Chapter 5

ANU College of Engineering and Computer Science

ANU College of Engineering and Computer Science

Contents

Introduction

The Faculty of Engineering and Information Technology, a constituent part of the ANU College of Engineering and Information Technology, represents the commitment of The Australian National University to developments in engineering and information technology. The Faculty has over 1,100 students enrolled in undergraduate and postgraduate degree programs including over 200 international students. Our degrees draw upon the extensive expertise and cutting-edge research activities of our staff and take advantage of the interdisciplinary nature of the University's research strengths in information and communications technology, engineering, and related mathematical and physical sciences.

There are approximately 150 computer scientists, engineers, software engineers, physicists, mathematicians, and information technology specialists across the university who are involved in internationally renowned research in engineering and information science at the University.

In addition, students have access to the world class facilities that ANU has to offer including a computing environment unequalled in Australia that includes a Super Computer and a Storage Tek device capable of holding more than 40 Terabytes of data connected to a 100Mbps FDDI ring. There are fully equipped manufacturing, materials, robotics and solar labs and the Wedge virtual reality theatre.

Faculty Office and student assistance

The Faculty Office can be found on the first floor of the Ian Ross Building (Bldg No 32a). Opening hours are 9am to 5pm Monday to Friday. A Student Advisor is available to provide information and assistance in person or you can email Student Services student.services@feit.anu.edu.au

In addition to this support, each Department has an Associate Dean (Undergraduate) to provide advice on academic matters. Appointments with the Associate Deans can be made at the relevant Department office:

Department of Engineering
Level 2, Engineering Building (Bldg No 32)

Department of Computer Science
Level 3, Computer Science Building (Bldg 108)

Programs for outstanding students

The Faculty offers the following programs for outstanding students:

- Bachelor of Computer Science (Honours)
- the Research and Development Scholars Program in Engineering
- the Distinguished Scholars Program in Information Technology and Software Engineering
- further information is available from the Faculty Office.

Women in Technology

The Faculty is committed to encouraging more women to enrol in its programs and to ensuring its programs are conducted in a manner that respects and values women's interest, experience and learning styles. The Faculty operates a women's network and offers a number of scholarships to female students. Further information is available from the Faculty Office.

Combined degrees

In addition to the programs listed within the Faculty handbook entry, combined degree programs are available in a number of areas including: BE/BIT, BE/Arts, BE/Commerce, BE/Economics, BE/Asian Studies, BE/Science, BIT/Law, BIT/Commerce, BIT/Economics, BIT/Arts, BIT/Forestry, BSEng/BSc, and BSEng/Commerce. Over 50 per cent of students in the Faculty study combined programs. For more information about combined program options, please see the Combined Program section at the end of the Handbook.

Accreditation

The Bachelor of Engineering and the Bachelor of Software Engineering programs are accredited to the appropriate level with Engineers Australia (formerly IE Aust). The Bachelor of Software Engineering program is also accredited with the Australian Computer Society (ACS). The Bachelor of Information Technology program is accredited with the Australian Computer Society and all students who complete the program are eligible for associate membership of the ACS.

The Bachelor of Computer Science (Honours) will be submitted for accreditation in 2007.

Status

Advanced standing or status towards undergraduate degree programs of the Faculty may be granted for studies completed elsewhere. Requests for status are assessed individually.

Undergraduate programs offered

Program	Usual program duration (yrs)
Bachelor of Computer Science (Honours)	4
Bachelor of Engineering	4
Bachelor of Software Engineering	4
Bachelor of Information Technology	3
Bachelor of Engineering/Bachelor of Science	5
Bachelor of Engineering/Bachelor of Information Technology	5
Bachelor of Engineering/Bachelor of Arts	5
Bachelor of Asian Studies/Bachelor of Engineering	5
Bachelor of Commerce/Bachelor of Engineering	5
Bachelor of Engineering/Bachelor of Economics	5
Bachelor of Arts/ Bachelor of Information Technology	4
Bachelor of Commerce/Bachelor of Information Technology	4
Bachelor of Economics/Bachelor of Information Technology	4
Bachelor of Information Technology/Bachelor of Science (Forestry)	5
Bachelor of Information Technology/Bachelor of Laws	5
Bachelor of Software Engineering/Bachelor of Science	5
Bachelor of Software Engineering/Bachelor of Commerce	5

Engineering

Professor Michael Cardew-Hall BSc (Hons) Nottm.,
PhD Imperial College
Head of Department

Engineering is the art of transforming the resources of nature for the benefit of humanity. Its roots are traceable to the tools, huts, pottery and materials of the first humans. Its progress has relied on ingenuity, invention, teamwork and the accumulation of experience — skills which remain essential to this day.

Engineers have a responsibility to help solve our environmental problems. The Department of Engineering is at the forefront of renewable energy research, with a particular interest in photovoltaic solar cells and semiconductor technology. The ANU 'Big Dish' is the largest of its kind in the world. The Department's Centre for Sustainable Energy Systems holds several world records for solar cell efficiency. It is also developing a unique thermochemical solar energy system. The Centre has strong links with industry and several technologies are being commercialised.

Engineering is vital to the economic well-being of nations. The Department's advanced manufacturing and production systems research integrates the disciplines of materials, manufacturing, robotics and control with modern computer simulation to understand, improve and optimise manufacturing processes. Many projects are industrially focused and major elements of the work are carried out at the collaborating company's site. This provides a healthy cross fertilisation between the Department and some of Australia's largest manufacturing companies. Related interests include discrete-event modelling and control and active vision systems.

Telecommunications is at the core of global information exchange. We can keep in touch with events happening on the other side of the world, or in the next street at the touch of a button. We have a multitude of ways of keeping in touch with family and friends, regardless of how far away they are. We can even send holiday snaps - as they're happening - from our phones! The Department's telecommunications activities involve both practical and theoretical components, focussing on mobile and wireless communications, ad hoc networks, CDMA, MIMO and smart antennas. Researchers in the Department are involved in projects focusing on the application of wireless channel characteristics to ad hoc networking protocols, mobility modelling in ad hoc networks and wireless channel modelling. Researchers are also involved in a major project, BushLAN, whose purpose is to bring high-speed internet access to remote areas using VHF frequencies.

The major strength of the Department in the field of materials is in reinforced composite materials (carbon, glass, Kevlar and natural fibres, as well as metal/fibre laminates), and in special areas of advanced materials, such as electrospinning of nanofibres (in collaboration with the National University of Singapore), piezoelectric materials, bulk amorphous metals and theory of materials.

The volatile environment faced by organisations today presents managers with continual challenges. Yet few managers understand the nature and impact of variation within complex systems. The Department carries out research aimed at enhancing the capacity of organisations to understand and improve their processes in order to achieve organisational goals under variable conditions.

Mechatronic engineering is associated with the analysis and design of electro-mechanical devices that typically include a computer system to provide a level of programmability or `intelligence'. The systems based focus of the Department of Engineering faculty provides a strong foundation for a discipline that involves integration of skills in electronics, mechanical and computer engineering tied together by dynamical and control systems analysis.

The Department of Engineering offers a four-year, Engineers Australia accredited Bachelor of Engineering degree program (see the Faculty of Engineering and Information Technology entry), Masters of Engineering, including Industry-based Masters by research and PhD degree programs. The Department has active collaborations with a wide range of other ANU Departments and Research Schools including RSISE, RSPhysSE, RSES, RSC, RSBS, RSAA, Faculty of Science, as well as CSIRO, NICTA and DSTO. The Department has strategic collaborative research relationships with organisations including Ford Australia, Canon, Origin Energy, Rheem, Toll Logistics and Wizard Research. The Department participates in the Cooperative Research Centre Automotive Technologies. Graduates are employed in a wide range of organisations and companies both in Australia and overseas. Undergraduate scholarship support from ANU Innovation, DSD and Boeing Australia is gratefully acknowledged. The Department is host to the ANU Centre for the Science and Engineering of Materials and to Future Materials.

The Department of Engineering buildings are located on the corner of University Avenue and North Road, opposite the ANU Sports Union, with the ANU Union, Library and other facilities all readily accessible.

For further information visit the Department's website at http://engn.anu.edu.au

Bachelor of Engineering

(Academic Program: 4700 | Academic Plan: 4700XBENG)
Duration: 4 years full-time
Minimum: 192 units
CRICOS Code: 001691D

The ANU Bachelor of Engineering degree course is a four-year, Engineers Australia (IEAust) accredited undergraduate program that integrates selected areas of electrical and mechanical engineering with computer systems and engineering management to produce well-rounded and multi-skilled engineering professionals. The systems engineering approach at ANU is underscored by technological trends that cut across boundaries between traditional disciplines of engineering and computer science.

Aims of the BE degree program

The aim of the BE degree program is to prepare students for successful careers as professional engineering managers, designers, analysts, educators and researchers.

The ANU Bachelor of Engineering degrees builds on a foundation of basic science and engineering fundamentals, offers a unique systems approach built into professional development courses and the diverse range of engineering discipline courses available, and provide for the opportunity to

diversify and specialise through a suitable choice of engineering major. The following engineering majors are offered within the four-year BE degree program:

- telecommunication systems
- mechatronic systems
- manufacturing and management systems
- materials and mechanical systems
- sustainable energy systems
- electronic systems
- digital systems
- photonic systems
- environmental systems.

The program of study is the same for all students in the first year, with specialisation opportunities starting in year two through the selection of at least one of the major disciplines listed above, appropriate professional electives and project work.

It is the aim that the BE graduate: has a sound and broad knowledge of basic science and engineering; is able to communicate effectively with engineers and the general public; has the capacity to acquire in-depth discipline knowledge; is able to use common sense, scientific and engineering knowledge to identify, formulate and solve problems; is able to use a systems approach to engineering analysis, design, operation and management; is able to contribute to a multidisciplinary and multicultural team; is conscious of the social, cultural, global, environmental, legal and business aspects of engineering, including a commitment to the principles of sustainable development; has an understanding of the responsibilities of an inclusive and socially aware engineering professional, including a commitment to the Engineers Australia Code of Ethics, life-long learning and continuing professional development.

These attributes are engendered by: formal courses in basic science, engineering fundamentals, engineering management and law; discipline courses that introduce students to the cutting edge of selected areas of engineering; hands-on experience in the analysis, design and development of telecommunications, manufacturing, energy and management systems; final-year project work which is relevant to industry research, development, operations and management; emphasis in all units on the functions, goals and wider context of engineering; teaching and assessment processes which reflect the importance of written and oral communications, project and design work; small-group teaching that encourages collaborative learning and problem solving; group laboratory, analysis and design exercises; and a student seminar program.

Students may specialise through their choice of Engineering majors and electives and other University electives. Students are encouraged to create a diverse program of study from a variety of engineering disciplines to take full advantage of the unique educational opportunities offered by ANU Engineering.

The Bachelor of Engineering Homepage: http://feit.anu.edu.au/UG_Engineering.php

Practical experience

Engineers Australia specifies that students are required to complete at least 60 days of engineering work experience during the course through approved professional employment taken in the vacation periods. For details, see entry for ENGN3100 Practical Experience.

Program requirements

The BE degree program requires the completion of at least 192 credit points of courses including:

1. 54 units of the following professional development courses:
   - ENGN1211 Discovering Engineering (6 unit)
   - ENGN2225 Systems Design (6 unit)
   - ENGN2226 Engineering Systems Analysis (6 unit)
   - ENGN3211 Investment Decisions and Financial Systems (6 unit)(or specified equivalent: BUSN1002 or Asian Studies equivalent or Arts equivalent.)
   - ENGN3221 Engineering Management (6 unit)
   - ENGN3100 Practical Experience (0 unit)
   - ENGN4200 Individual Project (12 unit)
   - ENGN4221 Systems Engineering Project (6 unit)
   - ENGN4611 Engineering Law (6 units) (or specified equivalent: BUSN1101 or Asian Studies equivalent or Arts equivalent.)

   Note that the courses defined as specific equivalents are only to be taken by students undertaking combined engineering programs with the ANU College of Business and Economics, Faculty of Arts or Faculty of Asian Studies. Specific equivalent courses in the Faculties of Arts and Asian Studies are listed in the relevant combined program entries.

2. 72 units of engineering discipline courses listed in Schedule 1, including ENGN1221 Electromechanical Technologies (6 unit), ENGN1215 Introduction to Materials (6 unit) and at least one engineering discipline major (42 unit).

   Schedule 1: Engineering Discipline Courses
   ENGN1215 Introduction to Materials
   ENGN1221 Electromechanical Technologies
   ENGN2211 Electronic Circuits
   ENGN2214 Mechanics of Materials
   ENGN2221 System Dynamics
   ENGN2222 Thermal Energy Systems
   ENGN2224 Semiconductors
   ENGN2228 Signal Processing
   ENGN3212 Manufacturing Technologies
   ENGN3213 Digital Systems and Microprocessors
   ENGN3215 Communications Technologies
   ENGN3222 Manufacturing Systems
   ENGN3223 Control Systems
   ENGN3224 Energy Systems Engineering
   ENGN3226 Digital Communications
   ENGN3227 Analogue Electronics
   ENGN4507 Microelectronic and Photonic Technology
   ENGN4511 Composite Materials
   ENGN4513 Fibre Optics Communications Systems
   ENGN4516 Energy Resources and Renewable Technologies
   ENGN4520 Special Topics in Engineering 1
   ENGN4521 Special Topics in Engineering 2
   ENGN4522 Special Topics in Engineering 3
   ENGN4523 Special Topics in Engineering 4
   ENGN4524 Solar Energy Technology
   ENGN4528 Computer Vision
   ENGN4532 Logistics and Operational Systems
   ENGN4533 Biomedical Engineering
   ENGN4535 Telecommunication Networks
   ENGN4536 Wireless Communications
   ENGN4544 Managing for Competitive Advantage
   ENGN4545 Radiofrequency Engineering
   ENGN4601 Engineering Materials

ENGN4612 Digital Signal Processing and Control
ENGN4615 Finite Element Analysis
ENGN4625 Power Electronics
ENGN4627 Robotics

3. 12 units mathematics, being
   - MATH1013 Mathematics and Applications 1 (or MATH1115) (6 unit)
   - MATH1014 Mathematics and Applications 2 (or MATH1116) (6 unit)
4. 12 units computing, being
   - COMP1100 Introduction to Programming and Algorithms (6 unit)
   - COMP1110 Introduction to Software Systems (6 unit) or, alternatively, COMP1120 From Programming to Software Engineering (6 unit) plus an additional 6 units of computing courses (COMPxxxx).
5. 6 units physics, being
   - PHYS1101 Advanced Physics I (6 unit)
6. 36 units of courses offered by the University. The degree program may not include more than 60 units of 1000-series courses.

Engineering Majors

The faculty offers six engineering majors that may be selected in terms of fulfilling item 2 of the BE program requirements. Refer to Majors tab. Students should note that all completed majors will be listed on their academic transcript.

