as an employee of an approved engineering organisation and to submit a satisfactory written report of his or her work. Normally 12 weeks of practical work experience (375 hours minimum) is required and this is undertaken after the completion of some or all of the prescribed Senior core courses and before enrolment in the final year of study. The University Careers and Appointments Service is available to assist students to obtain suitable employment. This course must be passed in order to graduate.

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**U4.490 Environmental Engineering** 6 units

*Senior Advanced elective course.*

**Mutually exclusive with** U4.491 Environmental Acoustics and Noise Control if Acoustics forms part of U4.490; mutually exclusive with U4.694 Pollution Control Engineering if Environmental Impact Assessment forms part of U4.490

**Prereq** 36 units of Senior courses

*Coreq* U4.486 Practical Experience

*Classes* Sem 1: 1.5hrs/wk plus 2 Saturday field-trips

**Assessment** one 2hr and one 1.5hr exam at end of Sem 1, plus assignments

**Course objectives:** To acquaint students with the methods engineers use to assess and deal with the environmental consequences of industry and other human activities, with particular emphasis on impact assessment and noise.

**Expected outcomes:** Students will appreciate the social, economic, and legislative aspects of environmental protection. They will understand the requirements of an environmental impact statement. They will be able to make the calculations and measurements necessary to estimate acoustic noise levels in machinery, buildings and the outside environment and to make recommendations as to how best to reduce them.

**Syllabus summary:** The course will consist of the following components depending on availability of lecturers.

- **Environmental acoustics and noise control**—Basic acoustics theory, sound generation and propagation, impendence, absorbing materials, industrial noise sources, isolation methods of noise control, enclosures, instrumentation and measurement, frequency analysis, noise regulations. Computational methods in acoustics.
- **Environmental impact assessment**—The nature of environment protection, fundamentals of air, water and noise pollution, solid waste disposal, limnology, marine and terrestrial ecology, aesthetics, urban and regional planning. Social and economic factors, legislation and its administration, preparation of environmental impact reports. Air pollution and its control — sources, dispersion, meteorology, photo-chemical smog formation, measurements, introduction to modelling, particles and aerosols, control equipment.

**Textbooks**

- Environmental Planning and Assessment Act 1979, No. 203
- Environmental Planning and Assessment Regulation, 1980

**Reference books**

- Bies and Hansen *Engineering Noise Control* (Allen and Unwin, 1986)
- G. Kiely *Environmental Impact Assessment*
- Other books as advised during classes

**Library classification:** 534.8, 620.23, 620.8, 628.1
Course objectives: To acquaint students with the methods engineers use to assess and deal with the environmental noise due to industry and other human activities.

Expected outcomes: Students will appreciate the social, economic, and legislative aspects of environmental noise. They will be able to make the calculations and measurements necessary to estimate sound levels and noise in machinery, buildings and the outside environment and to make recommendations as to how best to reduce them.

Syllabus summary: 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.

Computational methods in acoustics.

Reference books
Bies and Hansen Engineering Noise Control (Allen & Unwin, 1988)
Hassall and Zaveri Acoustic Noise Measurement (Brul & Kjaer, 1988)
Library classification: 534.8,620.23

U4.506 Biomedical Engineering Systems 4 units
Senior Advanced elective course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).
Prereq U3.506 Fundamentals of Biomedical Engineering
Classes Sem 2: (2 lec & 1hr lab/tut)/wk
Assessment lab reports and one 2hr exam at end of Sem
Syllabus summary: Implantable devices—pacemakers, defibrillators, cardio-myo-stimulator, bionic ear. Functional electrical stimulation—bladder and bowel control, cerebellar, mid-brain stimulation, limb control, walking in paraplegics. Advanced imaging—pattern recognition, cervical smear analysis, chromosome analysis, cardiac image processing, automated chest X-ray analysis, mammography. Instruments—automated blood pressure, cardiac output, blood flow, EEC Advanced instruments—automated anaesthesia, blood pressure controllers, artificial insulin injectors. Laboratory work on respiratory measurements, blood pressure measurement, image processing, pattern recognition.

U4.512 Practical Experience 2 units
Senior Advanced core course for the degree in Electrical Engineering and the ISE stream.
Prereq 28 units of Senior courses
Assessment assessment in this course is by the submission, within the first two weeks of First Semester, of a written (hand or typed) report of about 2500w of the industrial experience undertaken in accordance with regulations. This report is to be general in nature, indicating the overall structure of the company, the areas that the student became familiar with and their relationship to the firm and finally, what the student did. Detailed material may be incorporated as appendices if desired, and the student should have the report vetted beforehand by a responsible officer of the company.

Syllabus summary: A broad range of topics will be presented related to electrical systems analysis, with...
a particular focus on electric power systems. Modelling of power system components. Analysis of power systems under normal operating conditions. Faults and protection. Transmission line transients. An introduction to various aspects of transient stability, voltage and long-term stability, dynamic stability. The electric power systems of the 21st century. Introduction to software packages such as EUROSTAG, EMPT.

Textbook

U4.533 Non-linear and Adaptive Control 4 units
Senior Advanced elective course for the degrees in Electrical Engineering and Electrical Engineering (Information Systems Engineering).
Prereq U3.530 Control 1.
Classes 2 lec & 1 hr lab per week Sem 2
Assessment assignments and one 2hr exam at end of Sem 2


Textbook
Slotine and Li Applied Nonlinear Control (Prentice-Hall, 1991)

U4.539 Control 2 4 units
Senior Advanced elective course for the degree in Electrical Engineering and the ISE stream.
Prereq U3.530 Control 1
Classes Sem 1: (2 lec & 2 hr lab/tut)/wk
Assessment assignments, lab reports and one 2hr exam at end of Sem 1


Sampled data systems. Discrete signals and sampling, discrete transfer functions. Discrete equivalents for continuous controller. Discrete models for sampled data systems, pulse transfer functions for feedback systems. Direct digital design by transform methods.

U4.544 Microwave Engineering 4 units
Senior Advanced elective course for the degree in Electrical Engineering and the ISE stream.
Coreq U4.549 Electronic Design
Classes Sem 2: (1 lec & 1 hr lab/tut)/wk
Assessment lab work and one 2hr exam at the end of Sem 2

Syllabus summary: Review of travelling waves, planar transmission lines, passive microwave components, hybrids, connectors and transitions, directional couplers, matching, S parameters, network analyser measurements, active microwave components, microwave CAD.

U4.547 Optical Communication Systems 4 units
Senior advanced elective course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).
Prereq U3.540 Electronics 1 and U3.552 Communications 1
Classes Sem 2: (2 lec & 1 hr lab/tut)/wk
Assessment one 2hr exam at end of Sem 2 plus lab and assignments

Syllabus summary: Introduction to optical fibre communications, optical fibre transmission characteristics, semiconductor and fibre laser signal sources, optical transmitters, direct and external modulation, optical amplifiers, optical repeaters, fibre devices and multiplexers, fibre nonlinearity, optical detectors, optical receivers and regenerators, sensitivity and error rate performance, photonic switching and processing, lightwave local area networks, multi-channel multiplexing techniques, optical fibre communication systems.

U4.548 Integrated Circuit Design 4 units
Senior advanced elective course for the degree in Electrical Engineering and Electrical Engineering (Information Systems Engineering).
Prereq U3.540 Electronics 1 and U3.560 Digital Systems 1
Classes Sem 1: (2 lec & one 2hr lab/tut)/wk
Assessment a design project and one 2hr exam at the end of Sem 1

Syllabus summary: Technology (IC production process, design rules, layout). Design automation and verification (DRC, circuit extraction, simulation and hardware design languages). Basic digital building blocks (inverters, simple logic gates, transmission gates, propagation delays, power dissipation and noise margins). Digital circuits and systems (PLAs, dynamic circuits, RAM, ROM, microprocessors, systolic arrays).
Analog VLSI (switches, active resistors, current sources and mirrors, voltage, current references, amplifiers, DAC, ADC, continuous time filters, switch capacitor circuits, analog signal processing circuits).

Textbook

U4.549 Electronic Design  4 units
Senior advanced elective course for the degree in Electrical Engineering and core course for the degree in Electrical Engineering (Information Systems Engineering).

Prereq U3.540 Electronics I, U3.511 Circuit Theory and U3.512 Signals and Systems

Classes Sem 1: (2 lec & one 2hr lab/tut)/wk

Assessment 1 assignments and one 2hr exam at end of Sem 1

Syllabus summary: Electronic design, passive and active components in practice, modelling of electronic circuits, linear and non-linear circuits for communication systems, integrated circuit techniques, electronic filter design and implementation, mixed-signal circuits, analog-digital conversion techniques, distortion and noise in electronic systems, special topics in electronic design.

U4.555 Advanced Communication Networks  4 units
Senior Advanced elective course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Coreq U4.559 Data Communication Networks

Classes Sem 2: (2 lec & 1hr tut)/wk

Assessment 2 assignments, lab reports, quizzes and one 2hr exam at end of Sem 2


U4.556 Error Control Coding  4 units
Senior advanced elective course for the degree in Electrical Engineering and Electrical Engineering (Information Systems Engineering).

Coreq U4.558 Digital Communication Systems

Classes Sem 1: (2 lec & 1hr tut)/wk

Assessment assignments and one 2hr exam at end of Sem 1

Syllabus summary: Error control coding principles, linear algebra, linear block codes, cyclic codes, BCH codes, Reed-Solomon codes, burst-error correcting codes, design of codecs for block codes, applications of block codes in communications and digital recording, convolutional codes, Viterbi algorithm, design of codecs for convolutional codes, applications of convolutional codes in communications, soft decision decoding of block and convolutional codes, trellis coded modulation, block coded modulation, design of codecs for trellis codes, applications of trellis codes in data transmission, multidimensional codes.

U4.557 Satellite Communication Systems  4 units
Senior Advanced elective course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Coreq U4.558 Digital Communication Systems

Classes Sem 2: (2 lec & one 1hr tut)/wk

Assessment assignments and one 2hr exam at end of Sem 1

Syllabus summary: Introduction to satellite communication, satellite link design, propagation characteristics of fixed and mobile satellite links, channel modelling, access control schemes, system performance analysis, system design, mobile satellite services, global satellite systems, national satellite systems, mobile satellite network design, system reliability, channel signalling, digital modern design, speech code design, error control code design, low earth orbit communication satellites.