Electronic Systems Major requirements

Electronic Systems		
ENGN1221	Electromechanical Technologies	6 unit
ENGN2211	Electronic Circuits	6 unit
ENGN2224	Semiconductors	6 unit
ENGN3213	Digital Systems and Microprocessors	6 unit
ENGN3227	Analogue Electronics	6 unit
ENGN4507	Microelectronic and Photonic Technology	6 unit
ENGN4625	Power Electronics	6 unit
TOTAL		42 units

Manufacturing and Management Systems Major requirements

Manufacturing and Management Systems		
ENGN1215	Introduction to Materials	6 unit
ENGN2214	Mechanics of Materials	6 unit
ENGN2221	System Dynamics	6 unit
ENGN3212	Manufacturing Technologies	6 unit
ENGN3222	Manufacturing Systems	6 unit
ENGN4627 OR ENGN4532	Robotics OR Logistics and Operational Systems	6 unit
ENGN4601 OR ENGN4544	Engineering Materials OR Managing for Competitive Advantage	6 unit
TOTAL		42 units

Materials and Mechanical Systems Major requirements

Materials and Mechanical Systems		
ENGN1215	Introduction to Materials	6 unit
ENGN2214	Mechanics of Materials	6 unit
ENGN2221	System Dynamics	6 unit
ENGN2222	Thermal Energy Systems	6 unit
ENGN3224	Energy Systems Engineering	6 unit
ENGN4601	Engineering Materials	6 unit
ENGN4511 OR ENGN4615	Composite Materials OR Finite Element Analysis	6 unit
TOTAL		42 units

Mechatronic Systems Major requirements

Mechatronic Systems		
ENGN1221	Electromechanical Technologies	6 unit
ENGN2211	Electronic Circuits	6 unit
ENGN2221	System Dynamics	6 unit
ENGN3213	Digital Systems and Microprocessors	6 unit
ENGN3223	Control Systems	6 unit
ENGN4528	Computer Vision	6 unit
ENGN4627	Robotics	6 unit
TOTAL		42 units

Sustainable Energy Systems Major requirements

Sustainable Energy Systems		
ENGN1221	Electromechanical Technologies	6 unit
ENGN2211	Electronic Circuits	6 unit
ENGN2222	Thermal Energy Systems	6 unit
ENGN2224	Semiconductors	6 unit
ENGN3224	Energy Systems Engineering	6 unit
ENGN4516	Energy Resources and Renewable Technologies	6 unit
ENGN4524	Solar Energy Technology	6 unit
TOTAL		42 units

Telecommunication Systems Major requirements

Telecommunication Systems		
ENGN1221	Electromechanical Technologies	6 unit
ENGN2211	Electronic Circuits	6 unit
ENGN2228	Signal Processing	6 unit
ENGN3215	Communication Technologies	6 unit
ENGN3226	Digital Communications	6 unit
ENGN4545	Radiofrequency Engineering	6 unit
ENGN4536	Wireless Communications	6 unit
TOTAL		42 units

Science and other Engineering Majors

The 36 units of courses under item 6 of the BE program requirements may be used by students to further their interests in other subject areas. The Faculty of Engineering and Information Technology has developed majors in photonic systems, environmental systems and digital systems by incorporating non-engineering majors offered by the Faculty of Science and Department of Computer Science in fulfilment of the requirements under Items 5 and 6 of the BE program requirements. These are the Photonic Systems major, Environmental Systems major and Digital Systems major. Note that these majors cannot be counted towards Item 2 of the BE program requirements.

Digital Systems Major requirements

Digital Systems		
COMP1110	Introduction to Software Systems	6 unit
COMP2100	Software Construction	6 unit
COMP2300	Introduction to Computer Systems	6 unit
COMP2310	Concurrent and Distributed Systems	6 unit
COMP3300	Operating Systems Implementation	6 unit
COMP3310	Computer Networks	6 unit
COMP4330	Real Time and Embedded Systems	6 unit
TOTAL		42 units

Environmental Systems Major requirements

Administration: School of Resources, Environment and Society

Environmental Systems		
PHYS1101	Advanced Physics I	6 unit
	six courses in an appropriate field of study as recommended by the School of Resources, Environment and Society	36 unit
TOTAL		42 units

Further information

Note: for details on the different course patterns that may be followed to satisfy the requirements of the Environmental Systems major contact the Faculty of Engineering and IT.

Photonic Systems Major requirements

Administration: Department of Physics

Note: Engineering students who wish to undertake PHYS3060 in fulfilment of part 2 of the BE program requirements are advised to enrol in ENGN4513.

Photonic Systems		
PHYS1101 AND PHYS1201	Advanced Physics I AND Advanced Physics II	6 unit 6 unit
PHYS2013	Quantum Physics	6 unit
PHYS2017	Lasers and Photonics Fundamentals	6 unit
PHYS2016	Electromagnetism and Continuum Mechanics	6 unit
PHYS3057	Laser Physics and Electro-Optics	6 unit
PHYS3060 OR ENGN4513	Fibre Optic Communication Systems	6 unit
TOTAL		42 units

Alternation of ENGN4000 series courses

Each ENGN4000 series elective course will be offered in an ODD year or an EVEN year. All ENGN1000, 2000 and 3000 series courses and ENGN4000 series compulsory courses will be offered EVERY year. This leads to two possible alternation patterns (1 and 2):

	1	2
Year 1	EVERY	EVERY
Year 2	EVERY	EVERY
Year 3	ODD	EVEN
Year 4	EVEN	ODD

Students will need to bear this in mind when enrolling each year, particularly in years three and four. It is recommended that students finalise their elective choices and planned enrolment patterns for years three and four at the end of year two at the latest.

The Bachelor of Engineering degree with honours

Honours grades in the BE degree are awarded by the Faculty on the basis of a recommendation from the Head of Engineering and may be awarded with first class honours; second class honours, division A; or second class honours, division B.
The awarding of honours in engineering is based on meritorious performance over the entire four-year program. The assessment of meritorious performance includes the calculation of an average percentage mark (APM), together with the consideration of the overall academic progress of the student and the Individual Project result. To determine the global APM, the first year average mark is weighted by a factor 0.1, and the combined average of years two, three and four by a factor 0.9. The first year average mark is the average of the marks awarded in the following courses: ENGN1211 Discovering Engineering, ENGN1221 Electromechanical Technologies, ENGN1215 Introduction to Materials, MATH1013 Mathematics and Applications 1 (or MATH1115), MATH1014 Mathematics and Applications 2 (or MATH1116), PHYS1101 Advanced Physics I, COMP1100 Introduction to Programming and Algorithms and COMP1110 Introduction to Software Systems.

The average mark for the remainder years is the average mark awarded in all the additional engineering courses (that is, having an ENGNxxxx code number) completed by the student, excluding ENGN4200 Individual Project, which is considered separately.

ENGN4100 Engineering Honours

In order to be considered for the award of a degree offered by the Department of Engineering, students must formally enrol in ENGN4100 - Engineering Honours, at the commencement of their intended final semester.

Degree structure

Standard Bachelor of Engineering recommended program pattern

	Semester 1	Semester 2
Year 1 48 units	ENGN1211 Discovering Engineering MATH1013 Mathematics and Applications 1 PHYS1101 Advanced Physics I COMP1100 Introduction to Programming and Algorithms OR University Elective	ENGN1215 Introduction to Materials ENGN1221 Electromechanical Technologies MATH1014 Mathematics and Applications 2 COMP1110 Introduction to Software Systems OR University Elective
Year 2 48 units	ENGN2226 Engineering Systems Analysis Engineering elective MATH2305 Calculus and Differential Equations OR University elective University elective OR COMP1100 Introduction to Programming and Algorithms	ENGN2225 System Design Engineering major Engineering elective University elective OR COMP1110 Introduction to Software Systems
Year 3 ODD 48 unit	ENGN3211 Investment Decisions and Financial Systems (or equivalent) Engineering major Engineering elective University elective	ENGN3221 Engineering Management Engineering major Engineering elective University elective
Year 3 EVEN 48 unit	ENGN3211 Investment Decisions and Financial Systems (or equivalent) Engineering major Engineering elective University elective	ENGN3221 Engineering Management Engineering major Engineering elective University elective
Year 4 ODD 48 unit	ENGN4200 Individual Project (Part A) ENGN4221 Systems Engineering Project Engineering major Engineering elective	ENGN4200 Individual Project (Part B) ENGN4611 Engineering Law (or equivalent) Engineering major University elective
Year 4 EVEN 48 unit	ENGN4200 Individual Project (Part A) ENGN4221 Systems Engineering Project Engineering major Engineering elective	ENGN4200 Individual Project (Part B) ENGN4611 Engineering Law (or equivalent) Engineering major University elective

The above pattern is indicative only and may be tailored to suit individual needs. The choice of electives in a particular year will depend on the major chosen and on the alternation. These should be decided before commencing year 3.
All courses are 6 units in size.

Combined degrees

All BE combined degrees are 5 EFTSL, 5 year programs comprising 240 units:

Bachelor of Engineering may be combined with a
Bachelor of Science
Bachelor of Information Technology
Bachelor of Commerce
Bachelor of Economics
Bachelor of Asian Studies
Bachelor of Arts

Again, students are reminded that any completed majors will be listed on their academic transcript.

Associate Degree in Engineering

(Academic Program: 2700 | Academic Plan: 2700XADENG)
Duration: 2 years full-time
Minimum: 96 units
CRICOS Code: 056477M

The Canberra Institute of Technology and The Australian National University are offering a joint Associate Degree specialising in Engineering. The Associate Degree will provide students with a strong practical base as well as the theoretical foundation required for studying engineering at university level. Two fields of engineering will be offered; mechanical and electronic.

The two year program will see students study university-type subjects while at CIT and provide graduates with the potential to progress to a Bachelor of Engineering degree at ANU. Successful completion of the Associate Degree, with at least a credit average across all courses at CIT and at least passes in ANU courses, will ordinarily guarantee students direct admission to ANU Bachelor of Engineering programs with 18 months credit.

For more information go to the CIT Web Site:
www.cit.act.edu.au/study/choose/programs/sciencetech/electrotech/engineering_anu_associate_degree

Computer Science

Dr Christopher Johnson, BSc Monash, PhD ANU,
Associate Professor and Head of Department

How do people understand and use computers, computer networks, and the information they help us to manage? The subject matter of the computing discipline has many names, including software engineering, computer science, informatics, information systems, information technology, and computer programming. The discipline is only young, and the nature of the subject has been debated many times since the first electronic computers and the foundation of the first professional association in 1947. The nature of the discipline has changed in that time from a focus on computer hardware in a very small number of uniquely designed computers, and the highly specialised mathematical algorithms that were programmed into them, to the graphically interfaced, largely non-numerical, general purpose commodity computing of today. The focus of the IT industry has shifted from details of interaction with computers to the breadth of interaction with people, and so has the computing discipline broadened to include the ways in which its professional graduates apply computing to the information needs and creative expression of people and organisations.

Information Technology is the common global term which covers all aspects of computing, data storage, and communications - the generality of equipment, systems and services that involve the use of computers, advanced telecommunications, and digital electronics. The IT industry is now reckoned to be the world's largest. Although our Department's name continues to refer to "Computer Science," it is a centre for the study of wider aspects of IT: software engineering, which is the profession of designing and constructing complex groups of programs; information systems, which involves the ways in which computer systems are meshed with organisations; human centred computing, applying technology to human needs of creative expression and understanding how humans perceive and interact with technology; computational science, which is the application of computing in scientific research; computer systems, the creative engineering and science of making advances in the supporting technologies; and computer science, the systematic study of the fundamental algorithms and processes behind the technology. The department provides professional, technical, and service courses in these areas and introductory information technology for students in many areas of the university.

Department aims and objectives - programs offered

The Department aims to produce graduates with technical, professional and fundamental scientific education via a number of programs, in the Bachelor of Information Technology, the Bachelor of Software Engineering, the Bachelor of Computer Science (Honours), the Bachelor of Science majoring in Computer Science, and the Bachelor of Philosophy. The Department also aims to produce graduates with advanced Information Technology literacy skills via the IT in New Media Arts major in the new Bachelor of Arts (New Media Arts) program.

The Bachelor of Computer Science (Honours) is a four-year, flexible research-focused program for intellectually ambitious students in the fundamental theoretical and experimental science behind modern computing and future technologies, offered in the Faculty of Engineering and IT. Theoretical computer science includes a mathematical understanding of algorithms and models of processes. Experimental computer science is a disciplined approach to discovering and improving new concepts. Together we expect them to create new understanding and transform the potential of our present day unreliable and unpredictable computer systems and networks, to produce better, more intelligent, more helpful, less intrusive computer systems. Although the Internet and World Wide Web have grown into world-spanning, almost seamless networks of computer communications in only the last 15 years, we have almost no scientific or engineering understanding of what are their limits and failure modes, and how such networks can be improved. One of the grand challenges of computer science is to create a theory of network distributed computing, and it is likely to be as revolutionary as was the introduction of the web. Alternatively, consider doing the Bachelor of Philosophy (Honours), which is an innovative research focused program offered through the Faculty of Science. The program is extremely flexible in its structure and allows students to specialise in many areas of science, including computer science. For more details, look at the Faculty of Science entry for the program.

The Department aims to produce graduates with a professional education in Software Engineering and offers a four year professional Software Engineering program. This includes technical, professional, communications skills, and individual and group project work on a sound basis of mathematics and computer science. A pass degree or a degree with honours can be awarded after four years of study. The program is accredited with Engineers Australia and the Australian Computer Society.

The Department also offers a three-year technical and professional program, the Bachelor of Information Technology, in combination with the Faculty of Economics and Commerce. The BinfTech is accredited with the Australian Computer Society. BInfTech students can choose to specialise in software

development, information systems, new media or computer systems. The BInfTech program can also be combined with programs in Commerce or with Economics for a four year combined program that aims to provide a professional, business-oriented education. It can be combined with the Bachelor of Engineering program for five years of study that includes more computing within a full multidisciplinary Engineering program. It is also possible to combine the BInfTech program with the Bachelor of Science (Forestry), the Bachelor of Arts, or with the Bachelor of Laws programs.

The Department aims to produce graduates with a fundamental scientific education via the Bachelor of Science majoring in Computer Science. Many of the same computer science and software development courses can be taken within the more generalist Bachelor of Science program. Students can thereby combine study of a Science subject with as much computing as they wish or take combined Science programs such as Science and Law. The specialised Bachelor of Computational Science (Honours) program (described under the Faculty of Science entry) combines the study of computing, mathematics, and their application to modelling in the physical sciences.

The Department aims to produce graduates with a strong IT literacy base in the understanding and use of modern IT tools especially as applied to new media. This is via the major in IT in New Media Arts that the Department provides for the Bachelor of Arts (New Media Arts) program. This major can be taken as part of the program, or with a double major, or as a major in other programs, including the BInfTech.

A fourth year of honours study can be added to the BSc and the BInfTech.

Computational Science is a focused area that applies existing computer science in the other sciences. The Bachelor of Computational Science degree program consists of a basic core of mathematics and computation linked with a specialist area of science. The core courses provide the practical mathematical and computing training for the formulation, analysis, modelling and simulation of problems in science, engineering, commerce and industry. Typical areas of specialisation are physics, chemistry, biology, geology, geography, environmental sciences, applied mathematics, astrophysics and computer science. In this way the general mathematical and computing skills obtained from the core courses can be applied in a sophisticated manner in a specialisation area.