Textbook

Reference books
Bhargava et al. Digital Communications by Satellite (J. Wiley and Sons, 1981)
Spiker. Digital Communications Satellite (Prentice-Hall, 1977)

U4.558 Digital Communication Systems  4 units
Senior advanced elective course for the degree in Electrical Engineering and core course for the degree in Electrical Engineering (Information Systems Engineering).

Prereq U3.512 Signals and Systems and U3.552 Communications I

Classes Sem 1: (2 lec & one 2hr lab/tut)/wk

Assessment assignments, lab work and one 2hr exam at end of Sem 1


Textbook
U4.559 Data Communication Networks 4 units

Senior advanced elective course for the degree in Electrical Engineering and core course for the degree in Electrical Engineering (Information Systems Engineering).

Prereq U3.552 Communications 1
Classes Sem 1: (2 lec & one 2hr lab/tut)/wk
Assessment assignments, lab work and one 2hr exam at end of Sem 1


Textbooks
Stallings, Data and Computer Communications (Maxwell Macmillan Int., 1995)
Tannenbaum Computer Networks (Prentice Hall, 1996)

U4.568 Real Time Computing 4 units

Senior advanced elective course for the degree in Electrical Engineering and core course for the degree in Electrical Engineering (Information Systems Engineering).

Prereq U3.560 Digital Systems 1
Classes Sem 1: (2 lec & one 2hr lab/tut)/wk
Assessment one 2hr exam at the end of Sem 1, plus lab and assignments


U4.569 Digital Systems 2 4 units

Senior advanced elective course for the degree in Electrical Engineering and core course for the degree in Electrical Engineering (Information Systems Engineering).

Prereq U3.560 Digital Systems 1 and U3.450 Electronics 1
Classes Sem 1: (2 lec & one 2hr lab/tut)/wk in Sem 1
Assessment one 2hr exam at end of Sem 1, assignments, lab reports


U4.563 Advanced Digital Systems 4 units

Senior Advanced elective course for the degrees in Electrical Engineering (Information Systems Engineering) and Electrical Engineering.

Coreq U4.569 Digital Systems 2.
Classes Sem 2: (2 lec & 1hr tut/lab)/wk
Assessment assignments and one 2hr exam at end of Sem 2


U4.564 Advanced Real Time Computing 4 units

Senior advanced elective course for the degree in Electrical Engineering and for the degree in Electrical Engineering (Information Systems Engineering).

Coreq U4.568 Real Time Computing
Classes Sem 2: (2 lec & one 1hr tut)/wk
Assessment one 2hr exam at the end of Sem 2, plus assignments

Syllabus summary: Modelling of real-time systems, design techniques, analysis and prediction of real-time behaviour, advanced scheduling techniques, simulation, verification and validation, communications, distributed real-time systems, reliability and fault tolerance, hardware architectures, CASE tools for real-time systems. Standards for real-time languages and operating systems.

U4.572 Project Management 4 units

Senior Advanced core course for the degree in Electrical Engineering and for the degree in Electrical Engineering (Information Systems Engineering).

Classes Sem 1: (1 lec & one 2hr tut)/wk
Assessment one 2hr exam plus assignments

Syllabus summary: The organisation of research and development; estimating costs and resources; financial appraisal techniques for selection and appraisal; project planning and control; the management of human resources; problem specification and decision making; innovation; patents.

U4.588 Thesis A 8 units

Senior advanced core course for the double degree Bachelor of Engineering (Electrical) and Bachelor of Commerce.

Mutually exclusive with U4.589 Thesis
Coreq 12 units of Senior Advanced Electrical Engineering courses
Assessment thesis, final presentation and interim progress submissions
investigations, and to document such achievements and conclusions as are appropriate. The subject requires a consistent and significant effort equivalent to one or two hours per week in Semester 1, and one to two days per week in Semester 2.

U4.589 Thesis 12 units  
*Senior advanced core course for the degree in Electrical Engineering and Electrical Engineering (Information Systems Engineering).*

*Mutually exclusive with U4.588 Thesis A*

**Coreq** 24 units of Senior Advanced Electrical Engineering courses

**Assessment** thesis, final presentation and interim progress submissions

**Syllabus summary:** Each student is required to select a topic, carry out background searches, experimental investigations, and to document such achievements and conclusions as are appropriate. The subject requires a consistent and significant effort equivalent to one or two hours per week in Semester 1, and two days per week in Semester 2.

U4.591 Image Processing and Computer Vision 4 units  
*Senior Advanced elective course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).*

**Prereq** U3.512 Signals and Systems and U3.553 Digital Signal Processing

**Assessment** assignments (25%) and one 2hr exam (75%) at end of Sem

**Syllabus summary:** Mathematical preliminaries: two-dimensional (2D) signals and systems, image models and image transformation, image digitalisation; visual perception, sampling, quantisation and colour representation. Image enhancement and restoration; histogram modelling, spatial and transform operations, filtering, deconvolution and extrapolation. Image compression: predictive methods, transform coding, vector quantisation and fractal based methods. Image reconstruction: Radon transform and projection theorem computer tomography, (CT) and magnetic resonance imaging (MRI) systems and three-dimensional (3D) imaging. Image analysis and computer vision; edge detection and boundary extraction, region and object representation, image segmentation and pixel classification, texture analysis and scene detection and matching.

U4.592 Fuzzy Systems 4 units  
*Senior Advanced elective course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).*

**Classes** Sem 2: (2 lec & one 1hr lab/tut)/wk

**Assessment** assignments and one 2hr exam at end of Sem 2

**Syllabus summary:** Mathematical backgrounds: ordinary set theory, uncertainty and linguistic variables, fuzzy sets, algebra of fuzzy sets, membership functions. Fuzzy control; approximate reasoning, fuzzy logic, fuzzification, defuzzification, fuzzy associative memory, fuzzy system design, a fuzzy controlled vehicle, adaptive fuzzy systems. Other applications: fuzzy pattern recognition, fuzzy image transform coding, fuzzy knowledge based systems.

**Reference books**

Kaufmann *Fuzzy Mathematical Models in Engineering and Management Science* (North Holand, 1988)


Koskog *Neural Networks and Fuzzy Systems* (Prentice Hall, 1992)

U4.593 Neural Computing 4 units  
*Senior Advanced elective course for the degree in Electrical Engineering and for the degree in Electrical Engineering (Information Systems Engineering).*

**Classes** Sem 2: (2 lec & one 1hr tut)/wk

**Assessment** assignments and one 2hr exam at end of Sem 2


**Textbook**

Jabri, Coggins and Flower *Adaptive Analog Neural Systems* (Chapman and HaU, 1995)

U4.594 Adaptive Pattern Recognition 4 units  
*Senior Advanced elective course for the degree in Electrical Engineering and for the degree in Electrical Engineering (Information Systems Engineering).*

**Classes** Sem 2: (2 lec & one 1hr lab/tut)/wk

**Assessment** one 2hr exam at end of Sem 2

**Syllabus summary:** Mathematical preliminaries: probability theory, random vectors, decision theories.


U4.600 Practical Experience 8 units  
*Senior Advanced core course for the degree in Chemical Engineering.*

**Prereq** 28 units of Senior courses

**Classes** there are no formal classes. Students are required to obtain 12 weeks' practical work experience before entering their Senior Advanced Year
Assessment by submission of a report of approximately 2500w on the industrial experience undertaken. The report will cover the nature of the industry, the company’s organisational relationships both internally and externally and a technical section devoted to the work performed by the student. The report is to be submitted before the end of the first week of the Senior Advanced academic year.

**Syllabus summary:** Each student is required to work as an employee of an approved organisation and to submit a report on that work. The employment undertaken must be relevant to Chemical Engineering and should be discussed before acceptance with a member of the Department of Chemical Engineering. While the responsibility for obtaining satisfactory employment rests with the student, the Department, through the Chemical Engineering Foundation, and the Careers and Appointments Service will assist where possible.

**U4.625 Reaction Engineering** 4 units

*Senior Advanced elective course for the degree in Chemical Engineering.*

**Prereq** U3.625 Reaction Engineering 1

**Classes** Sem: 3hrs lec/tut/wk

**Assessment** one 3hr exam at end of course plus assignments

**Syllabus summary:** Homogeneous reactors: non-isothermal design; unsteady state operation and multiple steady-states; reactor stability. Diffusion and reaction in porous catalysts: packed bed reactors and chemical vapour deposition. Multiple reactions: net reactionrate and stoichiometric multiple steady states. Multiphase reactors: slurry and bioreactors. Residence time distribution, non ideal reactors. Reactor optimisation.

Textbook

Fogler *Elements of Chemical Reaction Engineering* (Prentice-Hall, 1990)

Reference book

Levenspiel *Chemical Reaction Engineering* (Wiley, 1972)

**U4.629 Advances in Polymer Engineering** 4 units

*Senior Advanced elective course for the degree in Chemical Engineering.*

**Prereq** U3.610 Unit Operations 1

**Classes** Sem: 3hrs lec & tut/wk

**Assessment** assignments, etc., and one 3hr exam at end of course

**Syllabus summary:** Basic structure and properties of polymers. Application of chemical engineering fundamentals including reaction engineering and kinetics to produce polymer resins from monomers. Engineering principles of polymer processing and shaping via extrusion, injection moulding, blow moulding, calendering and film blowing to obtain value-added products such as sheets, tubes, car parts, bottles, fibres for clothes, etc. A few case studies with nylon, polyester, polyethylene will be treated in detail.

Selection of polymers for engineering application based on chemical, mechanical, thermal and flow behaviour. Life cycle analysis, recycle and reuse of polymers.

**Suggested texts**


R.C. Progelhof and J.J. Throne *Polymer Engineering Principles* (Hansen, N.Y., 1993)

**U4.630 Mineral Processing (Mineral Dressing)** 4 units

*Senior Advanced elective course for the degree in Chemical Engineering.*

**Prereq** U3.610 Unit Operations 1

**Classes** Sem: 4hrs lec, lab & tut classes/wk; and field trips as arranged

**Assessment** tut assignments, lab reports and one 2hr exam at end of course


**Reference books**

Gaudin *Principles of Mineral Dressing* (McGraw-Hill, 1939)

Taggart *Elements of Ore Dressing* (Wiley, 1964)

Wills *Mineral Processing Technology* (Pergamon, 1992)

**U4.631 Mineral Processing (Extractive Metallurgy)** 4 units

*Senior Advanced elective course for the degree in Chemical Engineering.*

**Prereq** U3.610 Unit Operations 1

**Classes** Sem: 2hrs lec, lab & tut classes/wk; and field trips as arranged

**Assessment** tut assignments, lab reports and one 2hr exam at end of course


**Reference books**

Gilchrist *Extraction Metallurgy* (Pergamon, 1989)

Moore *Chemical Metallurgy* (Butterworths, 1981)

Pehlke *Unit Process in Extractive Metallurgy* (Elsevier, 1972)


**U4.632 Separation Processes** 4 units

*Senior Advanced elective course for the degree in Chemical Engineering.*

**Prereq** U3.610 Unit Operations 1

**Classes** Sem: 4hrs/wk

**Assessment** one 1.5hr exam plus assignments

Specific course topics will be drawn from: sources and type of air and water pollution; atmospheric chemistry and ozone pollution; control of sulphur and nitrogen oxides; transport, dispersion and reaction in the atmosphere; vapour emissions from landfills and surface impoundments; water pollution: physio-chemical and biological treatment processes; equilibrium in aqueous phase systems; groundwater movement and solute transport; oily phase migration in soils; in situ remediation of contaminated soils and sediments.

**U4.640 Project Engineering** 4 units

*Senior Advanced core course for the degree in Chemical Engineering.*

*Classes* Sem: approx. 4hrs lec, seminar & discussions/wk

*Assessment* tut assignments, seminar and one 3hr exam at end of sem

**Syllabus summary:** Principles of project management, management of large projects and a portfolio of small projects including planning techniques, organisation and control. Management of commissioning and start up of process plant, and of maintenance. Preparation and delivery of oral presentations on technical subjects. Introduction to occupational safety, safety management systems, management of environmental performance, safety during shutdowns, quality assurance and principles of Total Quality Management. The concept of 'completed staff work', introduction to process plant production management. Individual and in-team approaches to solving standard and open-ended problems.

*Textbook* Burke *Project Management Planning and Control* 2nd edn (Wiley, 1992)

**U4.655 Advanced Fluid Dynamics Modelling** 4 units

*Senior Advanced elective course for the degree in Chemical Engineering.*

*Classes* Sem: 3hrs/wk

*Assessment* assignments, projects and one 2hr exam at end of course

**Syllabus summary:** This course will familiarise students with modern development in computational fluid dynamics (CFD) modelling. It will contain a review of the basic equations and introductions to mesh generation, solution methods, graphical analysis of results, turbulence modelling, multiphase flows, combustion, non-Newtonian flow and chemical reactions. The course will comprise a mixture of theory and practical use of a CFD package. Assessment will be via a 2 hour exam and project work. The projects will involve studying a chemical engineering application using the package.

**Textbooks**

Furzer Distillation for University Students (published by the author, Department of Chemical Engineering, University of Sydney, 1986)

Kister Distillation Design (McGraw-Hill, 1992)

Reference book


**U4.633 Advanced Particle Mechanics** 4 units

*Senior Advanced elective course for the degree in Chemical Engineering.*

*Prereq* U3.610 Unit Operations 1

*Classes* Sem: 3hrs lec & tut/wk

*Assessment* assignments, etc., and one 3hr exam at end of course

**Syllabus summary:** Bulk solids flow: properties of bulk granular material; stress analysis of solids; testing of granular material; flow properties; design of bunkers; flow rate predictions; calculation of flow parameters of hoppers. Fluidisation: Applications; types of fluidisation; incipient fluidisation; theory of bubble rise; bubble formation; fluid-bed reactors. Pneumatic conveying of solids: regimes, models and equipment (including blowers). Hydraulic conveying: regimes, models and equipment (including pumps).

*Reference books*

Coulson and Richardson *Chemical Engineering* Vol. 2 (Pergamon, 1983)

Davidson and Harrison *Fluidised Particles* (C.U.P., 1963)

Shamlou *Handling of Bulk Solids* (Butterworths, 1988)

**U4.634 Advanced Topics in Environmental Engineering A** 4 units

**U4.635 Advanced Topics in Environmental Engineering B** 4 units

*Senior Advanced elective courses for the degree in Chemical Engineering.*

*Prereq* U3.610 Unit Operations 1

*Classes* Sem: 3hrs/wk (each course)

*Assessment* tut and assignments; one 3hr exam at the end of the semester (each course)

**Syllabus summary:** These two courses are focused on the application of chemical engineering fundamentals to developing quantitative descriptions of environmental fate and transport processes. These processes include chemical partitioning, reactions, and advective/dispersive transport in air, water and soil. Syllabuses for each subject will be defined annually.

Specific course topics will be drawn from: sources and type of air and water pollution; atmospheric chemistry and ozone pollution; control of sulphur and nitrogen oxides; transport, dispersion and reaction in the atmosphere; vapour emissions from landfills and surface impoundments; water pollution: physio-chemical and biological treatment processes; equilibrium in aqueous phase systems; groundwater movement and solute transport; oily phase migration in soils; in situ remediation of contaminated soils and sediments.
The case studies will be proposed and managed by the sponsoring company in consultation with the lecturer in charge of the subject U4.694 Process Plant Risk Management, and U4.696 Environmental Impact Assessment.


Textbook
Stephanopoulos Chemical Process Control: An Introduction to Theory and Practice (Prentice-Hall, 1984)

Reference books
As indicated during classes

U4.679 Major Industrial Project 24 units
Senior Advanced elective course for the degree in Chemical Engineering.

Syllabus summary: The course consists of the following components
1. Project
2. Case studies in project management
3. Case studies in hazard and environmental impact analysis
4. Case studies in process design and simulation

1. Project: This is the major component of the course. The project will be proposed by the sponsoring company in consultation with an academic supervisor. It will normally be carried out on the company’s premises, using company resources; some projects may also involve work at the University. The project will encompass many of the features of the subject U4.680 Thesis, but its scope will be larger, and it will have additional objectives of an immediately practical nature for the sponsoring company.

The student will be required to submit a bound report to both the University and the sponsoring company by the deadline set from year to year for the subject U4.680 Thesis. In addition, the student will be required to present a full seminar (as distinct from the summary seminars presented in U4.680).

2. Case Studies in Project Management: The case studies will be proposed and managed by the sponsoring company in consultation with the lecturer in charge of the subject U4.640 Project Engineering 2. The case study will demonstrate principles of project components, organisation, control; also the management of commissioning and start up of process plant, and of maintenance.


The case studies will introduce the student to the principles of major hazard identification and management; to hazard and operability studies, and to the principles of reliability related to safety. They will also introduce students to occupational safety, industrial hygiene and the preparation of environmental impact reports.

4. Case Studies in Process Design and Simulation: The case studies will be proposed and managed by the sponsoring company in consultation with the lecturer in charge of the subject U4.684 Chemical Engineering Design 1. They are designed to introduce the student to commercially available physical properties and simulation packages; and to provide experience in the use of simulators in process design.

U4.681 Thesis 8 units
Senior Advanced core course for the degree in Chemical Engineering.

Prereq or Coreq Students should have completed or be enrolled in all other Senior Advanced core courses

Classes no formal classes. The thesis supervisor will be available for discussion at agreed times but the student is expected to work on his or her own initiative

Assessment written thesis and seminar

Syllabus summary: Students are asked to write a thesis, based on a modest, but significant research project, which is very often some aspect of a staff member’s research interests. Most projects will be experimental in nature, but some may be largely theoretical or mathematical. Other topics may involve computer programming, feasibility studies, or the design, construction, and testing of equipment.

In undertaking the project, the student will learn 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. 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 or her own work and that of others.

Students are asked to nominate preferences from a list of available topics. Topics are allocated according to these preferences wherever possible. Deadlines are fixed each year for the submission of a thesis draft, and for the submission of the final thesis, typed and bound in an approved manner. Students are required to give a seminar, explaining the aims and achievements of their thesis.

U4.684 Chemical Engineering Design 1 4 units
Senior Advanced core course for the degree in Chemical Engineering.

Prereq U3.610 Unit Operations 1
Classes Sem 1: (3hrs lec & tut)/wk
Assessment one 2hr exam at end of Sem 1, plus assignments

Syllabus summary: Introduction to process design. Design of pressure vessels and associated equipment. Process flowsheeting. Sequential modular and equation-oriented approaches. Flowsheeting packages: structure, unit model libraries, thermo-

Textbooks


Reference book


U4.685 Chemical Engineering Design 2

**8 units**

*Senior Advanced core course for the degree in Chemical Engineering.*

**Prereq** U3.610 Unit Operations 1, U3.621 Thermodynamics and U3.645 Project Economics

**Coreq** U4.684 Chemical Engineering Design 1

**Classes** Sem 2: approx. 8hrs informal classes, design and library work/wk

**Assessment**

Project: flowsheet selection, heat and mass balances, detailed equipment design and costing, hazard assessment and hazard operability studies, environmental impact and project financial analysis.

**Syllabus summary:** The preparation of a detailed design project: flowsheet selection, heat and mass balances, detailed equipment design and costing, hazard assessment and hazard operability studies, environmental impact and project financial analysis.

U4.690 Reservoir Engineering

**4 units**

*Senior Advanced elective course for the degree in Chemical Engineering.*

**Prereq** U3.610 Unit Operations 1

**Classes** Sem: 4hrs/wk

**Assessment**

One 3hr exam at end of course plus assignments

**Syllabus summary:** This course discusses the mathematical techniques that are commonly used to solve the partial differential equations describing the flow of oil and gas through reservoir rocks. The applications are drawn from reservoir engineering, but the solution methods apply more generally to multiphase flow through porous media. Equations for single phase flow in porous media. Steady state flow in 1 and 2 dimensions; aerial sweep efficiencies in regular well arrays. Miscible displacement processes: the convective-dispersion equation. Equations of flow for two-phase displacement processes in porous media. Linear one-dimensional flow: the Buckley Leverett solution to the two phase convection equation; shock front solutions; simulation methods. Application of the method of characteristics to partially miscible displacements involving two or three components.