The Department of Computer Science offers single and combined degree programs that include a lot of choice of mixtures of computer science, creative and applied information technology, software engineering, and computational science, under the Faculty of Engineering and IT and the Faculty of Science.

In all of these programs, the Department aims to produce first class honours graduates who can enter postgraduate studies at leading international computer science laboratories.

The Department offers three coursework Masters programs, namely, the Master of Information Technology Studies, the Master of Computing and the professional Master of Software Engineering.

The Department has an active research program and educates Master of Philosophy and PhD students by research.

Introductory courses

The Department offers several courses that can be taken by students with no previous background in computing or information technology. COMP1710 and COMP2720 are courses that introduce students to the development and generalized use of IT tools in new media. COMP1710 studies tools used for new media and the web, while COMP2720 deals with script-level programming in the context of new media. COMP1710 is also an information technology service course offered to students in other faculties, which provides a university-level introduction to applied computing for students in any area who wish to use computers in their studies or their careers but do not necessarily need to study computer programming. COMP1200 provides a broad perspective on the field of computing for those with a deeper interest in the underlying science and technology, and it is a required part of the Information Technology programs.

COMP1100 provides an introduction to computer programming, both as a service course and as a foundation for all further studies in information technology. It assumes a prior knowledge of secondary college advanced mathematics, but does not require any previous computing experience. COMP1110 provides further study of programming and software engineering, with a focus on the construction of larger programs. It leads to further software development and software engineering studies.

COMP2400 can also be taken in first year, following COMP1100. It provides an introduction to the use of databases and to their underlying technology. This course can be used as part of a major in Commerce as well as contributing to Information Technology and Software Engineering programs.

Further information

Further information on the courses offered and the structures of the courses is available from the Department's website at http://cs.anu.edu.au

Bachelor of Computer Science (Honours)

(Academic Program: 4710 | Academic Plan: 4710HBCSCI)
Duration: 4 years full-time
Minimum: 192 units
CRICOS Code: 054425F

The Bachelor of Computer Science (Honours) is a four year, flexible, research-focused professional program for exceptional students who would like to pursue postgraduate research in computer science or research-oriented computing careers in commerce and industry. The program is built on strong foundations in computer science and mathematics. It provides ample scope for the student to pursue research in individual areas of interest, working with researchers of great international distinction in the areas of computer science, engineering and mathematics. It is anticipated that the program will have professional accreditation with the Australian Computer Society.

Students are required to maintain a superior distinction average each year to remain in the program. Students who do not meet the performance requirements can transfer to the

Bachelor of Science, the Bachelor of Information Technology or the Bachelor of Software Engineering, with transfer credit determined on a case by case basis. Exceptional students from other programs will be considered for transfer into the BCS on a case by case basis.

Program requirements

The program requires the completion of 192 units including:

(a) completion of 126 units of prescribed courses as follows:
COMP1130 Data Structures and Algorithms I
COMP1140 Data Structures and Algorithms II
COMP2300 Introduction to Computer Systems
COMP2310 Concurrent and Distributed Systems
COMP2600 Formal Methods in Software Engineering
COMP3006 Computer Science Research Project
COMP3130 Computer Science Group Project
COMP3600 Algorithms
COMP3610 Principles of Programming Languages
COMP3630 Theory of Computation
COMP4006 Computer Science Honours
MATH1115 Mathematics and Applications 1 Honours
MATH1116 Mathematics and Applications 2 Honours
MATH2303 Algebraic Systems and Coding Theory or
MATH2322 Algebra 1 Honours

(b) completion of a further 6 units of 2000/3000/4000-series Maths courses

(c) completion of a further 18 units of CS courses from Schedule 1, with no more than 6 units being at the 2000-series level. This must include at least 6 units of courses from each of the areas listed under Schedule 1

(d) completion of a further 6 units of 3000/4000-series CS courses

(e) completion of a further 36 units of courses, including no more than 12 units of 1000-series courses, from anywhere in the University.

CS courses are:

- COMP courses
- Computer Science relevant courses from other areas of the University that are approved by the Program Convenor.

Schedule 1

Applications

COMP2110 Software Design
COMP2400 Relational Databases
COMP3320 High Performance Scientific Computation
COMP3410 IT in E-Commerce
COMP3420 Advanced Databases and Data Mining
COMP3620 Artificial Intelligence
COMP3720 Advanced Studies in Computer Science (Applications)
COMP4220 Frontiers of Human Computer Interaction
COMP4610 Computer Graphics

Programming Languages and Systems

COMP3300 Operating Sytems Implementation
COMP3310 Computer Networks
COMP3640 Compiler Construction
COMP3730 Advanced Studies in Computer Science (Programming Languages and Systems)
COMP4300 Parallel Systems
COMP4320 Network Security
COMP4330 Real-time and Embedded Systems
ENGN3213 Digital Systems and Microprocessors

Theory

COMP3740 Advanced Studies in Computer Science (Theory)
COMP4600 Advanced Algorithms
COMP4630 Overview of Logic in Computing
MATH3343 Foundations of Mathematics Honours
MATH3401 Number Theory and Cryptography Honours

The Bachelor of Computer Science with Honours

The awarding of honours in computer science is based on meritorious performance in the honours year of the program, which consists of 50 per cent coursework and 50 per cent thesis.

Degree structure

BCS (Honours) possible enrolment pattern

	Semester 1	Semester 2
Year 1 (48 units)	COMP1130 Data Structures and Algorthims I (6u) COMP2300 Introduction to Computer Systems (6u) MATH1115 Mathematics and Applications 1 Honours (6u) University Elective (6u)	COMP1140 Data Structures and Algorthims II (6u) COMP2600 Formal Methods in Software Engineering (6u) MATH11116 Mathematics and Applications 2 Honours (6u) University elective (6u)
Year 2 (48 units)	COMP3630 Theory of Computation (6u) MATH2303 Algebraic Systems and Coding Theory or MATH2322 Algebra 1 Honours (6u) University Elective (6u) University Elective (6u)	COMP2310 Concurrent and Distributed Systems (6u) COMP3600 Algorithms (6u) COMP3610 Principles of Programming Languages (6u) 2000/3000/4000-series Maths (6u)
Year 3 (48 units)	COMP3130 Group Project (6u) 2 x Schedule 1 CS Elective (6u) University Elective (6u)	COMP3006 Research Project (6u) Schedule 1 CS Elective (6u) 3000/4000-series CS Elective (6u) University Elective (6u)
Year 4 (48 units)	COMP4006 Computer Science Honours	COMP4006 Computer Science Honours

Bachelor of Software Engineering

(Academic Program: 4708 | Academic Plan: 4708XBSENG)
Duration: 4 years full-time
Minimum: 192 units
CRICOS Code: 029273C

The Bachelor of Software Engineering (BSEng) is a four-year program accredited by Engineers Australia and the Australian Computer Society. The course emphasises the development of professional skills in the technical area of software engineering, that is, the systematic application of analysis, design, and construction techniques for computer systems and applications.

The computing industry has grown very rapidly in the last 40 years, despite a widely acknowledged, continual state of crisis in our abilities to manage reliably the process of developing software. The need for a mixture of technical computing knowledge with the skills of the computer programmer, and the disciplined organisation and judgement of the professional engineer, has been seen as desirable for many years. The introduction of the Bachelor of Software Engineering program in 1999 meets this need.

The BSEng graduate will acquire technical knowledge of the fundamentals of computer systems, programming languages, and the mathematical foundations of algorithms and data structures that are required to establish reliability and safety in software. Technical knowledge is honed by a selection of advanced technical topics. The principles and practices of the design and implementation of software are built up in a sequence of courses combining theoretical study and practical laboratory exercises, individual projects, and group projects. Of no less importance is an introduction to the professional skills of a competent engineer: management, communication with others and teamwork in particular, and ethical and other responsibilities. Graduates will also build their own skills of individual software development in university studies and in practical work experience which is required during the course, and will learn a systems approach developed and exemplified in individual and group project work.

Mathematics is an essential component of the program for developing the ability for abstraction that is the core of the computing discipline, and to allow rigorous formal description of aspects of the software engineering process. Discrete mathematics also has significant applications in the modelling and rigorous description of software properties, computing processes and programming languages.

The best computing professionals are informed by knowledge of a wider field than computing alone. The course includes the choice of a major line of study in another discipline in the university which can broaden the understanding of the social and cultural responsibilities of the software engineer, and strengthen the ability to communicate with others, or may be used to specialise in further fundamental sciences, or in specialised engineering streams. Both develop the capacity for lifelong learning by exposure to a broader range of ways of studying at university level.

The Bachelor of Software Engineering Homepage: http://feit.anu.edu.au/UG_SoftwareEngineering.php

Program requirements

The BSEng degree requires completion of 192 units including

(a) completion of 129 units of prescribed courses as follows:
- (COMP1100 Introduction to Programming and Algorithms, AND
  COMP1510 Introduction to Software Engineering) OR
  (COMP1120 From Programming to Software Engineering, AND
  6 units of unspecified 2000/3000-series COMP courses)
- COMP2300 Introduction to Computer Systems
- COMP2310 Concurrent and Distributed Systems
- COMP2400 Relational Databases
- COMP2500 Software Construction for Software Engineers
- COMP2510 Software Design for Software Engineers
- COMP2600 Formal Methods in Software Engineering
- COMP3110 Software Analysis and Design
- COMP3120 Managing Software Development
- COMP3500 Software Engineering Project
- COMP3600 Algorithms
- COMP4100 Software Quality Management
- COMP4110 Software Process
- COMP4211 Engineering Law

Degree structure

BSEng (4708) possible enrolment pattern

	Semester 1	Semester 2
Year 1 (48 units)	COMP1100 Introduction to Programming and Algorithms (6u) ENGN1211 Discovering Engineering (6u) MATH1013 Mathematics and Applications 1 (6u) Science/Engineering Elective (6u)	COMP1510 Introduction to Software Engineering (6u) COMP2400 Relational Databases (6u) MATH1014 Mathematics and Applications 2 (6u) Science/Engineering elective (6u)
Year 2 (48 units)	COMP2300 Introduction to Computer Systems (6u) COMP2500 Software Construction for Software Engineers (6u) ENGN3211 Investment Decisions and Financial Systems (6u) Elective (6u)[1]	COMP2310 Concurrent and Distributed Systems (6u) COMP2510 Software Design for Software Engineers (6u) COMP2600 Formal Methods in Software Engineering (6u) Elective (6u)[1]
Year 3 (48 units)	COMP3110 Software Analysis and Design (6u) COMP3500 Software Engineering Project (6u) 3000/4000-series COMP (6u)[2] Elective (6u)[1]	COMP3120 Managing Software Development (6u) COMP3500 Software Engineering Project (6u) COMP3600 Algorithms (6u) Elective (6u)[1]
Year 4 (48 units)	COMP4100 Software Quality Management (6u) COMP4211 Engineering Law (3u) COMP4500 Software Engineering Practice (6u) 3000/4000-series COMP (3u)[2] Elective (6u)[1]	COMP4110 Software Process(6u) COMP4500 Software Engineering Practice (6u) COMP4800 Industrial Experience 3000/4000-series COMP (6u)[2] Elective (6u)[1]

[1] May include no more than 12 units of 1000-series courses.

[2] Some 3000/4000-series COMP electives may have specific prerequisites that are not covered by the courses specified in the table.

- COMP4500 Software Engineering Practice OR COMP4540 Software Engineering Research Project
- COMP4800 Industrial Experience
- ENGN1211 Discovering Engineering
- ENGN3211 Investment Decisions and Financial Systems
- MATH1013 Mathematics and Applications 1 OR MATH1115 Mathematics and Applications 1 Honours
- MATH1014 Mathematics and Applications 2 OR MATH1116 Mathematics and Applications 2 Honours

(b) completion of a further 15 units of 3000/4000-series COMP courses, other than those prescribed in (a);

(c) completion of a further 12 units of Engineering or Science courses, excluding COMP courses;

(d) completion of a further 36 units of courses, including no more than 12 units of 1000-series courses, from anywhere in the university, including courses offered by the Department of Computer Science;

(e) no more than 60 units of 1000-series courses.

Industrial experience

Engineers Australia specifies that students are required to complete at least 60 days of engineering work experience during the course through approved professional employment taken in the vacation periods. For details, see entry for COMP4800 Industrial Experience.

BSEng engineering elective options

The Bachelor of Software Engineering (BSEng) program provides for students to choose: (a) 12 units Science or Engineering; (b) 36 units of courses (which must include at least 12 units at 1000-series level). The following suggestions are highlighted for BSEng students who want to consider engineering-related areas:

Telecommunications

PHYS1101, ENGN1221, ENGN2211, ENGN2228, ENGN3215, ENGN3226, ENGN4536, ENGN4545

Mechatronic Systems

PHYS1101, ENGN1221, ENGN2211, ENGN2221, ENGN3213, ENGN3223, ENGN4528, ENGN4627

Manufacturing and Management Systems

PHYS1101, ENGN1221, ENGN2214, ENGN2221, ENGN3212, ENGN3222, ENGN4532 or ENGN4627, ENGN4544 or ENGN4601

Electronics Systems

PHYS1101, ENGN1221, ENGN2211, ENGN2224, ENGN3213, ENGN3227, ENGN4507, ENGN4625

BSEng students who are pursuing elective interests outside the Faculty of Engineering and Information Technology are advised to consult the relevant section of the ANU Undergraduate Handbook and the relevant Sub-Dean or Departmental course adviser.

Combined degrees

The Bachelor of Software Engineering may be combined with a Bachelor of Science or a Bachelor of Commerce.

The degree with honours

The awarding of honours in software engineering is based on meritorious performance in the third and fourth year components of the program. The assessment of meritorious performance is based on the marks and grades obtained for all 3000-level and 4000-level courses that the student has undertaken. Students who qualify may be awarded a grade of first class honours; or second class honours, division A.

Bachelor of Information Technology

(Academic Program: 3701 | Academic Plan: 3701XBINFT)
Duration: 3 years full-time
Minimum: 144 units
CRICOS Code: 029996A

The Bachelor of Information Technology (BInfTech) is a three-year program that prepares graduates to enter the computing industry work force as novice practitioners to develop software or to apply computing in human organisations. The graduate attains the technical knowledge of fundamentals of computer systems, programming languages, computer applications, and information systems. The computing industry has always been subject to very rapid change, and so we also aim to prepare graduates to meet the changes in practice and in technology that will be met during their working careers. The graduate can enter the fields of software development and support, information systems development and support, or many other broad areas of choice in computing or general industry.

The BInfTech program allows students to approach information technology from either a technical, constructive angle, starting with courses in programming, or from a conceptual, critical or information and organisational management angle. It widens the approach to computing to include the creative and conceptual touch, starting by applying scripting to the application area of new media (video and audio), rather than from learning traditional general purpose programming languages applied to algorithms. The technically oriented student can major in Computer Systems or Software Development; whereas the more conceptually oriented student can major in Information Systems or IT in New Media Arts.