Reference books

Dake *Fundamentals of Reservoir Engineering* (Elsevier, 1978)


U4.691 Process Systems Engineering

**4 units**

*Senior Advanced elective course for the degree in Chemical Engineering.*

**Prereq** U3.630 Computations and Statistics and U3.660 Chemical Engineering or U3.271 Transport Engineering and U4.690 Reservoir Engineering

**Classes** Sem 1: one 3hr lec/wk; field trip and student seminar session; tut as arranged

**Assessment**

Tut assignments, report and one 2hr exam at end of course


Reference books


Reklaitis, Ravindran and Ragsdell *Engineering Optimisation: Methods and Theory* (John Wiley and Sons, 1983)

Stephanopoulos *Chemical Process Control* (Prentice-Hall, 1984)

U4.692 Optimisation Techniques

**4 units**

*Senior Advanced elective course for the degree in Chemical Engineering.*

**Mutually exclusive with** U4.691 Process Systems Engineering

**Prereq** U3.630 Computations and Statistics

**Classes** Sem: 4hrs lec & tut/wk

**Assessment**

Tut assignment on specific topics and one 2hr exam at end of course

**Syllabus summary:** Problem formulation, objective functions and constraints. Analytical and numerical search methods for single variable and multivariable systems. Linear systems, linear programming, network and distribution problems. Discrete sequential problems and dynamic programming. Flowsheeting programs and optimisation. Stochastic processes, queues, simulation, Monte Carlo methods.

Textbook


Reference books


U4.694 Environmental Impact Assessment

**4 units**

*Senior Advanced elective course for the degree in Chemical Engineering.*

**Mutually exclusive with** U4.490 Environmental Engineering

**Prereq** U3.610 Unit Operations 1 or U3.420 Thermo-fluid Engineering or U3.271 Transport Engineering and Planning

**Classes** Sem: one 3hr lec/wk; field trip and student seminar session; tut as arranged

**Assessment**

Tut assignments, report and one 2hr exam at end of course

**Syllabus summary:** Chemical process design. Preliminary process optimisation. Short-cut design procedures. Process optimisation theory and applications including: on-line optimisation, linear and nonlinear programming.
Syllabus summary: The nature of environmental protection; air, water, noise pollution and waste disposal; hazard analysis; limnology, marine and terrestrial ecology; urban and regional planning; aesthetics; economic framework; social and political factors; environmental legislation and its implementation; environmental impact reports, case studies; field work.

Reference books
Berthouex and Rudd Strategy of Pollution Control (Wiley, 1977)
A. Gilpin Environmental Impact Assessment (Cambridge U.P., 1995)
Environmental Planning and Assessment Act, 1979, No. 203
Environmental Planning and Assessment Regulation, 1980

U4.695 Biochemical Engineering 8 units
Senior Advanced elective course for the degree in Chemical Engineering.
Prereq U2.610 Chemical Engineering 2
Coreq U2.066 Biochemistry 2 Auxiliary and U3.067 Microbiology 2
Classes Sem: 4 lec/wk, six 1hr tut sessions and four all-day lab sessions of 8-10hrs duration
Assessment assignments, lab reports and one 3hr exam at end of course


Textbook
Bailey and Ollis Biochemical Engineering Fundamentals IS edn
(McGraw-Hill, 1986)

Reference books
Mandelstam and McQuillan Biochemistry and Bacterial Growth (Blackwell, 1976)
Pirt Principles of Microbe and Cell Cultivation (Blackwell, 1975)
Wang et al. Fermentation and Enzyme Technology (Wiley, 1979)
Whittaker and Stanbury Principles of Fermentation Technology (Pergamon, 1985)
Journal articles as indicated during classes

U4.696 Process Plant Risk Management 4 units
Senior Advanced core course for the degree in Chemical Engineering.
Classes Sem 2: 4hrs/wk involving 3hrs lec/tut and discussions
Assessment tut assignments and one 3hr exam


Reference book
Lees Loss Prevention in the Process Industries (Butterworths)

U4.697 Professional Option 2 units
Senior Advanced elective course for the degree in Chemical Engineering.
Prereq Credit for 145 units

Syllabus summary: Each student is required to carry out an assignment related to the profession of Chemical Engineering; this will normally consist of a discussion of the design or operation of an industrial process. The discussion will be presented in the form of a written report, as a seminar, or both.

U4.689 Advances in Chemical Engineering A 4 units
Senior Advanced elective course for the degree in Chemical Engineering.
Classes Sem 1: 3hrs/wk
Assessment assignments, reports and one 3hr exam at end of course

Syllabus summary: This course will discuss the impact of current research and new technology on the
profession of chemical engineering; it will address the changes that are taking place in industrial processes as a result of new technologies.

The syllabus details will change from time to time as specialist lecturers become available.

U4.699 Advances in Chemical Engineering

**Senior Advanced elective course** for the degree in Chemical Engineering.

**Classes** Sem 1: 3hrs/wk

**Assessment** assignments, reports and one 3hr exam at end of course

**Syllabus summary:** This course will discuss the impact of current research and new technology on the profession of chemical engineering; it will address the changes that are taking place in industrial processes as a result of new technologies.

The syllabus details will change from time to time as specialist lecturers become available.

U4.720 Aerodynamics 3

**Senior Advanced core course** for the degree in Aeronautical Engineering.

**Prereq** U3.725 Aerodynamics 2

**Classes** Sem 1: 4 lec/wk with associated tut

**Assessment** written exam at end of Sem 1 plus course assignments

**Syllabus summary:** Lifting-line theory for three dimensional wings. Steady flow panel methods for aerofoil sections. Linearised compressibility corrections; wind tunnel corrections; the effects of aspect ratio and sweepback.

Aerofoil section boundary layer theory; pressure gradients; laminar to turbulent boundary layer transition; laminar separation bubbles; aerofoil stall. Calculation of aerofoil drag.

Steady two-dimensional supersonic flow; shock waves; method of characteristics. Two-dimensional supersonic aerofoils. Introduction to three-dimensional effects.

**Reference books**

Abbott and Von Doenhoff *Theory of Wing Sections* (Dover, 1959)


Bertin and Smith *Aerodynamics for Engineers* (Prentice Hall, 1985)

John *Gas Dynamics* (Allyn & Bacon, 1984)

Jones and Cohen *High Speed Wing Sections* (Dover)


Milne-Thomson *Theoretical Aerodynamics* (Macmillan, 1966)

Pankhurst and Holder *Wind Tunnel Technique* (Wiley)


U4.725 Aerodynamics 4

**Senior Advanced core course** for the degree in Aeronautical Engineering.

**Coreq** U4.720 Aerodynamics 3

**Classes** Sem 2: 3 lec/wk with associated tut

**Assessment** written exam at end of Sem 2 plus course assignments

**Syllabus summary:** Three dimensional panel methods; lift distribution for arbitrary wing planforms; effects of fuselage and control surfaces. Unsteady subsonic aerodynamics; introduction to flutter and divergence. Unsteady supersonic one-dimensional flow. Hypersonic flow; real gas effects. Rarefied gas flow.

Introduction to transonic aerodynamics.

**Reference books**


Bertin and Smith *Aerodynamics for Engineers* (Prentice Hall, 1985)

Bisplinghoff and Ashley *Principles of Aeroelasticity* (Dover, 1962)

Dowell *Modern Course in Aeroelasticity* (Sijthoff&Noordhoff, 1978)

Houghton and Brock *Aerodynamics for Engineering Students* (Edward Arnold)

John *Gas Dynamics* (Allyn & Bacon, 1984)

Liepmann and Roshko *Elements of Gasdynamics* (Wiley, 1957)

Thompson *Compressible Fluid Dynamics* (McGraw-Hill)

U4.730 Aircraft Structures 3

**Senior Advanced core course** for the degree in Aeronautical Engineering.

**Mutually exclusive with** U4.430 Applied Numerical Stress Analysis

**Prereq** U3.730 Aircraft Structures 1 and U3.735 Aircraft Structures 2

**Classes** Yr: 4 lec/wk

**Assessment** iat work assignments and rwo2hr exams

**Syllabus summary:** Plates and shells. Optimum structures. Buckling of bars, plates and shells; imperfection sensitivity. Structural dynamics. Structural fatigue; principles and practice. Finite element analysis; static and dynamic, for bars, plates and shells.

**Reference books**

Brush and Almroth *Buckling of Bars, Plates and Shells* (McGraw-Hill)


Cox *Design of Structures of Least Weight* (Pergamon, 1965)

Heubner *The Finite Element Method for Engineers* (Wiley-Interscience)

Madag *Metal Fatigue: Theory and Design* (Wiley)

Roark *Formulas for Stress and Strain* (McGraw-Hill)

Washizu *Variational Methods in Elasticity and Plasticity* (Pergamon)

Zienkiewicz *The Finite Element Method in Engineering* (McGraw-Hill)

Library classification: 620, 620.11, 624.17

U4.740 Aircraft Design 2

**Senior Advanced core course** for the degree in Aeronautical Engineering.

**Prereq** U3.740 Aircraft Design 1 and U3.725 Aerodynamics 2

**Classes** Yr: one 3hr class/wk

**Assessment** course assignments

**Syllabus summary:** Design requirements. Sources of information for aircraft design. Configuration design:

Reference book
Torenbeek Synthesis of Subsonic Airplane Design (Delft U.P.)

U4.750 Flight Mechanics 3     4 units
Senior Advanced core course for the degree in Aeronautical Engineering.

Prereq U3.725 Aerodynamics 2 and U3.755 Flight Mechanics
2
Classes Sem 1:3 lec/wk with associated tut
Assessment written exam at end of sem and course assignments


Reference books
Etkin Dynamics of Atmospheric Flight (Wiley, 1972)
Roskam Airplane Flight Dynamics and Automatic Flight Controls (Roskam & EEC, 1979)

U4.770 Propulsion     4 units
Senior Advanced core course for the degree in Aeronautical Engineering.

Prereq U3.421 Thermodynamics and U3.725 Aerodynamics
2
Classes Sem 1:3 lec/wk with associated tut and project work
Assessment written exam at end of Sem 1


Reference books
Glauert The Elements of Aerofoil and Airscrew Theory (C.U.P.)
Syllabus summary: Introduction to rotary wing aircraft; vertical flight performance; forward flight performance; blade motion and control; dynamics of rotors; rotorcraft stabilities; rotor blade design.

Reference books
Bramwell Helicopter Dynamics (Arnold)
Gessow and Myres Aerodynamics of the Helicopter (Macmillan)

U4.791 Advanced Rotary Wing Aerodynamics 2 units
Senior Advanced elective course for the degree in Aeronautical Engineering.
Coreq U4.790 Rotary Wing Aircraft
Classes Sem: 2hrs/wk
Assessment course assignment

Syllabus summary: This course provides an extension of the course U4.790 Rotary Wing Aircraft in the specific area of blade aerodynamics.
Theory of rotating and translating blade elements. Vortex theory of rotor blades, including vortex formation, wake geometry and trailing vortices. Requirements for blade aerofoils and aerofoil design.

Reference book
NASA CR-3082

U4.792 Aviation Operation and Management 2 units
Senior Advanced elective course for the degree in Aeronautical Engineering.
Classes this course is given by visiting lecturers from airlines and by aviation officials. Times are arranged to suit lecturers and classes may be held in the evening. The course is not provided every year
Assessment to be advised during classes

Syllabus summary: Principles and practice of aviation and airline management. Discussion and analysis of airline operations. Discussion of flight safety and airworthiness standards.

Reference books
As advised during lectures

U4.793 Probabilistic Design 4 units
Senior Advanced elective course for the degree in Aeronautical Engineering.
Prereq U4.740 Aircraft Design 2
Classes Sem: 3hrs/wk
Assessment course assignments

Syllabus summary: Optimisation methods: linear and dynamic programming, simplex method.
Application of probability theory to loads, strength and structural degradation. Estimation of time to failure, survival rate and MTBF.
Optimisation of designs: replaceable, fail-safe, safe life and damage-tolerant systems. Minimum-weight and minimum cost optimisation.

Reference books
As advised during lectures

U4.795 Flight Mechanics 4 3 units
Senior Advanced elective course for the degree in Aeronautical Engineering.
Prereq U4.750 Flight Mechanics 3
Classes Sem 2: 3 lec & tut/wk
Assessment major assignment/project duringSem

Syllabus summary: Overview of aircraft dynamic system modelling.
Overview of applications of digital flight control systems. Review of classical continuous system controller characteristics and control system design techniques. Discretised dynamic system characteristics. Controllability and observability. Modern control techniques and their application to guidance, control, navigation and structural-dynamic control problems. Common control system design software.

Reference books
LY Azzo and Houpis Linear Control System Analysis and Design: Conventional and Modern (McGraw-Hill, 1995)
Roskam Airplane Flight Dynamics and Automatic Flight Controls (Roskam A&EC, 1979)
Stevens and Lewis Aircraft Control and Simulation (Wiley, 1992)

U4.796 Advanced Computational Aerodynamics 2 units
Senior Advanced elective course for the degree in Aeronautical Engineering.
Prereq U3.725 Aerodynamics 2
Coreq U4.720 Aerodynamics 3, U4.725 Aerodynamics 4
Classes Sem 2: one 1hr tut/wk
Assessment course assignments

Syllabus summary: Explicit methods; implicit finite difference and finite volume methods. Extensions to the basic method to capture shock wave effects. Computation of one- and two-dimensional flows. Benchmarking of computational results against known flow solutions.

Reference book
C.A.J. Fletcher Computational Techniques for Fluid Dynamics Vols 1 and 2 (Springer-Verlag, 1992)

U4.797 Unsteady Aerodynamics 2 units
Senior Advanced elective core course for the degree in Aeronautical Engineering.
Prereq U3.720 Aerodynamics 1, U3.725 Aerodynamics 2
Coreq U4.720 Aerodynamics 3, U4.725 Aerodynamics 4
Classes Sem 2: (1hr lec/tut)/wk
Assessment course assignments

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; rate derivatives; response to gusts; aeroelasticity; prediction of flutter and divergence.

Reference books
Abbott and Von Doenhoff Theory of Wing Sections (Dover, 1959)
Bertin and Smith Aerodynamics for Engineers (Prentice Hall, 1979)
Fung An Introduction to the Theory of Aeroelasticity (Dover, 1969)
Moran Introduction to Theoretical and Computational Aerodynamics (Wiley, 1984)

U4.802 Engineering Construction 3  4 units
Senior Advanced core course for the degree in Project Engineering and Management (Civil).
Prereq U3.801 Engineering Construction 2
Assessment coursework, project and written exam
Syllabus summary: Environmental impact assessment and mitigation, construction safety fundamentals, construction power/energy supply analysis and design, system and optimisation of temporary structures for both on- and off-shore facilities, construction techniques for large caisson, diversion and retaining structures.

U4.812 Operations Research 4 units
Senior Advanced core course for the degree in Project Engineering and Management (Civil). Elective course for other branches.
Prereq U2.000 Mathematics 2
Assessment coursework and written exam
Syllabus summary: Introduction to operations research in construction management, methods and procedures in operations research, problem formulation, optimisation functions and constraints, linear programming, transportation and network distribution systems, allocation of resources, inventory management, queues, simulation and Monte Carlo methods, discrete sequential problems and dynamic programming, reliability analysis.

U4.822 Value Engineering and Risk Analysis 4 units
Senior Advanced core course for the degree in Project Engineering and Management (Civil). Elective course for other branches.
Prereq U2.820 Engineering Economics
Coreq U4.823 Cost Engineering
Assessment project work and written exam
Syllabus summary: Value engineering techniques and methods, life cycle costing, cost/worth ratio, creativity and brainstorming, overall and specific project risks using deterministic and probabilistic methods, computerised techniques for risk analysis.

U4.823 Cost Engineering 4 units
Senior Advanced core course for the degree in Project Engineering and Management (Civil). Elective course for other branches.
Assessment coursework, assignments and written exams

Syllabus summary: Estimating fundamentals, parametric estimating, preliminary and operational estimating, bidding strategy, quotations, tendering, cash flow projection and management, work analysis and design, productivity control, productivity database, computerised techniques for cost engineering.

U4.824 Project Formulation 4 units
Senior Advanced core course for the degree in Project Engineering and Management (Civil). Elective course for other branches.
Prereq U2.820 Engineering Economics and U2.821 Engineering Accounting
Classes assessment and syllabus summary: see U4.293 Civil Engineering Project Design

U5.204 Thesis Honours 10 units
Senior Advanced elective course for the degree in Civil Engineering and in Project Engineering and Management (Civil).
Coreq a Senior core course in the field of the thesis
Classes Yr: 104hrs study
Assessment submitted typed thesis and oral presentation
Syllabus summary: A study, in groups of two students, of a selected topic in Civil Engineering. Detailed information sheets are available from the School of Civil and Mining Engineering at the beginning of the semester.

U5.213 Materials Honours 4 units
Senior Advanced elective course for the degree in Civil Engineering.
Coreq U4.214 Materials Aspects in Design
Classes 40hrs lec & 12hrs lab/tut
Assessment one 3hr exam plus assignments
Course objectives: To develop an understanding of advanced cement-based and metallic materials for new and challenging applications.
Course outcomes: Ability to select advanced cement-based and metallic materials for use under demanding service conditions for which their traditional counterparts may be less suitable.
Reference books
Campbell-Allen and Roper Concrete Structures: Materials Maintenance and Repairs (Longman Scientific & Technical)
Others to be advised
Steel Structures Honours  
**Senior Advanced elective course** for the degree in Civil Engineering.

**Mutually exclusive with** U4.238 Steel Structures 2

**Prereq** U3.235 Steel Structures 1

**Classes** 28hrs lec, 28hrs tut

**Assessment** one 3hr exam at end of the Sem plus assessment of assignment work

**Course objectives:** To develop a working knowledge of the analysis, behaviour and design of steel structures beyond a basic competency.

**Expected outcomes:** Proficiency in the analysis and design of steel structures

**Syllabus summary:** Three of the 4 subjects will be available: (1) Elastic and plastic analysis and design for bending and torsion in steel structures; (2) Elastic local buckling of plates, behaviour and design of plate web girders; (3) Flexural-torsional buckling—behaviour, analysis, and design; (4) Shell structures—behaviour, analysis, and design.

**Textbooks**
- Gibson *Thin Shells* (Pergamon, 1980)
- Standards Australia AS4100—Steel Structures (1990)
- Trahair and Bradford *Behaviour and Design of Steel Structures* (Chapman & Hall, 1991)
- Tiahaix *Flexural-Torsional Buckling of Structures* (Spon, 1993)
- Vinson *The Behaviour of Plates and Shells* (Wiley, 1974)

**Reference books**
- Bulson *Stability of Flat Plates* (Chatto & Windus, 1970)
- Hugge *Stresses in Shells* (Springer Verlag, 1973)
- Gould *Finite Element Analysis of Shells of Revolution* (Prentice-Hall, 1985)
- Hancock *Design of Cold-Formed Structures* (AISC, 1994)

**Other books as indicated during classes**

Library classification: 624.17,624.182

**U5.225 Advanced Finite Elements Honours**  
**Senior Advanced elective course** for the degree in Civil Engineering.

**Coreq** U4.223 Finite Element Methods

**Classes** Sem: 26hrs lec & 26hrs tut

**Assessment** class work, assignments and one 3hr exam

**Syllabus summary:** Advanced elastic analysis, high order elements, isoparametric elements. Analysis of seepage and consolidation. Boundary element analysis, analysis of plates and shells. Advanced topics, computational techniques.