The Computer Systems major focuses on developing a sound knowledge in the area of computer systems, including distributed systems, networks and digital systems; the Software Development major aims to develop the conceptual and practical skills for software development and the technology of computer systems; the Information Systems major focuses on developing an understanding of organisations, the management of computer systems applications in them, and the accompanying systems analysis and design; and the IT in New Media Arts major focuses on the understanding and use of modern IT tools especially as applied to new media.

All of the majors are founded on an introduction to the principles of programming, a broad perspective on the computing discipline and profession, and an introduction to the functional structure of computers. They also require a grounding in mathematics and theoretical computer science, which is a means of developing the ability to work with abstractions, a fundamental requirement for understanding and applying ideas in computing.

The Bachelor of Information Technology Homepage: http://feit.anu.edu.au/UG_InformationTechnology.php

Program requirements

The program requires the completion of 144 units of courses offered, or approved by, the Faculty of Engineering and Information Technology, including:

(a) completion of 90 units of IT courses, of which at least 36 units must be 3000/4000-series courses, and 6 units of maths courses. This must include:
- all the courses from the core and a major from Schedule 1 or
- all the courses from the core and a major from Schedule 2

(b) completion of a further 6 units of IT courses or a 6 unit elective chosen from Schedule 3

(c) completion of a further 42 units of courses from anywhere in the university, including courses offered by the Department of Computer Science, of which no more than 18 units may be 1000-series courses

(d) no more than 48 units of 1000 series courses.

IT courses are:

COMP courses
INFS courses that are specified in the major
NEWM courses that are specified in the major
ENGN1211 Discovering Engineering
ENGN2225 System Design
ENGN3213 Digital Systems and Microprocessors
ENGN3215 Communications Technologies
ENGN3226 Digital Communications
ENGN4528 Computer Vision
ENGN4612 Digital Signal Processing and Control
MATH3511 Scientific Computing

Schedule 1

Core

- COMP1200 Perspectives on Computing or ENGN1211 Discovering Engineering
- COMP1710 Tools for New Media and the Web or COMP1100 Introduction to Programming and Algorithms
- COMP2400 Relational Databases
- COMP2410 Networked Information Systems
- COMP3120 Managing Software Development
- MATH1005 Mathematical Modelling 2 or MATH1014 Mathematics and Applications 2 or MATH1116 Mathematics and Applications 2 Honours

Majors:

IT in New Media Arts

As specified in the requirements for the Bachelor of Arts (New Media Arts) program in the Faculty of Arts entry.

Information Systems

- COMP1110 Introduction to Software Systems or COMP2750 Java Programming for New Media
- COMP2600 Formal Methods in Software Engineering
- COMP3110 Software Analysis and Design
- COMP3410 IT in eCommerce or COMP3420 Database Systems
- INFS2024 Information Systems Analysis
- INFS3024 Information Systems Management
- COMP3760 Project Work in Information Systems or INFS3059 Project Management and Information Systems

Schedule 2

Core

- (COMP1100 Introduction to Programming and Algorithms AND
  COMP1110 Introduction to Software Systems) OR
  (COMP1120 From Programming to Software Engineering AND
  6 units of unspecified 2000/3000-series COMP courses)
- COMP1200 Perspectives on Computing or ENGN1211 Discovering Engineering
- COMP2100 Software Construction
- COMP2400 Relational Databases
- COMP2600 Formal Methods in Software Engineering
- COMP3120 Managing Software Development
- MATH1005 Mathematical Modelling 2 or MATH1014 Mathematics and Applications 2 or MATH1116 Mathematics and Applications 2 Honours

Majors:

Computer Systems

- COMP2300 Introduction to Computer Systems
- COMP2310 Concurrent and Distributed Systems
- COMP3310 Computer Networks
- COMP3750 Project Work in Computer Systems

And at least three courses from the following:

- COMP3300 Operating Systems Implementation
- COMP3320 High Performance Sicientific Computation
- COMP4300 Parallel Systems
- COMP4330 Real-Time and Embedded Systems
- ENGN3213 Digital Systems and Microprocessors

Software Development

- COMP2110 Software Design
- COMP2300 Introduction to Computer Systems
- COMP2310 Concurrent and Distributed Systems
- COMP2410 Networked Information Systems or COMP3310 Computer Networks
- COMP3100 Software Engineering Group Project
- COMP3110 Software Analysis and Design

Schedule 3

- BUSN1001 Business Reporting and Analysis
- BUSN1101 Introduction to Commercial Law
- ECON1101 Microeconomics 1
- EMET1001 Foundations of Economic and Financial Models
- FINM1001 Money, Markets and Finance
- MATH1003 Mathematical Modelling 1
- MATH1013 Mathematics and Applications 1
- MATH1115 Mathematics and Applications 1 Honours
- MATH2301 Games, Graphs and Machines
- PSYC1003 Introduction to Psychology 1
- SCOM1001 Science and Public Awareness
- STAT1003 Statistical Techniques
- STAT1008 Quantitative Research Methods

Degree structure

BInfTech (3701:Computer Systems) possible enrolment pattern

	Semester 1	Semester 2
Year 1 (48 units)	COMP1100 Introduction to Programming and Algorithms (6u) COMP1200 Perspectives on Computing (6u) IT Elective or Schedule 3 elective (6u) Elective (6u)[1]	COMP1110 Introduction to Software Systems (6u) COMP2400 Relational Databases (6u) MATH1005 Mathematical Modelling 2 (6u) Elective (6u)[1]
Year 2 (48 units)	COMP2100 Software Construction (6u) COMP2300 Introduction to Computer Systems (6u) Elective (6u)[1] Elective (6u)[1]	COMP2310 Concurrent and Distributed Systems (6u) COMP2600 Formal Methods in Software Engineering (6u) 2000/3000/4000-series IT (6u) Elective (6u)[1]
Year 3 (48 units)	COMP3310 Computer Networks (6u) 3000/4000-series IT (12u)[2] Elective (6u)[1]	COMP3120 Managing Software Development (6u) COMP3750 Project Work in Computer Systems (6u) 3000-4000-series IT (6u)[2] Elective (6u)[1]

[1] May include no more than 18 units of 1000-series courses.

[2] Choose three courses from: COMP3300 Operating Systems Implementation, COMP3320 High Performance Scientific Computation, COMP4300 Parallel Systems, COMP4330 Real-Time and Embedded Systems and ENGN3213 Digital Systems and Microprocessors.

BInfTech (3701: IT in New Media Arts) possible enrolment pattern

	Semester 1	Semester 2
Year 1 (48 units)	COMP1200 Perspectives on Computing (6u) COMP1710 Tools for New Media and the Web (6u)[1] IT Elective or Schedule 3 elective (6u) Elective (6u)[2]	COMP2400 Relational Databases (6u) COMP2720 Automating Tools for New Media (6u) MATH1005 Mathematical Modelling 2 (6u) Elective (6u)[2]
Year 2 (48 units)	COMP2410 Networked Information Systems (6u) COMP2750 Java Programming for New Media (6u)[3] 2000/3000/4000-series IT (6u) Elective (6u)[2]	2000/3000/4000-series IT (6u) 2000/3000/4000-series IT (6u) Elective (6u)[2] Elective (6u)[2]
Year 3 (48 units)	3000/4000-series IT (18u)[4] Elective (6u)[2]	COMP3120 Managing Software Development (6u) COMP3900 Human Computer Interface Design and Evaluation (6u) COMP4610 Computer Graphics (6u) Elective (6u)[2]

[1] Can be replaced with COMP1100 Introduction to Programming and Algorithms.

[2] May include no more than 18 units of 1000-series courses.

[3] Can be replaced with COMP1110 Introduction to Software Systems.

[4] Some 3000/4000-series IT electives may have specific prerequisites that are not covered by the courses specified in the table.

BInfTech (3701: Information Systems) possible enrolment pattern

	Semester 1	Semester 2
Year 1 (48 units)	COMP1100 Introduction to Programming and Algorithms(6u)[1] COMP1200 Perspectives on Computing (6u) IT Elective or Schedule 3 elective (6u) Elective (6u)[2]	COMP1110 Introduction to Software Systems(6u)[3] or 2000/3000/4000-series IT (6u) COMP2400 Relational Databases (6u) MATH1005 Mathematical Modelling 2 (6u) Elective (6u)[2]
Year 2 (48 units)	COMP2410 Networked Information Systems (6u) COMP2750 Java Programming for New Media [3] or 2000/3000/4000-series IT (6u) INFS2024 Information Systems Analysis (6u) Elective (6u)[2]	COMP2600 Formal Methods in Software Engineering (6u) 2000/3000/4000-series IT (6u) Elective (6u)[2] Elective (6u)[2]
Year 3 (48 units)	COMP3110 Software Analysis and Design (6u) 3000/4000-series IT (6u)[4][5] INFS3024 Information Systems Management (6u) Elective (6u)[2]	COMP3120 Managing Software Development (6u) COMP3760 Project Work in Information Systems(6u) or INFS3059 Project Management and Information Systems 3000/4000-series IT (6u)[4][5] Elective (6u)[2]

[1] Can be replaced with COMP1710 Tools for New Media and the Web.

[2] May include no more than 18 units of 1000-series courses.

[3] Must include either COMP1110 Introduction to Software Systems or COMP2750 Java Programming for New Media, but not both.

[4] Must include one of COMP3410 IT in eCommerce or COMP3420 Database Systems.

[5] Some 3000/4000-series IT electives may have specific prerequisites that are not covered by the courses specified in the table.

BInfTech (3701: Software Development) possible enrolment pattern

	Semester 1	Semester 2
Year 1 (48 units)	COMP1100 Introduction to Programming and Algorithms (6u) COMP1200 Perspectives on Computing (6u) IT Elective or Schedule 3 elective (6u) Elective (6u)[1]	COMP1110 Introduction to Software Systems (6u)[3] COMP2400 Relational Databases (6u) MATH1005 Mathematical Modelling 2 (6u) Elective (6u)[1]
Year 2 (48 units)	COMP2100 Software Construction (6u) COMP2300 Introduction to Computer Systems (6u) Elective (6u)[1] Elective (6u)[1]	COMP2110 Software Design (6u) COMP2310 Concurrent and Distributed Systems (6u) COMP2600 Formal Methods in Software Engineering (6u) Elective (6u)[1]
Year 3 (48 units)	COMP3100 Software Engineering Group Project (6u) COMP3110 Software Analysis and Design (6u) 3000/4000-series IT (6u)[2][3] Elective (6u)[1]	COMP3100 Software Engineering Group Project (6u) COMP3120 Managing Software Development (6u) 3000/4000-series IT (6u)[2][3] Elective (6u)[1]

[1] May include no more than 18 units of 1000-series courses.

[2] Must include one of COMP2410 Networked Information Systems or COMP3310 Computer Networks.

[3] Some 3000/4000-series IT electives may have specific prerequisites that are not covered by the courses specified in the table.

Information Technology Honours

(Academic Program: 3701 | Academic Plan: 3701HBINFT)
Duration: 1 year full-time, 1 - 3 years part-time
Minimum: 144 units
CRICOS Code: 029996A

The BInfTech program with honours requires an additional year of study after the pass degree of Bachelor of Information Technology. Admission is by invitation based on performance in the best 48 units of 2000 and 3000 series Information Technology and Mathematics courses and generally requires an average performance at better than Credit level. The honours program includes advanced coursework and a major individual project worth 50 per cent of the year. Honours grades are awarded on the result of the whole year's work. For more details refer to http://cs.anu.edu.au/honours

Alternating later year courses

A number of COMP3000-series and COMP4000-series courses are offered in alternating years (odds and evens system).

Only the courses offered in this year are listed with course descriptions. Courses not offered this year are listed at the conclusion of the Faculty of Engineering and Information Technology course descriptions.

For further information and to plan your enrolment pattern refer to the StudyAt website: http://info.anu.edu.au/StudyAt/_Engineering_and_IT/Undergraduate/Programs/_3701XBINFT.asp?tab=4

Course Descriptions

Introduction to Programming and Algorithms COMP1100 (6 units) A

First year course
Semester 1, Semester 2
Thirty one-hour lectures, nine two-hour tutorial/ laboratory sessions.

Assumed Knowledge: Students are assumed to have achieved a level of knowledge of mathematics comparable to at least ACT Maths Methods major or NSW 2 unit maths or equivalent.

Syllabus: This course is an introduction to the basic principles of programming from an object-oriented perspective. These principles are applied in a study of straightforward algorithms for searching and sorting. It provides a foundation for studies in computer science, information systems and software engineering.

The following topics are covered: basic concepts of programming (data types, assignment, control structures, the procedural abstraction), basic concepts of object-oriented programming (class, object, attributes, routines), library classes for basic datatypes, straightforward algorithms for search and searching, object-oriented methods (class inheritance, assertions on routines, design by contract).

The course has a strong practical emphasis, with required attendance at laboratory sessions.

Proposed Assessment: Continuous Assessment (30 per cent); Examinations (70 per cent)

Introduction to Software Systems COMP1110 (6 units) A

First year course
Summer Session 2007, Semester 2
Thirty one-hour lectures and nine two-hour tutorial/ laboratory sessions

Prerequisites: COMP1100

Incompatible: COMP1510

Syllabus: This course introduces students to the tools and techniques for developing software systems of a size and quality of an industrially relevant nature. The course teaches the fundamental strategies of abstraction, decomposition and reuse as methods for constructing such systems. Verification and validation techniques, with an emphasis on testing, are taught as a means to ensure that students are able to deliver software products of the quality required.
In particular, the course will cover: recursive data structures and algorithms; structured data types, abstract data types and their applications; object-oriented programming; and software life-cycle. The course will also introduce some of the theoretical fundamentals that underpins software engineering, including: reasoning about software and its application to specifications, and verification and validation.

Proposed Assessment: Assignments (40 per cent); Quiz (10 per cent); Final Exam (50 per cent)

Data Structures and Algorithms I COMP1130 (6 units)

First year course
Semester 1

Prerequisites: Enrolment in the Bachelor of Computer Science (Honours) or permission from Head of Computer Science.

Syllabus: This course, and its sequel, COMP1140 Data Structures and Algorithms II, will study problem solving using programming languages, data structures and algorithms. The mode of delivery will be via problem seminars which will be seeded by an academic who will introduce a problem, typically associated with his/her research area. Each problem will be worked on by the students who will report in class on their solutions. The problems will be selected to be appropriate vehicles for the students to use to learn about various syllabus topics.

After the completion of both courses, student will have improved their problem solving abilities and have implemented algorithms in at least two languages, including a functional one and an object-oriented one.

Proposed Assessment: Assignments (30 per cent); Final exam (70 per cent)

Data Structures and Algorithms II COMP1140 (6 units)

First year course
Semester 2

Prerequisites: Enrolment in BCS (Honours) or permission from Head of Computer Science.

Syllabus: This course, and its prequel, COMP1130 Data Structures and Algorithms I, will study problem solving using programming languages, data structures and algorithms. The mode of delivery will be via problem seminars which will be seeded by an academic who will introduce a problem, typically associated with his/her research area. Each problem will be worked on by the students who will report in class on their solutions. The problems will be selected to be appropriate vehicles for the students to use to learn about various syllabus topics.