**Textbooks**
- As prescribed during the course

**Reference books**

**U5.226 Finite Element Applications Honours**  
**Senior Advanced elective course** for the degree in Civil Engineering.

4 units

**Coreq** U4.223 Finite Element Methods

**Classes** Sem: 4hr/wk, including lec plus tut and computer lab sessions

**Assessment** assessment of computer assignments during

Sem and one 2hr exam at end of course


**Reference books**
- Bathe *Finite Element Procedures in Engineering Analysis* (Prentice-Hall, 1982)
- Cheung *Finite Strip Method in Structural Analysis* (Pergamon, 1976)

**Relevant computer manuals**

Library Classification: 624.171

**U5.234 Structural Dynamics Honours**  
**Senior Advanced elective course** for the degree in Civil Engineering.

**Coreq** U4.222 Structural Analysis 2 and U4.231 Structural Behaviour 2

**Classes** 26hrs lec & 26hrs tut

**Assessment** one 3hr exam

**Syllabus summary:** Structural dynamics, wind loading on structures. Finite element dynamic analysis, consistent mass matrix, damping matrix, free vibration, forced vibration, Eigenvalue routines.

**Reference books**

Library Classification: 624.171,624.176

**U5.239 Concrete Structures Honours**  
**Senior Advanced elective course** for the degree in Civil Engineering.

**Coreq** U4.222 Structural Analysis 2 and U4.231 Structural Behaviour 2

**Classes** 4hr/wk including lec and tut

**Assessment** one 3hr exam

**Syllabus summary:**

(a) Composite structures: shear connection, full and partial interaction. Simply supported and continuous beams, columns, bridge design, fatigue.

(b) Concrete structures: analysis of time-dependent effects in concrete structures: mathematical models of concrete creep and shrinkage, analysis of reinforced concrete beams, slabs and columns.
Non-linear behaviour of prestressed and reinforced concrete sections and members; load-moment-curvature relationships; analysis of beams, columns and beam-columns; stability of members and frames.

Textbooks
Park and Paulay Reinforced Concrete Structures (Wiley, 1975)
Warner and Faulkes Prestressed Concrete (Longman Cheshire, 1988)
Australian Standard for Concrete Structures AS3600-1988

U5.243 Soil Engineering Honours 4 units
Senior Advanced elective course for the degree in Civil Engineering.
Coreq U4.241 Soil Engineering
Classes 39hrs lec & 13hrs tut
Assessment one 3hr paper on the whole syllabus; assignment work may count towards the final assessment
Reference books
Poulos Marine Geotechnics (Unwin Hyman, 1988)
Library Classification: 624.183

U5.253 Surveying Honours 4 units
Senior Advanced elective course for the degree in Civil Engineering.
Coreq U4.251 Surveying 2
Classes Sem: 26hrs lec & 26hrs tut
Assessment fieldwork and one 3hr exam at end of course
Textbook
Uren and Price Surveying for Engineers 2nd edn (Macmillan)
Reference books
Clark Plane and Geodetic Surveying Vol. II (Constable)
Library classification: 526.9

U5.267 Environmental Fluids Honours 4 units
Senior Advanced elective course for the degree in Civil Engineering.
Mutually exclusive with U4.265 Environmental Fluids 2
Prereq U3.262 Fluids 2
Classes 26hrs lec & 26hrs tut
Assessment one 3hr exam covering the whole syllabus at the end of the Sem. Satisfactory performance in class assignments is also a requirement. Credit will be given for assignment submissions, as indicated at the beginning of the course
Course objectives: To develop an understanding of: the methods of analysis of the turbulent flow of fluids; fluid flow in open channels under complex conditions; aspects of fluid-structure interaction; ocean waves and their effect on offshore structures; advanced flood analysis techniques.
Expected outcomes: Students will be able to: apply the Navier-Stokes equations to a range of different flow systems; describe the behaviour of flows in open channels near channel transitions; detail open channel surface profiles under sub- and super-critical flow conditions; describe several types of fluid structures, together with associated fluid-structure interaction, including, but not limited to, spillways, stilling basins, bridge piers, water supply intakes; list and evaluate the parameters affecting ocean wave generation and transmission; describe the behaviour of waves in shallow water and explain energy transfer by waves; calculate forces exerted on structures subjected to wave action; design wave basins, explain the principles of river routing and discuss the applications of flood modelling techniques and use of computer programs.
Reference books
As advised during the course

U5.294 Civil Engineering Design Honours 4 units
Senior Advanced elective honours course for the degree in Civil Engineering.
Coreq U4.292 Civil Engineering Design
Classes 13hrs lec & 39hrs drawing office work
Assessment no formal exam; assessment will be based on submitted work
Syllabus summary: Aspects of the design cycle from concept to detailed design documentation are explored by way of selected project design assignments.
Design assignments will have a complexity requiring the selection and use of advanced analytical techniques and the interpretation of results, for incorporation in the design.
The course will be conducted by a practising professional engineer and will draw on the specialist expertise of academic staff.
Text and reference books
Advice will be given in class at the commencement of each assignment

U5.785 Honours Thesis 16 units
Honours course for the degree in Aeronautical Engineering. Alternative to the Senior Advanced core course U4.785 Thesis.
Prereq Credit for 36 units of Senior courses
Refer to course U4.785 for details.
Poor performance will lead to consideration for the award of a grade in the Pass course U4.785 only.
5 Other faculty information

General University information
This chapter of the handbook is concerned specifically with the Faculty of Engineering. For further details about the University—its organisation, examinations, child care facilities, assistance for disabled students, housing, health, counselling, financial assistance, careers advice and a range of other matters—see the separate publication University of Sydney Diary, available free from the Student Centre or from University of Sydney Union outlets.

The Faculty
Faculty adviser
You may discuss with the Secretary to the Faculty any questions about your studies, difficulties in maintaining your studies for financial or personal reasons, or any other questions or problems that may arise. As difficulties can usually be handled more easily in the early stages, you should seek help without delay. Discussions are held in strict confidence—simply come to the Faculty Office, in Room 226, Engineering Faculty Building and make an appointment.

Noticeboards
Faculty noticeboards, one for Junior courses and one for Intermediate courses, located outside the Student Enquiry Office, 2nd level, Faculty Building. Each of the Engineering departments has a noticeboard for Senior and Senior Advanced students.

Noticeboards are also in the various Science departments, and information concerning the courses given by those departments will be posted on these boards.

Details of class lists, timetable variations, examination times and other information relating to courses of study will be posted on the relevant noticeboards. Students are expected to inspect the noticeboards at frequent intervals.

Notices referring to cadetships, scholarships, vacation employment and career opportunities and other matters of this nature are also displayed on the noticeboards in and around the Student Enquiry Office, 2nd level, Engineering Faculty Building.

The Faculty library
The University of Sydney Library consists of a central library—called Fisher Library—and a number of branch libraries of which Engineering is one. The Engineering Library is on the ground floor of the PNR Building in the Engineering Precinct. Other branch and department libraries within the University contain relevant material, e.g. Architecture, Physics, Mathematics, Chemistry, Wolstenholme and Badham Libraries. Engineering students may use all the libraries of the University.

Multiple copies of reference books for Junior and Intermediate courses are held in the undergraduate section of Fisher Library. Students in the senior years in Engineering will find most of their reference material in the Engineering Faculty Library. Books may be borrowed for two weeks with two loan renewals permitted. Journals may not be borrowed but photocopying facilities are available.

The Engineering Library opens from 8.45 am to 6.00 pm Monday-Friday during term. Vacation hours are 9.00 am to 5.00 pm Monday to Friday.

Dewey Decimal Classification numbers are given for some courses in chapter 4: Courses of Study. These are not meant to be exhaustive lists and reference should also be made to the subject catalogue in the library.

Engineering associations
SUCEA
The Sydney University Chemical Engineering Association (SUCEA) is a body representing the graduates of the Department of Chemical Engineering. Established in the 1950s, it is one of the oldest alumni associations at the University of Sydney. With 1326 members living in over 20 countries around the world, it is also one of the largest.

SUCEA holds a number of social events and a technical symposium each year with the aim of maintaining strong contact between the Department and its graduates (some of whom are well into their sixties). So, via SUCEA, you will still be part of the 'Chem Eng' family even after you graduate.

SUEUA
The objects of SUEUA, the Sydney University Engineering Undergraduates' Association, are:
(a) to perform such actions and to organise such functions as the committee may deem necessary and desirable in the interests of the Faculty of Engineering, University of Sydney, and the students thereof;
(b) to act as an intermediary body between the teaching staff on the one hand and the members of the Association on the other;
(c) to organise Engineering teams for inter-faculty sport.

The office of the SUEUA is on the ground floor of the PNR Building close to the Faculty library.

In this office the association conducts a bookshop where many items of stationery, and some textbooks and codes of practice, are available at competitive prices.

The SUEUA normally holds an election for the president and other office bearers in March each year and all financial members of the association are eligible to vote. The president becomes a member of the Faculty by virtue of this office. The by-laws of the University provide for the undergraduates in
Engineering to elect two others of their number to be members of Faculty and an election for this purpose is conducted in October each year. All Engineering undergraduates, including those enrolled in the Faculty of Science as candidates for the double degree, are eligible to vote.

Institution of Engineers, Australia
The professional body for Engineering in Australia is the Institution of Engineers, Australia, whose first objective is to 'promote the science and practice of engineering in all its branches'.

The institution functions through a series of divisions, the local one being the Sydney Division. Within each division are branches representing the main interests within the profession—e.g. civil, electrical, mechanical, chemical and transportation to name a few.

Any student of an approved School of Engineering can join the Institution as a student member (StudE Aust).

As a student member you will receive the fortnightly magazine Engineers Australia, containing articles of general engineering interest and advising you of site tours, conferences, technical meetings of all branches, harbour cruises, film nights, and so on.

Student members may freely use the comprehensive library and reference facilities maintained by the Institution—a handy place to obtain a hard-to-get book or periodical.

Within most divisions is a Graduates and Students Section, known as GAS, and all graduates of, or students at, approved engineering schools are eligible for membership.

The Graduates and Students Sections organise film nights, site tours and other activities of general interest. The Malcolm Stanley Speakers’ Competition or public speaking is held each year, usually in September, and prizes are awarded for the best speeches.

For membership information and application forms enquire at the Faculty Office or at the Sydney Division Office, 118 Alfred Street, Milsons Point 2061 (P.O. Box 138).

The Institution of Chemical Engineers
An alternative organisation for Chemical Engineering students is the Institution of Chemical Engineers. The Institution welcomes and values student members, offering special rates for technical meetings, together with Institution literature and guides to gaining employment. For further information contact the General Office in Chemical Engineering.

The Association of Professional Engineers, Scientists and Managers, Australia
APESMA is a professional organisation that represents the industrial interests of its members. Its major focus is on providing advice and assistance on employment-related matters, including individual representation and improving salaries and conditions for professional engineers, scientists and managers. The Association also provides members with legal, financial and insurance services and runs an extensive management education program.

APESMA has some 19 000 members in all areas of public and private sectors in Australia. In addition, 6500 university students in engineering and science-related disciplines are student members.

The Association invites students to become affiliate members for no charge while they are studying. This membership gives students access to information and advice on industrial experience, salary rates for graduates and contracts of employment. Student members receive The Student Update, a publication designed specifically for students, three times a year. This gives students some practical insight into aspects of the workplace to which they may not have given much thought, in particular the employment issues that affect them as professional engineers.

For more information and student membership application forms, contact Felicity Ryan, Membership Liaison Officer, tel. 9264 9500.

Enrolment
Special enrolment instructions
These are the special requirements for Engineering students.

To complete your enrolment in Engineering you proceed to the PNR Enrolment Centre in the Drawing Office, where you
—collect your enrolment form,
—complete a registration form,
—consult an adviser about your plan of courses and
—record your courses on the computer and receive your timetable.

Examinations
Freedom of Information Act
Examination scripts, or copies of same, are available for viewing or collection from Departmental Offices for three months after final examinations each year, after which they will be shredded.

Enquiries
The Engineering Faculty Office is open for enquiries about Junior and Intermediate results during January. All enquiries should be made in person during this period. Enquiries about the Senior and Senior Advanced results should be made to the adviser in the appropriate department.

Supplementary examinations
A supplementary examination may be granted by the Faculty:
(a) to candidates whose performance in an examination has been significantly affected by duly certified illness or misadventure;
(b) to candidates who have failed an examination but whose overall level of performance in the year’s work is deemed sufficient to warrant the concession of a further test.

Supplementary examinations under category (b) are normally granted only to those candidates who are in their first year of attendance.

The award of supplementary examinations is a privilege and not a right.
Illness or misadventure
The Faculty of Engineering recognises that the performance of students may be adversely affected by illness or other misadventure, and makes provision for special consideration of such disabilities when examination results are considered.

Any student who believes that his/her performance has been or may be adversely affected by an occurrence of illness or misadventure may request the Faculty to make special consideration of same. All such requests must include a special consideration application on the form provided by the Faculty, supplied within one week of the occurrence and accompanied by an appropriate medical certificate or other relevant documentary evidence apart from the student’s own submission. Such certificates or documentary evidence should state not only the nature of the illness or misadventure but also (where relevant) the opinion of the issuer as to the extent of the disability involved.

If the student has completed the assessment for which special consideration is requested, then further documentary evidence of the extent of the disability from a specialist medical practitioner/counsellor etc. must also be supplied. For example, if a student completes an examination but still wishes to request special consideration for it, this additional specialist evidence is required.

Finally, the Faculty intends only to compensate for sub-standard performance in assessments which do not reflect a student’s true competence in a subject, and such provisions must not act to the disadvantage of other students. The Faculty will only compensate students when there is clear evidence that results have been adversely affected by the disability for which special consideration is requested.

Financial assistance
Special assistance
In certain circumstances assistance is available to students who encounter some unforeseen financial difficulty during their studies. The assistance is usually in the form of bursaries or interest free loans.

Students wishing to apply for financial assistance should make enquiries from either of the following:
Financial Assistance Office, Student Services, tel. 93512416.
President of the Students’ Representative Council, tel. 9660 5222.

J.N. Ellis Memorial Fund
The J.N. Ellis Memorial Fund was established in 1969 following an appeal made to all graduates in engineering to honour the memory of Neil Ellis, who as Sub-Dean and later as Administrative Assistant to the Dean over a considerable period of years was able, by sympathetic counselling, to help many students who were having difficulties in completing their studies.

The object of the fund is to provide financial assistance to students in the Faculty of Engineering who are in such a position that without assistance they would not be able to continue their studies. Students seeking such assistance should apply to Financial Assistance, Student Services, tel. 9351 2416. Awards are made on the recommendation of the Dean. Value: $500. Applications may be made at any time.

Those who receive assistance from the fund are asked to make a contribution to it when they are financially able to do so. In this way the fund will be able to continue and grow in the extent to which it can help deserving students in future years.

Learning assistance
The University's Learning Assistance Centre offers a wide range of workshops and other activities to assist students develop the learning and language skills needed for academic study. The workshops are available free to all enrolled students of the University. Workshop topics include essay and assignment writing, oral communication skills, studying at university, conducting research.

The Learning Assistance Centre is located on Level 7 of the new Education Building next to Manning House (tel. 9351 3853).

Cadetships, scholarships and prizes
Many students enrolling in the Faculty of Engineering obtain financial assistance by way of a cadetship or scholarship, either at the time of enrolment, or at a later stage in their studies.

Information about the Australian government Austudy Scheme is available from the State Director, Department of Employment, Education and Training, 477 Pitt Street, Sydney 2000.

Scholarships are also awarded by a number of industrial organisations. Many of these do not require the student to enter into a financial bond.

Some government departments and public authorities provide cadetships or traineeships which require the student to enter into an agreement to work for the employer for a specified number of years after graduation.

Before accepting a bonded cadetship or traineeship students should give careful consideration to the conditions of the award and in particular the obligations which they will incur should they decide to relinquish the award for any reason.

A list of currently available prizes and scholarships is available from the University’s Scholarships Office in the Main Quadrangle, tel. 9351 3250.
6 Postgraduate study

The Faculty of Engineering offers a wide range of postgraduate research and coursework programs within the Departments of Aeronautical, Chemical, Electrical and Mechanical and Mechatronic Engineering and the specialisation, Environmental Engineering.

Full details of the postgraduate degrees and diplomas are contained in a leaflet which is available from the Faculty Office.

Doctor of Engineering

The senior of the higher degrees in the field of engineering is the DEng degree. Originally called Doctor of Science in Engineering, DScEng, the name was changed to Doctor of Engineering in 1981. The degree is awarded for distinguished published work. The first doctorate in engineering was conferred in 1924.

DScEng
John Job Crew Bradfield, 1924
William George Baker, 1932
David Milton Myers, 1938
David Lipscombe Hollway, 1954
Bernard Yarnton Mills, 1959
Robert Thomas Fowler, 1960
James Brydon Rudd, 1962
John Ernest Benson, 1975
Harry George Poulos, 1976
George Kossoff, 1981
Robert Henry Frater, 1982

DEng
John Robert Booker
Bhushan Lai Karihaloo
Kerry Rowe
Nicholas Snowden Trahair

Doctor of Philosophy

The degree of Doctor of Philosophy is a research degree awarded for a thesis considered to be a substantially original contribution to the subject concerned. This degree is becoming a prerequisite for research appointments in government and industrial research and development laboratories.

Applicants should normally hold a master's degree or a bachelor's degree with first or second class honours of the University of Sydney, or an equivalent qualification from another university or institution.

The degree may be taken on either a full-time or part-time basis.

In the case of full-time candidates, the minimum period of candidature is six semesters (3 years). The maximum period of candidature is normally ten semesters.

Part-time candidature may be approved for applicants who can demonstrate that they are engaged in an occupation or other activity which leaves them substantially free to pursue their candidature for the degree. Normally the minimum period of candidature will be determined on the recommendation of the Faculty but in any case will not be less than six semesters; the maximum period of candidature is normally 14 semesters.

The Faculty may admit some applicants on a probationary basis for a period not exceeding twelve months.

Master of Engineering

Graduates in engineering of the University of Sydney who have had at least three years’ experience after graduation may be admitted as candidates for the ME degree. The award is made for a thesis or a design of special merit, and may be looked upon as an external degree reserved by the Faculty for its own graduates.

Master of Engineering (Research)

The Master of Engineering (Research) degree provides candidates with opportunities to develop specialist interests through a program of supervised research (theoretical or applied), shorter than the three years usually required for the PhD degree. Candidature is normally on a full-time basis but may also be undertaken part-time. The ME(Res) degree may be undertaken in the Departments of Aeronautical, Chemical, Electrical or Mechanical Engineering in the School of Civil and Mining Engineering.

The minimum academic entry requirement is normally the 4-year Bachelor of Engineering degree from the University of Sydney with first or second class honours in the same branch of engineering as that in which the ME(Res) degree is to be undertaken, or an equivalent qualification from another university or tertiary institution. In exceptional circumstances a graduate in engineering with a pass degree or a graduate with an honours degree in a different branch of engineering or from another Faculty may be admitted to candidature but such an applicant may be required to undergo a preliminary examination.

The Faculty may admit some applicants on a probationary basis for a period not exceeding twelve months.

The minimum period of candidature is one year full-time and two years part-time and the maximum period of candidature is two years full-time and three years part-time. If a candidate is required to undertake a preliminary examination then the candidature commences after the completion of the preliminary examination.

Special attention is drawn to the need for applicants to provide concise details of their proposed research program including aims and methodology and evidence of their ability to carry out intensive research and advanced study. Candidates who enrol for this degree with the object of later transferring to candidature for the PhD degree should select a research project that is suitable for this purpose.
Applicants admitted to candidature for the ME(Res) degree are expected to work individually on advanced study and research under the direction of a supervisor, with whom regular consultation about their work and the general planning of their thesis is required. On completion of their candidature a thesis must be submitted embodying the results of their work.

Master of Engineering Studies
The MES degree provides candidates with programs of formal coursework alone or coursework and applied research aimed at meeting the professional development needs of engineers and scientists in the private and public sectors of industry and in private practice.