After the completion of both courses, students will have improved their problem solving abilities and have implemented algorithms in at least two languages, including a functional one and an object-oriented one.

Proposed Assessment: Assignments (30 per cent); Final exam (70 per cent)

Perspectives on Computing COMP1200 (6 units) A

First year course
Semester 1
Thirty one-hour lectures, six two-hour tutorial and laboratory sessions

Syllabus: This course presents the important concepts in the computing discipline and places them in context, in order to introduce the nature of the computing profession and the education of a computing professional.The course covers the following topics, through case studies. Abstractions and the user view: the interactive machine, the stored-program machine, data, programming languages and virtual machines, computational objects. Applications of computer systems: personal computation, application software, information systems, knowledge-based systems, and real-time control. Computer systems and their environment: the personal computer, networked computers and concurrency, the world wide web. The nature of the computing discipline: mathematical theory, scientific experimentation and engineering design. Professional issues: the engineering of software systems, the client focus, and professional ethics. Educational issues: curriculum issues, the ANU experience.

Proposed Assessment: Assignments (24 per cent);Tutorials and Laboratories (6 per cent); Quiz (14 per cent); Final Exam (56 per cent)

Introduction to Software Engineering COMP1510 (6 units)

First year course
Semester 2
Thirty one-hour lectures, nine two-hour tutorial/laboratory sessions and three two-hour seminars.

Prerequisites: Enrolment in BSEng; COMP1100

Incompatible: COMP1110

Syllabus: This course introduces students to the tools and techniques for developing software systems of a size and quality of an industrially relevant nature. The course teaches the fundamental strategies of abstraction, decomposition and reuse as methods for constructing such systems. Verification and validation techniques, with an emphasis on testing, are taught as a means to ensure that students are able to deliver software products of the quality required. It also introduces students to the principles and practices of software engineering.

In particular, the course will cover: recursive data structures and algorithms; structured data types, abstract data types and their applications; object-oriented programming; and software life-cycle. The course will also introduce some of the theoretical fundamentals that underpins software engineering, including: reasoning about software and its application to specifications, and verification and validation.

Proposed Assessment: Assignments (40 per cent); Quiz (10 per cent); Final Exam (50 per cent)

Tools for New Media and the Web COMP1710 (6 units)

First year course
Semester 1
Thirty one-hour lectures and nine two-hour laboratory sessions

Syllabus: This course focuses on multimedia and its delivery on the world wide web. It introduces multimedia as a combination of text, graphics, video, animation and sound for the purposes of information access, storage and dissemination. Topics such as the nature of multimedia and types of multimedia objects, components of a multimedia system, Web authoring, multimedia delivery tools, multimedia applications and societal implications of multimedia, will be covered. Students will have the opportunity to create multimedia applications using HTML, JavaScript, animation, sound, video and 3D.

Proposed Assessment: Laboratories (25 per cent); Assignment (35 per cent); Final Exam (40 per cent)

Software Construction
COMP2100 (6 units) B

Later year course
Semester 1
Thirty one-hour lectures and six two-hour tutorial/laboratory sessions

Prerequisites: COMP1110 or COMP1510 or COMP1120; and MATH1005 or MATH1014 or MATH1116

Incompatible: COMP2500

Syllabus: This course is about the implementation and test phases of the software construction process. It is based around an individual project lasting the whole semester. In this project, students work on the construction of a substantial application, relevant to their experience as computer users. The project is closely specified, and involves a graphical user interface. During the semester, students follow the Personal Software Process, learning time-management, planning, and quality control.

The following topics are covered: working with larger systems; code review and inspections; test planning and procedures (derived from specification and design documents); object-oriented (Eiffel), procedural (C) and scripting (Bash) languages; recursive data structures; graphical user interfaces; the Personal Software Process; build tools (Make) and version control (RCS); use of external libraries.

Proposed Assessment: Assignments (30 per cent); Mid Semester Exam (20 per cent); Final Exam (50 per cent)

Software Design
COMP2110 (6 units) B

Later year course
Semester 2
Twenty six one-hour lectures, four one-hour tutorials and five two-hour tutorial/laboratory sessions

Prerequisites: COMP1110 or COMP1510 or COMP1120; and MATH1005 or MATH1014 or MATH1116

Incompatible: COMP2510

Syllabus: This course is one of three courses (COMP2100, COMP2110, COMP3110) which address constructive aspects of the software development process. It has a primary focus on the design phase. The following topics are covered. Introduction to requirements specifications. Designing to specifications. The design milieu (notations, documentation standards). Design techniques (object-oriented, software architectures, design patterns). Design review. Design in the context of requirements change. Principles of quality in design.

Proposed Assessment: Assignments (50 per cent); Presentation (10 per cent); Final Exam (40 per cent)

Introduction to Computer Systems
COMP2300 (6 units) B

Later year course
Semester 1
Thirty one-hour lectures and nine two-hour laboratory/tutorial sessions

Prerequisites: COMP1100 or COMP1120; and 6 units of 1000-level MATH courses.

Syllabus: An introduction to the hardware and software components of a modern computer system. Comparisons of different types of instructions sets and corresponding addressing modes. Emphasis on the relationships among instruction sets, fetch and execute operations, and the underlying architecture. Introduction to the concept of interrupts, as well as the purpose and specifications of a control course with respect to logic operations. Consideration of the physical implementation of large memory systems, together with the techniques of data storage and checking. Overall concepts of virtual memory, operating system functions, file systems and networks.

Virtual machines and the levels of machine organization, the assembly and linking process and software libraries.

Proposed Assessment: Assignments (30 per cent); Final Exam (70 per cent)

Concurrent and Distributed Systems
COMP2310 (6 units) B

Later year course
Semester 2
Thirty one-hour lectures, nine two-hour tutorials/laboratory sessions.

Prerequisites: COMP1110 or COMP1510 or COMP1120; COMP2100 or COMP2500 or COMP2300; and MATH1005 or MATH1014 or MATH1116

Syllabus: This course is concerned with the issues that arise when computational processes are supported in a computer system. The scope is broad enough to include discussion of all the layers of a computer system - from the hardware to large information systems applications, and all sizes of computer system - from systems as small as a single processor, to systems as large as the entire Internet. The principal areas of study are processes and process coordination, concurrency support in operating systems and high level languages, and distributed systems.

The following topics are addressed: operating system structure, process management, interaction between system components (processes, devices and processors), mutual exclusion, concurrent programming, semaphores and monitors, inter-process communication, distributed systems, crash resilience and persistent data, deadlock, transaction processing.

Proposed Assessment: Assignments (30 per cent); Final Exam (70 per cent)

Relational Databases
COMP2400 (6 units) B

Later year course
Semester 2
Thirty one-hour lectures and six two-hour tutorial/laboratory sessions

Assumed Knowledge: COMP1100 or COMP1710 or INFS1001

Syllabus: Introduction to the basic goals, functions, models, components, applications, and social impact of database system applications. The course introduces the relational data model and the database query language SQL. Entity-Relationship Diagrams are introduced as a tool for conceptual modeling. Effective mapping of a conceptual model to a relational

database scheme requires some appreciation of the role of integrity constraints, and the impact of DBMS characteristics.

Proposed Assessment: Continuous Assessment (30 per cent); Mid Semester Exam (20 per cent); Final Exam (50 per cent)

Networked Information Systems COMP2410 (6 units)

Later year course
Semester 1
Thirty one-hour lectures and six two-hour tutorial/ laboratory sessions

Prerequisites: COMP1100 or COMP1710; and 6 units of 1000-level MATH/STAT courses

Incompatible: COMP3400

Syllabus: This course studies networking fundamentals including LANS, MANS, WANS, the Internet, intranets, extranets and the WWW, with the focus being the Internet. The topics covered include: hardware, software, network topologies, architecture and protocols; network and web applications; website design and construction; information architecture; standards; privacy, security, firewalls and reliability; systems integration; network monitoring and management; and professional ethics and social issues.

Proposed Assessment: Assignments (30 per cent); Final Exam (70 per cent)

Software Construction for Software Engineers COMP2500 (6 units)

Later year course
Semester 1
Thirty one-hour lectures, six two-hour tutorial/laboratory sessions and three two-hour seminars

Prerequisites: Enrolment in BSEng; COMP1510; or COMP1110 and COMP1800; or COMP1120 and COMP1800; and MATH1005 or MATH1014 or MATH1116

Incompatible: COMP2100

Syllabus: This course is about the implementation and test phases of the software construction process. It is based around an individual project lasting the whole semester. In this project, students work on the construction of a substantial application, relevant to their experience as computer users. The proejct is closely specified, and involves a graphical user interface. During the semester, students follow the Personal Software Process, learning time-management, planning, and quality control. The course also studies aspects of the principles and practices of software engineering.

The following topics are covered: working with larger systems; code review and inspections; test planning and procedures (derived from specification and design documents); object-oriented (Eiffel), procedural (C) and scripting (Bash) languages; recursive data structures; graphical user interfaces; the Personal Software Process; build tools (Make) and version control (RCS); use of external libraries.

Proposed Assessment: Assignments (20 per cent); Mid Semester Exam (20 per cent); Presentation (5 per cent); Report (5 per cent); Final Exam (50 per cent)

Software Design for Software Engineers COMP2510 (6 units)

Later year course
Semester 2
Thirty one-hour lectures, six one-hour tutorial and one two-hour laboratory sessions, and three two-hour seminars

Prerequisites: Enrolment in BSEng; COMP1510;or COMP1110 and COMP1800; or COMP1120 and COMP1800; and MATH1005 or MATH1014 or MATH1116

Incompatible: COMP2110

Syllabus: This course is one of three courses (COMP2500, COMP2510, COMP3110) that address constructive aspects of the software development process for software engineering students. It has a primary focus on the design phase. The course also studies aspects of the principles and practices of software engineering.

The following topics are covered; Introduction to requirements specifications; Designing to specifications; The design milieu (notations, documentation standards); Design techniques (object-oriented, software architectures, design patterns, structured); Design review; Design in the context of requirements change; Principles of quality in design.

Proposed Assessment: Assignments (50 per cent); Presentation (10 per cent); Final Exam (40 per cent)

Formal Methods in Software Engineering COMP2600 (6 units) B

Later year course
Semester 2
Thirty one-hour lectures, eight one-hour tutorials and four two-hour laboratory sessions.

Prerequisites: COMP1110 or COMP1510 or COMP1120 or COMP2750; and MATH1005 or MATH1014 or MATH1116.

Syllabus: This course presents some formal notations that are commonly used for the description of computation and of computing systems, for the specification of software and for mathematically rigorous arguments about program properties.

The following areas of study constitute the backbone of the course. Predicate calculus and natural deduction, inductive definitions of data types as a basis for recursive functions and structural induction, formal language theory (particularly regular expressions, finite state machines and context free grammars), specification languages, propositional programming language semantics, partial correctness and proofs of termination.

Proposed Assessment: Assignments (40 per cent); Tutorials and Laboratories (5 per cent); Quiz (10 per cent); Final Exam (45 per cent)

Automating Tools for New Media COMP2720 (6 units)

Later year course
Semester 2
Thirty one-hour lectures and ten two-hour laboratory sessions

Prerequisites: COMP1710 or COMP1100

Syllabus: This course will introduce script-level programming in the context of New Media. Topics covered will include the

nature of New Media applications, New Media data formats and data manipulation, program organisation, control structures, writing and debugging New Media programs.

Proposed Assessment: Portfolio (30 per cent); Assignments (30 per cent); Final Exam (40 per cent)

Java Programming for New Media COMP2750 (6 units)

Later year course
Semester 1
Thirty one-hour lectures, six two-hour laboratory sessions.

Prerequisites: COMP1100 or COMP2720

Incompatible: COMP1110

Syllabus: A Java-based introductory programming course which includes aspects of graphical user-interfaces and Java2D graphics as well as good programming practice and software engineering.

Proposed Assessment: Assignments (30 per cent); Final Exam (70 per cent)

Software Engineering Group Project COMP3100 (6 units) C

Later year course
Semester 1, Semester 2
Annual course. Students must enroll in Semester 1 and Semester 2

Forty one-hour lectures and 300 hours of group project work

Prerequisites: COMP2100 and COMP2110; or COMP2500 and COMP2510; and 12 units of courses from COMP2300, COMP2310, COMP2400 and COMP2600

Corequisites: COMP3110

Incompatible: COMP3500

Syllabus: This course provides the student with project experience to complement the studies of the software development process in courses COMP2100, COMP2110, COMP3110 and COMP3120.

Students work in small groups and participate in all the development phases (requirements analysis, design, construction, testing and documentation) of a nontrivial software system. As well, each group has to address the control of the development process by constructing and following a detailed software development management plan.

Proposed Assessment: Project (90 per cent); Presentation (10 per cent)

Software Analysis and Design COMP3110 (6 units) C

Later year course
Semester 1
Thirty one-hour lectures and five two-hour laboratory sessions

Prerequisites: 12 units of 2000-level COMP or INFS courses including COMP2110 or COMP2510 or INFS2024; and 6 units of 1000-level MATH courses

Syllabus: This course is one of three courses (COMP2100, COMP2110, COMP3110) which address constructive aspects of the software development process. It has a primary focus on the software requirements and design phases.

This course provides a practical introduction to requirements analysis methods and design specification techniques that are either structured or object-oriented. The essential rationale for the requisite components of a number of such methods will be taught together with some techniques for their application. As always, the emphasis of applying any such method is to create, from a set of original requirements, a semi-formal representation or model of a system software specification that is unambiguous, consistent and understandable. The various techniques for achievement of such requirements and specifications often seem straight forward and even conceptually simple. However, despite the apparent simplicity of a technique, students will discover that a good deal of effort and diligence is required to produce accurate, meaningful, understandable and easily maintainable specifications.

Software system requirements specifications are essential for creating and trading-off design specification alternatives. There are several representations available for specifying a software design. Some of these will be discussed and applied including some very recent approaches to design that allow for the inclusion of multiple architectural alternatives and simple verification. The latest design techniques place appropriate emphasis on accurate, semi-formal models, transformation rules and direct code generation.

Whenever appropriate, computer aided modelling tools will be used to reinforce the various concepts that are covered theoretically.

Proposed Assessment: Assignments (30 per cent), Presentation (10 per cent); Mid Semester Exam (15 per cent); Final Exam (45 per cent)

Managing Software Development COMP3120 (6 units) C

Later year course
Semester 2
Thirty one-hour lectures and five two-hour laboratory sessions.

Prerequisites: 12 units of 3000-series IT

Syllabus: This course addresses the control of the software development process. It is a companion course to COMP2100, COMP2110 and COMP3110, which address construction aspects of the process. COMP3120 addresses some of the initial tasks for effectively planning and managing the development process within which the techniques introduced in those courses might be used.

The following topics are covered. Choosing or tailoring a software development life cycle. Constructing a software development plan. Applying techniques and tools for determining size, effort and cost of a software development. Constructing a schedule and determining resource requirements and allocations. Identifying, assessing and managing risks (including technical, schedule and resource risks). Choosing and using metrics for different purposes such as monitoring progress, controlling resources and estimating rework.