The minimum academic entry requirement is the 4-year Bachelor of Engineering degree from the University of Sydney, or an equivalent qualification from another university or tertiary institution.

The minimum period of candidature is one year full-time and two years part-time and the maximum period of candidature for all candidates is two years full-time and three years part-time.

Candidates for the MES have two alternative methods of candidature, by coursework alone or by coursework and project. They are required to complete either 30 units of coursework or at least 20 units of coursework and a design or research project valued at 10 units.

Candidates may choose to complete the units of coursework from the same subject area or from related subject areas, in the same department or school, or they may choose to complete all subjects from departments other than the one in which they are primarily studying. Candidates may also be given permission to take subjects from another Faculty at this University or from another tertiary institution such as the University of New South Wales or the University of Technology, Sydney. If you wish to apply to count subjects from another tertiary institution, you would of course need approval from that institution to enrol there and the permission of the University of Sydney.

The regulations in regard to coursework taken external to the Faculty are:
- Up to 12 units and a maximum of 4 approved subjects can be taken in other Faculties or external to the institution.
- Up to 12 units of approved business related subjects.
- A maximum of 5 units of approved undergraduate engineering subjects can be taken within the Faculty at this university.
- A minimum of 50% of all coursework must be undertaken within the Faculty of Engineering at the postgraduate level.
- Approval to take courses at another institution is given on the understanding that you may not count these courses towards a degree, diploma or any other qualification at the other institution where you are taking them.

A candidate who fails to demonstrate satisfactory progress may be asked to show good cause why he or her candidature should not be terminated. A candidate who fails (or discontinues without permission) in more than 2 courses or 6 units (whichever is the higher) will be deemed not to have made satisfactory progress and may be asked to show good cause why he or she should be allowed to re-enrol.

Most postgraduate subjects are run in the afternoon or evening.

A 1-hour lecture each week for one semester (i.e. 14 weeks) together with the associated tutorial, laboratory and assignment work, is rated normally as one unit.

For their projects, candidates are encouraged to select problems based on their professional experience or their research interests. Many projects will be closely related to the research activity within the Faculty, and in some cases it may be possible for original work to be reported in the project report. A design study or a critical examination of a professional problem may also be acceptable as a project. The work on the project is expected to occupy about one-third of a candidate’s total program, i.e. a maximum of 10 units credit.

Aeronautical Engineering
There is no coursework program currently available.

Chemical Engineering
There is no coursework program currently available.

Civil Engineering
The School of Civil and Mining Engineering offers the MES coursework program in the areas of Geotechnical Engineering, Structural Engineering and Foundation Engineering.

You should note, however, that the School of Civil and Mining Engineering may not be able to offer all its courses each year, so that even a full-time candidate may take 18 months or two years to complete the degree requirements in that School.

Electrical Engineering
The Department of Electrical Engineering is not able to offer its full coursework program each year. It therefore may take candidates two years to complete the degree requirements.

Mechanical and Mechatronic Engineering
The coursework program is available on both a full- and part-time basis in Mechanical Engineering. There is no Masters program in Mechatronic Engineering available at present.

In order to complete the degree requirements in one year, however, a candidate would need to take subjects from those offered by other departments or by another tertiary institution.

Environmental Engineering
The Faculty of Engineering offers a coursework program in Environmental Engineering for the MES degree and DipEnvironEng. While the program is managed by the Department of Chemical Engineering, teaching is by Chemical, Civil and Mechanical Engineering, as well as by other departments in the University.

Both MES and Diploma candidates will be required to complete certain core requirements:
- MES candidates will need to choose at least 15 units from the list of postgraduate environmental subjects taught by the Faculty of Engineering and Diploma candidates 10. The course P4.300 Environmental
Impact Assessment will be a core requirement for all candidates within these 15/10 compulsory units. This will mean that 50% of the coursework will have to be taken from postgraduate Environmental Engineering subjects.

- All candidates will also be required to complete at least one subject from each of the approved Economics subjects and Planning and Law subjects.
- The remaining units to be completed may be chosen from any of the postgraduate subjects offered by the Faculty of Engineering.

Diplomas

Courses leading to the award of a diploma are currently available in the following specialist areas:

- Geotechnical Engineering DipGeotEng
- Structural Engineering DipStructEng
- Structural and Foundation Engineering DipStructFoundEng
- Power Engineering DipPowEng
- Computer Systems Engineering DipCompSystEng
- Telecommunications DipTelecomm
- Environmental Engineering DipEnvironEng

The minimum academic entry requirement is the 4-year Bachelor of Engineering degree from the University of Sydney, or an equivalent qualification from another university or tertiary institution.

The minimum period of candidature is one year full-time and two years part-time and the maximum period of candidature for all candidates is two years full-time and three years part-time.

Candidates are required to complete 20 units of coursework, chosen from the subjects available for the MES degree. The Diploma requirements differ from the MES requirements only in that no project is required.

The School of Civil and Mining Engineering offers Diplomas in Geotechnical Engineering, in Structural Engineering and in Structural and Foundation Engineering. As for the MES, even full-time candidates could take 18 months to two years to complete the diploma requirements.

The Department of Electrical Engineering offers Diplomas in Computer Systems Engineering, in Power Engineering and in Telecommunications. As for the MES degree, it may take candidates longer than the minimum period of candidature to complete the Diploma requirements.

The Diploma in Environmental Engineering is managed by the Department of Chemical Engineering. The teaching is provided by Chemical, Civil and Mechanical Engineering and by other teaching departments in the University. As for the MES in Environmental Engineering, the DipEnvironEng has certain requirements:

- Diploma candidates will need to choose at least 10 units from the list of postgraduate environmental subjects taught by the Faculty of Engineering.
- The course P4.300 Environmental Impact Assessment will be a core requirement, as will the completion of at least one subject from each of the approved Economics and Planning and Law subjects.
Symbols may have been used in the courses of study chapter in the handbook as a succinct way of presenting teaching and assessment information. Because of the varied nature of the work described and occasional difficulties in interpretation and typesetting, such details are not construed as a firm undertaking. Students are advised to check details with the departments concerned. The significance of symbols used is as follows:

_Hypothetical examples of symbols used_

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<thead>
<tr>
<th>Title of course</th>
<th>Double Dutch 1</th>
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<tbody>
<tr>
<td>Actual lecturers</td>
<td>Assoc. Prof. Holland, Dr Nederlands</td>
</tr>
<tr>
<td>Allied studies</td>
<td>AKn HSC German</td>
</tr>
<tr>
<td>Class contact &amp; Classes</td>
<td>Yr: (3 lec &amp; 1 tut)/wk</td>
</tr>
</tbody>
</table>

Exams, essays, etc.  
Assessment one 3hr exam, two 2000w essays/sem, 4 tut papers/sem

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<th>Title of course</th>
<th>8766 Star Wars 5</th>
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</thead>
<tbody>
<tr>
<td>Actual lecturers</td>
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</tr>
<tr>
<td>Allied studies</td>
<td>Prereq 7653 Coreq Intro. Media Manipulation</td>
</tr>
<tr>
<td>Class contact &amp; course duration</td>
<td>Sem 1: (2 lec &amp; 3 tut/prac)/wk; Sem 2: (2 lec &amp; 2 tut/prac)/wk</td>
</tr>
</tbody>
</table>

Exams, essays, etc.  
Assessment one 3hrexam/sem, classwork

Allied studies  
_AKn_ assumed knowledge  
_Prereq_ prerequisite (you must have passed the indicated prerequisite before you start the course)  
_Coreq_ corequisite (you must enrol in this course at the same time unless you have already passed it)

_Type of class contact/assessment_

_class..................class contact of any form  
lab......................laboratory  
lec......................lecture  
prac....................practical  
tut......................tutorial  
exam....................examination  
tut paper.............tutorial paper

Duration  
/hr.....................hour  
Sem 1..................Semester 1  
Sem 2..................Semester 2  
Yr....................throughout the year

_Frequency_

/wk........................per week  
/fn..........................per fortnight  
/sem........................per semester  
/yr..........................per year

_Examples_

_Classes_

Sem 1: 1 class/wk  
Yr: (2 lec & 3 tut/prac)/wk  
Sem 2: 3 lec/wk & 1 tut/fn

_Assessment_  
one 3hr exam  
two 3 hr exams/sem  
one 2000w essay  
one 3000w essay, two 2000w essays/sem, 4 tut papers the course (one 3000w & two 2000w essays)/sem

one 3-hour exam  
two 3-hour exams per semester  
one 2000-word essay  
one 3000-word essay for the course, two 2000-word essays per semester and four tutorial papers for one 3000- and two 2000-word essays per semester
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<th>Departments, schools and buildings – main campus</th>
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<td>Accounting</td>
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<tr>
<td>Administrative Policy &amp; Strategic Planning</td>
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<td>Architecture, Dept &amp; Faculty Office</td>
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<td>Archives</td>
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<td>Art Workshop</td>
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<td>Arts Faculty Office</td>
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<td>Attendee’s Lodge</td>
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<td>Badham Bld &amp; Library</td>
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<td>Banks (see Financial institutions)</td>
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<td>Behavioural Sciences in Medicine</td>
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<td>SRC Secondhand</td>
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<td>Great Hall</td>
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<td>Greek, Modern</td>
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<td>History</td>
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<td>History &amp; Philosophy of Science</td>
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<td>Holmes Bld</td>
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<td>Industrial Relations, Dept of Infectious Diseases</td>
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<td>Institute Bld</td>
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<td>International Office &amp; International Student Bld</td>
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<td>International House</td>
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<td>Koori Centre</td>
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<td>Language Centre</td>
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<td>Madame Bld</td>
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<td>Mail Room (Internal)</td>
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<td>Mandelbaum House</td>
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<tr>
<td>Manning House</td>
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<td>Margaret Peller Bld</td>
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Student Centre (17L):
- academic transcripts
- admissions
- enrolments
- examinations
- graduations
- handbook sales
- HECS enquiries
- travel concessions

Student Services (13G):
- accommodation
- counselling
- financial assistance
- special services (disabilities, etc.)