Proposed Assessment: Individual Project Plan (25 per cent); Group Business Plan (25 per cent weighted as 15 per cent for the document; 10 per cent for a concept presentation and minutes of the first meeting); Final Exam (50 per cent)

Computer Networks
COMP3310 (6 units) C

Later year course
Semester 1
Thirty one-hour lectures and six two-hour laboratory/tutorial sessions.

Prerequisites: 12 units of 2000-level COMP or INFS courses including COMP2300; and 6 units of 2000-level MATH courses or COMP2600

Incompatible: ENGN 4535

Syllabus: This course studies the standard models for the layered approach to communication between autonomous machines in a network and the main characteristics of data communication (transmission protocols) for the lower layers. It introduces several application layer protocols from a distributed systems viewpoint, and considers alternative lower layer methods such as ATM, and problem areas in the Internet protocol suite.

The following topics are included: introduction to communication network architectures (protocol hierarchies, layered services, the OSI model); the physical layer (transmission media, signal representation, limits to data capacity); the data link layer (error detection and recovery, point-to-point protocols); the medium access layer (protocols for Local Area Networks and satellite communication); the network layer (routing algorithms, congestion control); internetworking (addressing, internetwork routing and protocols, quality of service); the transport layer (connection-oriented transport layer services and protocols); application protocols for distributed systems.

Proposed Assessment: Assignments (30 per cent); Quizzes (5 per cent); Final Exam (65 per cent)

Information Technology in Electronic Commerce
COMP3410 (6 units) C

Later year course
Semester 2
Thirty one-hour lectures and seven two-hour tutorial/laboratory sessions

Prerequisites: COMP1100 or COMP2720; 12 units of 2000-series IT courses; and 6 units of MATH/STAT courses

Syllabus: This course is about some of the current and potential applications of information technology in electronic commerce. Topics will be chosen from areas such as document representation (XML, DTDs, XML Schema, XSLT, CSS), data management (metadata, digital libraries, electronic document management and processing), electronic trading (spontaneous, deliberative, auctions) and security (encryption, public key, symmetric key, PKI, authentication). Case studies will be used where appropriate. Other topics will be included to match recent developments and maturation of the area, such as web application frameworks, web services and the semantic web.

Proposed Assessment: Assignments (30 per cent); Final Exam (70 per cent)

Software Engineering Individual Project
COMP3500 (6 units)

Later year course
Semester 1, Semester 2
Annual course. Student enrolls in Semester 1 and Semester 2

Forty one-hour lectures and 300 hours of project work

Prerequisites: Enrolment in BSEng; COMP2500 and COMP2510; or COMP2100, COMP2110 and COMP2800; and 12 units of courses from COMP2300, COMP2310, COMP2400 and COMP2600

Corequisites: COMP3110

Incompatible: COMP3100

Syllabus: This course provides the student with project experience to complement the studies of the software development process in courses COMP2500, COMP2510, COMP3110 and COMP3120.

Students work in small groups and participate in all the development phases (requirements analysis, design, construction, testing and documentation) of a nontrivial software system. As well, each group has to address the control of the development process by constructing and following a detailed software development management plan. Students will also study relevant aspects of the software engineering milieux.

Proposed Assessment: Project (90 per cent); Presentation (10 per cent)

Algorithms
COMP3600 (6 units) C

Later year course
Semester 2
Thirty one-hour lectures and nine two-hour tutorial/laboratory sessions.

Prerequisites: COMP2100 or COMP2500; 6 units of 2000-level COMP courses or enrollment in BComptlSci; and 6 units of 2000-level MATH courses or COMP2600

Syllabus: This course deals with the study of algorithms for solving practical problems, and of the data structures used in their implementation. Detailed analysis of the resource requirements of algorithms will be an important issue. A large variety of algorithms are candidates for study. These include, but are not limited to, the following: greedy algorithms, dynamic programming, divide-and-conquer, exhaustive search, graph algorithms, advanced data structures such as binomial heaps and Fibonacci heaps, network flow algorithms, algorithms for string matching, parallel algorithms, heuristics and approximation algorithms, and an introduction to intractability. As well as studying the implementation, the mathematical tools used to study the resource usage of algorithms will be considered.

Proposed Assessment: Assignments (30 per cent); Final Exam (70 per cent)

Principles of Programming Languages COMP3610 (6 units) C

Later year course
Semester 2
Thirty one-hour lectures, three one-hour tutorials and seven two-hour laboratory sessions.

Prerequisites: COMP2100 or COMP2500; and COMP2600

Syllabus: The course will provide an introduction to the major declarative paradigms of functional programming and logic programming. It will give the student some experience with Prolog and a representative functional language in problem domains where these paradigms are most suited. The theoretical underpinnings of each paradigm will be introduced, as will elementary aspects of implementation.

As well as exploring these new classes of languages the course will introduce the students to ideas that apply across the language landscape. Firstly, languages can only be defined rigorously when some systematic notation is used to assign meanings to each program and program fragment. The course will discuss formal semantics in general and will focus on a widely used system - denotational or structured operational.

The requirement that a language be implementable means that some aspects of formal language theory become part of the programming languages area. The course will approach the topic in-so-far-as it supports the construction of language acceptors. It will also give introductions to topics that underpin run-time structures of language.

Proposed Assessment: Assignments (30 per cent); Final Exam (70 per cent)

Course offered in Semester 2 in alternate odd-numbered years.

Artificial Intelligence COMP3620 (6 units)

Later year course
Semester 1
Thirty one-hour lectures, six tutorials and six laboratory sessions

Prerequisites: COMP2100 or COMP2500; and COMP2600

Syllabus: This course focuses on techniques and approaches that are successfully used in making computers more intelligent. Areas of study will include: problem solving using search, knowledge representation and reasoning, planning, diagnosis, learning, agent approaches, natural language processing, and perception. The subject will also briefly examine the historical, philosophical, and logical foundations of AI.

Proposed Assessment: Assignments (30 per cent); Final Exam (70 per cent)

Theory of Computation COMP3630 (6 units)

Later year course
Semester 1

Prerequisites: COMP1140 and COMP2600

Syllabus: This course covers the theoretical computer science areas of formallanguages and automata, computability and complexity. Topics covered include: regular and context-free languages; finite automata and pushdown automata; Turing machines; Church's thesis; computability - halting problem, solvable and unsolvable problems; space and time complexity; classes P, NP and PSPACE; NP-Completeness.

Proposed Assessment: Assignments (40 per cent); Final Exam (60 per cent)

System Architectural Understanding and the Human Brain COMP3650 (6 units)

Later year course
Semester 1

Prerequisites: Departmental consent required to enroll in course

Syllabus: This course will teach how to understand the behaviours of complex functional systems in terms of their components, using as an example the problem of relating psychology to physiology for the human brain.Students will learn how to approach understanding of complex functional systems by means of descriptions on many different levels of detail which can be mapped into each other. This is one of the basic skills needed to understand, design and modify complex functional systems. The course will be relevant to students interested in designing or maintaining complex functional systems. Using the human brain as the example will make the course relevant to students interested in research on the mammal brain, and students interested in medical studies of the human brain.

Proposed Assessment: Assignments (30 per cent); Classwork (10 per cent); Exam (60 per cent)

Topics in Software Engineering I COMP3700 (6 units) C

Later year course
Semester 1, Semester 2
Contact hours as appropriate

Prerequisites: Written approval of Head of Department of Computer Science.
Minimal background is 18 units of 2000 series COMP courses including COMP2500 and COMP2510; and 6 units of 2000-level MATH courses or COMP2600.

Syllabus: This course is available so that senior students can pursue, under supervision, topics that are not covered in the regular curriculum or to execute a project that will significantly increase their knowledge of software engineering theory or practice.

The activities in the course will be some combination of lectures, reading, writing and project work, as appropriate to the topic.

Proposed Assessment: An appropriate combination of written report, exercises, examination and seminar presentation

Topics in Computer Science COMP3710 (6 units) C

Later year course
Semester 1, Semester 2
Contact hours as appropriate

Prerequisites: Written approval of Head of Department of Computer Science.
Minimal background is 18 units of 2000-level COMP courses

including COMP2100 or COMP2500; and 6 units of 2000-level MATH courses or COMP2600.

Syllabus: This course is available so that senior students can pursue, under supervision, topics that are not covered in the regular curriculum or to execute a project that will significantly increase their knowledge of some aspect of computer science. The activities in the course will be some combination of lectures, reading, writing and project work, as appropriate to the topic.

Proposed Assessment: An appropriate combination of written report, exercises, examination and seminar presentation

Project Work in Computer Systems COMP3750 (6 units)

Later year course
Semester 1, Semester 2

Prerequisites: Written approval of Head of Computer Science. Minimal background is 24 units of 2000-level IT courses.

Syllabus: Students will conduct a small project, under supervision, that will act as a capstone to the Computer Systems major by applying and increasing the depth of the student's knowledge in this area.

The activities in the course will normally include some combination of reading, writing, project work and presentation as appropriate to the topic. The learning objectives, project overview and assessment arrangements will be specified at the outset using the Department of Computer Science form 'Independent Student Contract'.

Proposed Assessment: An appropriate combination of written report, project documentation and presentation, which may include a demonstration of the project.

Project Work in Information Systems COMP3760 (6 units)

Later year course
Semester 1, Semester 2

Prerequisites: Written approval of Head of Computer Science. Minimal background is 24 units of 2000-level IT courses.

Syllabus: Students will conduct a small project, under supervision, that will act as a capstone to the Computer Systems major by applying and increasing the depth of the student's knowledge in this area.

The activities in the course will normally include some combination of reading, writing, project work and presentation as appropriate to the topic. The learning objectives, project overview and assessment arrangements will be specified at the outset using the Department of Computer Science form 'Independent Student Contract'.

Proposed Assessment: An appropriate combination of written report, project documentation and presentation, which may include a demonstration of the project.

Human Computer Interface Design and Evaluation COMP3900 (6 units)

Later year course
Semester 2
Thirty one-hour lectures

Prerequisites: COMP1110 or COMP2750; and a further 12 units of COMP 2000-series courses.

Syllabus: This course will provide an introduction to the field of Human Computer Interaction and will introduce students to behavioural research methods and techniques used in usability testing. The course will give students the essential theoretical background to approaches, methods and techniques followed by practical experience in conducting usability studies for interactive systems. Students will gain experience in designing and evaluating user interfaces for new media.

Proposed Assessment: Assignments (30 per cent); Final Exam (70 per cent)

Computer Science IV Honours COMP4005F (12 - 24 units)

Later year course
Semester 1, Semester 2
Full Year

Prerequisites: Enrolment in the BSc Honours Degree, with specialisation in Computer Science

Syllabus: The honours program consists of a coursework component and a project component, of equal weight. The coursework component involves courses in advanced aspects of the computing discipline, which in recent years have been drawn from: architecture of parallel systems, artificial intelligence, computational logic, algorithms, object oriented databases, programs for parallel computer systems, formal aspects of software engineering, software engineering project, document technologies and automated reasoning. The project component involves a substantial individual project under detailed academic supervision. A formal thesis is submitted (nominally 10,000 words), and a seminar is presented.

Proposed Assessment: Courses (50 per cent); Project (50 per cent)

Computer Science IV Honours COMP4005P (12 - 24 units)

Later year course
Semester 1, Semester 2
Full Year
Part-Time Intensity

Prerequisites: Enrolment in the BSc Honours degree, with specialisation in computer science.

Syllabus: The honours program consists of a coursework component and a project component, of equal weight. The coursework component involves courses in advanced aspects of the computing discipline, which in recent years have been drawn from: architecture of parallel systems, artificial intelligence, computational logic, algorithms, object oriented databases, programs for parallel computer systems, formal aspects of software engineering, software engineering project, document technologies and automated reasoning. The project component involves a substantial individual project under detailed academic supervision. A formal thesis is submitted (nominally 10,000 words), and a seminar is presented.

Proposed Assessment: Courses (50 per cent); Project (50 per cent)

Software Quality Management
COMP4100 (6 units)

Later year course
Semester 1
Thirty one-hour lectures and five two-hour laboratory sessions

Prerequisites: Enrolment in BSEng or permission of Head of Department of Computer Science; COMP2600; COMP3100 or COMP3500; and COMP3120

Syllabus: This course introduces students to advanced topics on managing the quality of products to be delivered as part of the progression within a software development project. Two approaches to the area are used - use of formal methods and process oriented techniques.

Several causal aspects of software (bad) quality will be introduced and discussed so that students can understand the context for undertaking risk and bad quality avoidance.

The focus will be on practical techniques for identifying and removing defects as well as implementing procedures to track the success or failure of risk and defect resolutions.

Half the course will be devoted to the study of several standard mathematical notations that are applicable to various stages of the software life cycle. They are particularly relevant to the specification of artifacts and systems and to the verification of properties of those systems.

Proposed Assessment: Assignments (30 per cent); Final Exam (70 per cent)

Software Process
COMP4110 (6 units)

Later year course
Semester 2
Thirty one-hour lectures and five two-hour laboratory sessions

Prerequisites: Enrolment in BSEng or permission of Head of Department of Computer Science; COMP3100 or COMP3500; and COMP3120

Syllabus: This course covers advanced topics concerning software process improvement (SPI) frameworks and standards. There are several SPI frameworks/standards available, each one possessing its own merits and difficulties. Most are regarded as being more appropriate to large software development organisations where the assumed expenses of incorporated SPI initiatives typically provide significant return on investment. The content of COMP4110 will introduce the various well known frameworks and standards in the context of importance to organisations but then also discuss tailored versions of some SPI frameworks that are more suitable to small organisations or teams of software developers.

COMP4110 is intended to provide students with further important possible options for a career in software engineering. SPI is a relatively new area within the overall subject of software engineering and requires a relatively deep knowledge of most if not all facets of software engineering activities. Hence it is a course especially constructed for those who wish to pursue a career loaded with experiences and research.

Proposed Assessment: Assignments (60 per cent); Final Exam (40 per cent)

Milestone Papers in Computing
COMP4200 (3 units) C

Later year course
Semester 1
Contact hours as appropriate

Prerequisites: Enrollment in the BInfTech Honours or the BSc Honours degree; or permission of Head of Department of Computer Science

Syllabus: Each week, students in this course will read, discuss and review a landmark paper from one of the various disciplines of computer science. The papers will be chosen so as to expose the students to a broad array of topics. The unit will also introduce students to the resources, like the science citation index, necessary to research and evaluate the origins and impact of a paper.

Proposed Assessment: Reports and Presentations (70 per cent), Discussion Questions (25 per cent) and Seminar Participation (5 per cent)

Engineering Law
COMP4211 (3 units)

Later year course
Semester 1
Fifteen one-hour lectures

Prerequisites: ENGN1211

Syllabus: The course covers the following topics: Sources and classification of law; professional engineering legislation, code of ethics, registration and discipline; negligence; contract law; employment law; patent law and submission; environmental law.

Proposed Assessment: Tutorials (10 per cent); Final Exam (90 per cent)

Parallel Systems
COMP4300 (6 units) C

Later year course
Semester 1
Thirty one-hour lectures, six two-hour tutorial/ laboratory sessions

Prerequisites: COMP2310; 6 units of 2000-series COMP courses; and 6 units of 2000-series MATH courses or COMP2600

Syllabus: A practically oriented introduction to programming paradigms for parallel computers. Considers definitions of program efficiency on parallel computers, addresses the modelling, analysis and measurement of program performance. Description, implementation and use of parallel programming languages, parallel features of operating systems, library routines and applications.

Proposed Assessment: Assignments (30 per cent); Laboratories (20 per cent); Final Exam (50 per cent)

Course offered in alternate odd-numbered years.

Real-Time and Embedded Systems COMP4330 (6 units)

Later year course
Semester 2
Three hours per week lectures and two hours per week laboratory sessions

Prerequisites: COMP2300 and COMP2310; or ENGN2211 and ENGN2223

Syllabus: Real-time and embedded systems are all around us. Controlling cars, trains, or aeroplanes, as well as mobile phones, cameras, or A/V equipment, embedded systems are a challenging and demanding part of computer science and engineering. This course delivers foundations of real-time analysis and implementation of systems which are interconnected with the physical world (embedded systems). It also delivers the principles of fault tolerant systems and highly reliable systems. Techniques which are introduced include real-time calculus, real-time scheduling, elementary sensor data filtering and fusion methods, error recovery strategies, and graceful degradation methods.

Proposed Assessment: Laboratories (30 per cent); Final Exam (70 per cent)

Course offered in alternate, odd-numbered years commencing in 2007.

Software Engineering Practice COMP4500 (6 units)

Later year course
Semester 1, Semester 2
Annual course. Student enrolls in Semester 1 and Semester 2.

As many hours as necessary for reviews and a nominal 12 hours per week

Prerequisites: Enrolment in BSEng; COMP3110, COMP3120 and COMP3500

Incompatible: COMP4540

Syllabus: At the commencement of this course, students will be introduced to customers (from industry, government or other university entities) who require a software development project to be undertaken. The typical team size will be three to five students, the members of which will be required to form/analyse customer requirements and plan (define, estimate, schedule) the project to ultimately deliver and control a software project according to the customer requirements. The implementation part of the project will include monitoring, measuring, tracking, managing change and ultimately close out the project. All teams will be required to produce a minimum set of documents including:

- Software Development Plan (inclusive of other important plans)
- Software Requirements Specification
- Software Design Specification(s)
- Acceptance, System and Integration Test Cases and Procedures
- Source and Binary Code.

The typical size of the project will be limited to 1000 - 1600 person hours.

Proposed Assessment: Project (90 per cent); Presentation (10 per cent)

Software Engineering Research Project COMP4540 (12 units)

Later year course
Semester 1, Semester 2
As many hours as necessary for meetings with supervisors and a nominal 20 hours per week

Prerequisites: Enrolment in BSEng and permission of the Head of Department; COMP3110, COMP3120 and COMP3500

Incompatible: COMP4500

Syllabus: Students will conduct an individual research project under the close supervision of one or more academic staff. Projects will, at least in part, require the application of theoretical or experimental research techniques. In particular, students will be expected to conduct and present a survey of the literature relevant to the research topic.
Students will prepare a thesis reporting on the research project and its outcomes. They will also be expected to present a poster and a short seminar describing their work.
Students will be expected to apply their software engineering knowledge and skills in the planning and execution of their research project.

Proposed Assessment: Project (90 per cent); Presentation (10 per cent)

Computer Graphics COMP4610 (6 units) C

Later year course
Semester 2
Twelve two-hour lectures, some seminars, and ten laboratory sessions

Prerequisites: COMP2600 or COMP2750; and 6 units of 3000-series COMP courses

Syllabus: Computer graphics are an intrinsic component of many modern software applications and are often essential to the success of these applications. The objective of this course is to familiarize the student with fundamental algorithms and data structures that are used in today's interactive graphics systems as well as programming and architecture of high-resolution graphics computers. The principles and practise of computer graphics are described from their mathematical foundations to the modern applications domains of scientific visualisation, virtual reality, computer games and film animation. The course will include some practical experience of graphical software environments such as OpenGL, VRML and Java3D.

Proposed Assessment: Assignments (40 per cent); Mid Semester Exam (10 per cent); Final Exam (50 per cent)

Overview of Logic and Computation COMP4630 (6 units) C

Later year course
Semester 1
Twenty-six one hour lectures, ten one-hour tutorials

Prerequisites: 24 units of 3000-level COMP courses including COMP3610

Syllabus: This course covers: essentials of first order logic, up to and including completeness proofs; introductions to proof theory and model theory; elements of modal and temporal

logic; introduction to automated reasoning. Students will have the opportunity to read and present material going beyond that in the lectures.

Proposed Assessment: Assignments (50 per cent);Final Exam (50 per cent)

Introduction to Statistical Machine Learning COMP4670 (6 units)

Later year course
Semester 1
Thirty one-hour lectures

Prerequisites: Departmental consent required to enroll in course

Syllabus: This course provides a broad but thorough introduction to the methods and practice of statistical machine learning. Topics covered will include Bayesian inference and maximum likelihood modeling; regression, classification, density estimation, clustering, principal and independent component analysis; parametric, semi-parametric, and non-parametric models; basis functions, neural networks, kernel methods, and graphical models; deterministic and stochastic optimisation; overfitting, regularisation, and validation.

Proposed Assessment: Two Written Assignments (30 per cent each); Oral Examination (40 per cent)

Topics in Software Engineering II COMP4700 (3 units)

Later year course
Semester 1, Semester 2
Contact hours as appropriate

Prerequisites: Written approval of Head of Department of Computer Science. Minimal background is 24 units of 3000-level COMP courses.

Syllabus: This course is available so that students can pursue, under supervision, topics that are not covered in the regular curriculum.

The activities in the course will be some combination of lectures, reading, writing and project work, as appropriate to the topic. These activities, and the assessment arrangements, will be specified, for each enrolled student, using a Computer Science Department 'Independent Study Contract'.

Proposed Assessment: An appropriate combination of written report, exercises, examination and seminar presentation

Topics in Software Engineering III COMP4710 (6 units)

Later year course
Semester 1, Semester 2
Contact hours as appropriate

Prerequisites: Written approval of Head of Department of Computer Science. Minimal background is 24 units of 3000-level COMP courses.

Syllabus: This course is available so that students can pursue, under supervision, topics that are not covered in the regular curriculum.

The activities in the course will be some combination of lectures, reading, writing and project work, as appropriate to the topic. These activities, and the assessment arrangements, will be specified, for each enrolled student, using a Computer Science Department 'Independent Study Contract'.

Proposed Assessment: An appropriate combination of written report, exercises, examination and seminar presentation

Project Work in Software Engineering I COMP4720 (3 units)

Later year course
Semester 1, Semester 2
Contact hours as appropriate

Prerequisites: Written approval of Head of Department of Computer Science. Minimal background is 24 units of 3000-level COMP courses. Approval is also contingent on the availability of supervision.

Syllabus: This course is available so that students can conduct, under supervision, a small project that will significantly increase their depth of knowledge in some aspect of software engineering theory or practice.
The activities in the course will normally include some combination of reading and writing as appropriate to the project. The learning objectives, project overview and assessment arrangements will be specified at the outset using the Department of Computer Science form 'Independent Study Contract'.

Proposed Assessment: An appropriate combination of written report and presentation (which may include a demonstration of the deliverable).

Project Work in Software Engineering II COMP4730 (6 units)

Later year course
Semester 1, Semester 2
Contact hours as appropriate

Prerequisites: Written approval of Head of Department of Computer Science. Minimal background is 24 units of 3000-level COMP courses. Approval is also contingent on the availability of supervision.

Syllabus: This course is available so that students can conduct, under superivision, a small project that will significantly increase their depth of knowledge in some aspect of software engineering theory or practice.

The activities in the course will normally include some combination of reading and writing as appropriate to the project. The learning objectives, project overview and assessment arrangements will be specified at the outset using the Department of Computer Science form 'Independent Study Contract'.

Proposed Assessment: An appropriate combination of written report and presentation (which may include a demonstration of the deliverable).

Industrial Experience COMP4800 (0 unit)

Later year course
Semester 1, Semester 2

Prerequisites: Enrolment in BSEng and COMP3500.

Syllabus: Industrial Experience gives the student exposure to current professional practice. It consists of 60 days of work,

organised by the student. Of those 60 days, 20 must be in a software engineering context, 20 must be in a professional context, and the remaining 20 may be in any employment. Industrial Experience is usually undertaken outside study periods, and is graded satisfactory or unsatisfactory.
Students must fulfil the requirements during the course of their degree; they normally enroll in COMP4800 in their final year and need to have satisfied the requirements by October in order to graduate at the ceremony the following December.

Information Technology IV Honours(S) INFT4005F (12 - 24 units)

Later year course
Semester 1, Semester 2
Full Year

Prerequisites: Enrolment in the BInfTech Honours degree.

Syllabus: The honours program consists of a coursework component and a project component, of equal weight. A student's individual course program is selected in consultation with the BInfTech honours coordinator.The coursework component involves courses in advanced aspects of the computing discipline and information systems. The coursework is drawn from the fourth year honours courses in Computer Science (see the COMP4005 course description), Information Systems (see the entry in Faculty of Economics and Commerce), and other Science departments.
The project component involves a substantial individual constructive project under detailed academic supervision. Several formal project reports are submitted for assessment.

Proposed Assessment: Courses (50 per cent); Project (50 per cent)

Information Technology IV Honours(S) INFT4005P (12 - 24 units)

Later year course
Semester 1, Semester 2
Full Year
Part-Time Intensity

Prerequisites: Enrolment in the BInfTech Honours degree.

Syllabus: The honours program consists of a coursework component and a project component, of equal weight. A student's individual course program is selected in consultation with the BInfTech honours coordinator.The coursework component involves courses in advanced aspects of the computing discipline and information systems. The coursework is drawn from the fourth year honours courses in Computer Science (see the COMP4001 course description), Information Systems (see the entry in Faculty of Economics and Commerce), and other Science departments.

The project component involves a substantial individual constructive project under detailed academic supervision. Several formal project reports are submitted for assessment.

Proposed Assessment: Courses (50 per cent); Project (50 per cent)

Discovering Engineering ENGN1211 (6 units)

First year course
Semester 1

Coordinator: Dr K. Lovegrove

Prerequisites: Admission to the BE degree course or the BSEng degree course or approval of Head of Engineering.

Syllabus: Discovering Engineering provides an introduction to three aspects of engineering: the disciplines; the practice; and the roles and responsibilities. These three themes are interwoven throughout the course to enhance student skills in communication, teamwork, problem formulation, systems design, an understanding of the responsibilities of engineering practice, and an awareness of reflective and ethical professional practice.
A range of engineering disciplines are discovered through team research projects and guest speaker presentations by practicing engineers in the fields of biomedicine, environment, military, telecommunications, production, materials, software development, robotics, virtual environments and more.

The practice of engineering is discovered in a group design and build project. From conceptualization to production and testing, students are responsible for the outcomes of an open-ended design problem. They gain an appreciation of the issues involved in taking a design from the concept phase to the manufacturing phase.

The roles and responsibilities of engineers, technologists and scientists in society are examined through analysis and debate of topical contentious issues. Students will appreciate the complexity of social issues and develop a framework for ethical, professional analysis of such issues. Contemporary issues examined include: decision-making in science and technology; environmental decision-making in support of sustainable development; the impact of technology on social health; privacy and security issues in the internet age; the future in artificial intelligence; professionalism and ethics in technological development.

Proposed Assessment: Team Project Report (50 per cent); Individual Essay 1200 words (30 per cent); Group Presentation (10 per cent); In-class Reflective Response (5 per cent)

Introduction to Materials ENGN1215 (6 units) A

First year course
Semester 2

Coordinator: Dr A. Lowe

Prerequisites: Admission to the BE degree course, the BSEng degree course or approval of Head of Engineering.

Syllabus: Introduction to materials science for structural, electrical, magnetic, and optical engineering applications. Atomic bonding, atomic basis of physical and chemical properties. The crystalline state; crystal structures and imperfections. The amorphous state; structure of metallic, inorganic and organic glasses. Multiphase materials, phase rule, binary phase diagrams of iron-carbon, aluminium-copper and ceramic examples. Kinetics of nucleation and crystal growth, atomic diffusion. Microstructures, TTT diagrams, heat treatment, hardening. Magnetism, hard and soft magnets, ceramic magnets. Electronic structure of solids; electronic conductivity,

piezo- and pyro-electricity, solar cells. Materials in optical fibres, transparency, dispersion and IR absorption. Environmental degradation and corrosion of materials.

Proposed Assessment: Materials selection exercise (15 per cent); Essays and problem sets (20 per cent); Quizzes (30 per cent); Final Exam (35 per cent)

Electromechanical Technologies ENGN1221 (6 units)

First year course
Semester 2

Coordinator: Dr H. Jones, Dr Z. Stachurski

Prerequisites: MATH1013 (or MATH1115) and PHYS1101

Syllabus: This course introduces the fundamentals of electrical, mechanical and electromechanical systems. Practical laboratory sessions to help students develop and integrate theoretical knowledge, physical applications and practical skills form a substantial part of the course. Modeling and design skills are developed through group project activities. The laboratory and project work continue the process of developing teamwork skills and graphical representation skills, including graphical presentation of experimental data.

Electrical topics include: Resistors, capacitors, inductors; breadboards and simple circuit testing; voltmeter and oscilloscope operation; Kirchoff's laws; series and parallel circuits; Thevenin and Norton Equivalent circuits; loop and nodal analysis of circuits; transient and phasor analysis of RC and RL circuits; laboratory technique (including notebook keeping); laboratory reporting and written technical communication; writing in a group.

Mechanical topics include: forces in planar and spatial rigid bodies, equivalent force systems, static equilibrium, static indeterminacy and friction.

Proposed Assessment: Statics section = Balsa Bridge Design Exercise (16 per cent); two Assignments (8 per cent); Final Exam (26 per cent)
Electro section = two Quizzes (32 per cent); Lab Notebook (8 per cent); Lab Report (10 per cent)

Research and Development Scholars Program 1 ENGN1900 (6 units)

First year course
Semester 1, Semester 2, Summer Session

Coordinator: Dr J. Kim

Syllabus: This course is taken with the approval of the R&D Scholars Program Coordinator and is subject to appropriate supervision being available. Research projects are available in the Faculty and also in the Research Schools of the ANU. Research projects require approval by the Head of the Department of Engineering.

Proposed Assessment: Written details of the assessment are approved by the Head of the Department of Engineering on the recommendation of the R&D Scholars Program Coordinator and given in writing to the student at the start of the period of study for the course.

Requisites: Acceptance into the Research and Development Scholars Program

Electronic Circuits ENGN2211 (6 units) B

Later year course
Semester 1

Coordinator: Dr S. Durrani

Prerequisites: ENGN1221

Syllabus: This course introduces the analysis and design of fundamental analogue electronic and introductory digital electronic circuits. It also provides an understanding of the basic properties and applications of different electronic devices (diodes, bipolar junction and field effect transistors). The primary aim is to provide a solid foundation for students in the field of electrical engineering.

Specific topics include:
- Electric Circuit Analysis: first order RC and RL circuits, second order RLC circuits
- Diodes: Basic diode concepts and diode circuit models, applications (rectifier and wave shaping circuits)
- Bipolar Junction Transistors: Basic BJT concepts and circuit models, BJT Amplifiers (bias circuits, small-signal and large-signal equivalent circuits)
- Field Effect Transistors: Basic FET concepts (NMOS and PMOS), FET circuit models and applications
- Introduction to Operational Amplifiers: Ideal op-amp, Basic Op-amp configurations, First order active filters (low-pass and high pass)
- Introduction to Digital Electronics: Number systems, Boolean algebra, Logic gates, Combinational logic circuits, Karnaugh maps.

PSPICE is used extensively in the analysis and simulation.

Proposed Assessment: Laboratories; (30 per cent); Mid Semester Exam (20 per cent); Final Exam (50 per cent)

Mechanics of Materials ENGN2214 (6 units) B

Later year course
Semester 1

Coordinator: Dr S. Kalyanasundaram

Prerequisites: ENGN1221

Syllabus: This course introduces the mechanical properties of materials, focusing on their importance for the design of structures, mechanical systems and manufacturing systems. Small design exercises integrate design throughout the curriculum. The course also includes an introduction to finite element modelling of mechanical structures and manufacturing processes.

Specific topics include: Hooke's law for isotropic materials, true stress/strain and engineering stress/strain; mechanical properties of materials and testing methods, Young's modulus, tensile and compressive strength, fracture and yield strength, hardness and ductility. Operation of the universal testing machine, hardness tester and impact tester; creep testing and measurement of activation energy for creep; analysis of stress and strain in statically determinant structures; beam under simple tension, compression, torsion and pure bending; angle of twist of a circular shaft under torsion; stress distribution in a thin-walled pressure vessel; transformation of stress and strain using Mohr's circle; principal stresses and maximum sheer stresses; mechanisms of fracture and fatigue; energy methods

in deformation; buckling. Other concepts developed include 3D stress-strain transformation, column buckling, beam deflection and energy methods.

Proposed Assessment: Problem Sets (20 per cent); Design (20 per cent); Final Exam (60 per cent)

System Dynamics
ENGN2221 (6 units)

Later year course
Semester 2

Coordinator: Dr J. Kim

Prerequisites: MATH1014

Syllabus: System dynamics is the study of the response of mechanical and electromechanical systems with changing time. The concepts learned in this unit can be used in a number of engineering disciplines including robotics, control system theory, dynamic response of mechanical, aerospace and marine structural components, manufacturing problems, biomedical engineering and interaction between electrical and mechanical systems. Several examples/design problems will be given to illustrate the principles of dynamics. The emphasis of this course will be on rigid body dynamics, electromechanical systems and computer aided design. The topics covered include kinematics of dynamics systemsmomentum formulation for system of particles, variational formulation for system of particles, dynamics of systems containing rigid bodies and dynamics of electrical and electromechanical systems.

Proposed Assessment: Problem Sets (20 per cent); Laboratory Work (5 per cent); Group Project (20 per cent); Final Exam (55 per cent)

Thermal Energy Systems
ENGN2222 (6 units) B

Later year course
Semester 2

Coordinator: Dr. K. Lovegrove

Prerequisites: PHYS1101

Syllabus: Energy systems are of major importance in society and are a significant engineering research activity at ANU. This course emphasises a systems approach to engineering, integrating technical fundamentals with social and environmental issues through site visits and case studies of energy systems. Engineering science fundamentals include the first law of thermodynamics and heat transfer. The thermal performance of houses is used as a major systems theme for the course. The course also introduces the second law of thermodynamics, and fluid dynamics.

Proposed Assessment: House Thermal Analysis (20 per cent); Laboratory (15 per cent); Field Trip (5 per cent); Quiz (10 per cent); Final Exam (50 per cent)

Semiconductors
ENGN2224 (6 units) B

Later year course
Semester 2

Coordinator: Prof A. Blakers

Prerequisites: ENGN2211

Syllabus: This course introduces semiconductor physics, devices and technology. Physics topics comprise basic semiconductor physics, diodes, solar cells and transistors. Technology topics comprise oxidisation, diffusion, ion implantation, photolithography, film deposition, electrical interconnection, characterisation, packaging and process integration.

Proposed Assessment: Laboratories (10 per cent); Seminar (15 per cent); Quiz (15 per cent); Final Exam (60 per cent)

System Design
ENGN2225 (6 units)

Later year course
Semester 2

Coordinator: Dr P. Compston

Prerequisites: ENGN1211

Syllabus: This course aims to provide a framework for the interdisciplinary systems engineering program. It looks at the design of an engineering product or service from a systems engineering perspective and introduces methods and techniques required for a systems approach to design. This will require students to understand the concepts behind systems thinking, how to identify and define a system, how it responds to input changes and the effect of variation on the system. Through a series of lectures and group workshops students will discover the stages in the systems design process, how to carry out a requirements analysis for the system leading to a system specification and how those requirements are met through design synthesis and verification phases of the process. These requirements will be cascaded to sub-system requirements and component requirements, with emphasis placed on methods to partitioning of the sub-systems and the interaction between them. Use will be made of the generic systems design V model, trade off analysis techniques, quality function deployment approaches (QFD). The importance of modelling in the analysis of design alternatives will be covered involving the use of software tools such as MatLab and ProEngineer. Basic concepts in statistics will be introduced in order to analyse the effect of variability on design robustness. The concepts and techniques covered will be illustrated with example cases and applied to an ongoing systems design problem.

Proposed Assessment: Individual Report (15 per cent); Individual Design Assignment (15 per cent); Group Design Report (45 per cent); Final Exam (25 per cent)

Engineering Systems Analysis
ENGN2226 (6 units)

Later year course
Semester 1

Coordinator: Dr R. Mahony

Prerequisites: 12 units of MATH courses

Syllabus: Introduction to the systems approach; hard versus soft systems thinking; problem solving approaches; probabilistic approaches to systems analysis; statistical approaches to systems analysis. Various systems engineering approaches (calculus methods, critical path method, PERT/LOB, network flow analysis, linear programming, decision analysis, and queueing models - Markovian analysis of dynamic systems).

Proposed Assessment: Problem-based Tutorials (20 per cent), MATLAB Systems Analysis Laboratory (20 per cent), Final Exam (60 per cent)

Signal Processing
ENGN2228 (6 units)

Later year course
Semester 2

Coordinator: TBA

Prerequisites: ENGN2211 and ENGN2226

Incompatible: ENGN2223

Syllabus: Introduction to signals via RC circuits, step functions and impulse functions; impulse, frequency and step responses; Fourier analysis; linear time invariant systems; convolution; DTFT; line codes including power spectra; AM, FM, PM and phase locked loops; speech coding and delta modulation

Proposed Assessment: Written Assignments (30 per cent), Labs (30 per cent), Exams (40 per cent)

Research and Development Scholars Program 2
ENGN2900 (6 units)

Later year course
Semester 1, Semester 2, Summer Session

Coordinator: Dr J. Kim

Syllabus: This course is taken with the approval of the R&D Scholars Program Coordinator and is subject to appropriate supervision being available. Research projects are available in the Faculty and also in the Research Schools of the ANU. Research projects require approval by the Head of the Department of Engineering.

Proposed Assessment: Written details of the assessment are approved by the Head of the Department of Engineering on the recommendation of the R&D Scholars Program Coordinator and given in writing to the student at the start of the period of study for the course.

Requisites: Acceptance into the Research and Development Scholars Program

Practical Experience
ENGN3100 (0 unit)

Later year course
Semester 1, Semester 2

Coordinator: Dr K. Blackmore

Prerequisites: Completion of 48 units of study

Syllabus: Twelve weeks of suitable full-time employment, a requirement that applies to all BE degrees throughout Australia. The training has two purposes:

- to expose the student to the workplace and workplace issues (such as human and industrial relations, job organisation, maintenance, safety and environmental issues)
- to provide direct insight into professional engineering practice.

It is the student's responsibility to obtain the employment, although the Department of Engineering will assist in providing lists of people to contact.

As a general rule, the ideal would be four weeks in any sort of employment; four weeks in employment in a technical industry of some kind; and four weeks of work with engineering staff in an engineering environment (preferably working with professional engineers). Minor variations of this scheme may be acceptable, but at least a reasonable portion must be within an engineering environment.

Students are required to submit reports on their work experience and will satisfy the requirements when their portfolio is acceptable to the Head of Engineering.

Please refer to http://engnet.anu.edu.au/DEcourses/engn3100

Investment Decisions and Financial Systems
ENGN3211 (6 units)

Later Year Course
Semester 1

Coordinator: Dr J. Lee

Prerequisites: 12 units of 1000-series mathematics or statistics courses

Incompatible: BUSN1002, ASHI2021, ASHI2041, POLS1004, ECHI1105, ECHI1106, ASHI2023

Syllabus: One segment of the course will provide an introduction to the economic principles which underly decisions on private and public investment. These principles will be used to analyse relevant issues such as choice of capacity, pollution, public goods, safety standards and patents. Mathematical models will be used to inform the analysis. The second of the two segments focuses on the recording of transactions and the generation of financial reports. Practical problems are included to motivate the lectures/workshops and provide some insight into practical accounting issues.

Proposed Assessment: Quizzes (30 per cent); Exams (70 per cent)

Manufacturing Technologies
ENGN3212 (6 units)

Later year course
Semester 1

Coordinator: Dr P. Compston

Prerequisites: ENGN1215

Syllabus: This subject introduces the elements of a number of basic manufacturing processes and associated materials behaviour required in the design of mechanical devices. The configuration of machine tools is discussed in the context of orthogonal cutting and the basics of materials deformation processes, including, casting, forging, sheet-metal forming and polymer processing, are developed. Graphical representation techniques include sectioning, conventional representations, dimensioning, tolerancing, and further develops computer-aided design skills (CAD). Also included are 24 hours of practical workshop experience with assorted hand and machine tools to produce a manufactured article.

Proposed Assessment: Reports (20 per cent); Quiz (10 per cent); Group Design Exercise (40 per cent); Final Exam (30 per cent)

Digital Systems and Microprocessors ENGN3213 (6 units)

Later year course
Semester 2

Coordinator: Dr K. Weber

Prerequisites: ENGN2211 or 12 units B-Group COMP courses including COMP2300

Syllabus: This course provides an introduction to the analysis and design of digital systems and microprocessors. Review of combinational logic analysis and design. Systematic design methods. Analysis and design of synchronous sequential machines. Computer aided design and programming of digital electronic circuits using VHDL hardware description language and FPGA programmable logic devices. Microprocessor and microcomputer architecture. Microprocessor devices, their architecture and instruction sets. Hardware aspects of instruction execution. Assembler and C programming. Input/output, bus interfacing, interrupts. Co-design of digital hardware and microprocessor systems.

Proposed Assessment: Hardware Labs (30 per cent); Tutorials (10 per cent); Mid-Semester test (15 per cent); Final Exam (45 per cent)

Communications Technologies ENGN3215 (6 units)

Later year course
Semester 1

Coordinator: Dr H. Jones

Prerequisites: ENGN1211 and ENGN2226

Incompatible: ENGN3214

Syllabus: Historical perspective on telecommunications; overview of networks eg architecture, protocols and cellular; telephone systems such as PSTN, ISDN and TDM; Cellular mobile technology; wired computer networks (ethernet, OSI, switched network topologies etc.); Queueing theory; wireless computer networks such as Bluetooth and Wifi; ad hoc networks.

Proposed Assessment: Written Assignments (30 per cent), Labs (30 per cent), Exams (40 per cent)

Engineering Management ENGN3221 (6 units)

Later year course
Semester 2

Coordinator: Prof M. Cardew-Hall

Prerequisites: ENGN3211 (or COMM1020 or ASHY2012 or ASHY2014 or POLS1004 or ECHI1102) and ENGN1211

Syllabus: Engineering management introduces students to a range of people and technical orientated issues in management. Students are provided with concrete strategies for addressing these issues within practical, relevant and contemporary contexts.

The course comprises the following topics:

- Project Management - this topic engages almost half the course. Tools and techniques appropriate to management of both generic and software-specific projects are introduced.
- Business Environments - a systems thinking approach to understanding the internal and external environments for an organisation will be used to set the stage for work in business planning and management.
- Business Planning - students will gain practical experience of new venture planning.
- Ethics and Corporate Responsibility - individual ethics and ethical culture - structured approach to arrive a a normative conclusion.
- Planning and Strategic management - management decision-making; risk management.
- Organisational Design - alignment with corporate goals; staffing and people management.
- Leadership - motivating, influencing, communicating, managing groups and teams.
- Control in Organisations and change management
- Quality - definition, value and scope. Quality management techniques.
- Understanding Variation - the truth behind the management report, statistical process control (SPC) for managers.

Proposed Assessment: Individual Project Plan (25 per cent); Group Business Plan (25 per cent weighted as 15 per cent for the document; 10 per cent for a concept presentation and minutes of the first meeting); Final Exam (50 per cent)

Manufacturing Systems ENGN3222 (6 units)

Later year course
Semester 2

Coordinator: Dr P. Compston

Prerequisites: ENGN3212 and ENGN2226

Syllabus: This course develops a comprehensive overview of the analysis, design and technology of manufacturing systems, with the emphasis on production systems. Technologies considered include machine configuration and control, CNC technology, cellular and flexible manufacturing systems, robotics and automation, and an introduction to scheduling, operations research and process optimisation.

Using a case study approach, the course will introduce basic statistical quality control, including probability distributions, regression analysis, variance, central limit theorem, significance and hypothesis testing. This leads on to statistical quality control and the design of experiments for manufacturing systems. An introduction to hard and flexible automation systems, and the arguments for both.

Proposed Assessment: Simulation Exercise (10 per cent); Quiz (20 per cent); Case Study (40 per cent); Quiz (30 per cent)

Control Systems ENGN3223 (6 units)

Later year course
Semester 1

Coordinator: Dr J. Kim

Prerequisites: ENGN2223 or MATH2305

Syllabus: Introduction to control system analysis, identification, design and implementation. Laboratory work involves real-time identification and control of a range of electrical and electromechanical systems. Topics covered include: History of

Control. Representation of linear dynamics and properties of systems. Time domain specifications of performance. Discrete-time systems and the Z-transform. Closed loop and open loop control. Classical PID controllers. Steady state errors and system type. Stability and robustness. Discrete-time systems and design by emulation. Root locus analysis and design of continuous and discrete systems. Frequency response of continuous and discrete time systems. Nyquist plots and stability margins. Lead-Lag control design. Sensitivity and robustness in the frequency domain. Practical design issues approaches.

Proposed Assessment: Problem Sheets (5 per cent); Quiz (10 per cent); Laboratories (30 per cent); Final Exam (55 per cent)

Energy Systems Engineering ENGN3224 (6 units) C

Later year course
Semester 1

Coordinator: Dr M. Dennis

Prerequisites: ENGN2222

Syllabus: This course continues the study of energy systems and related environmental issues. The course begins with a revision of the first law of thermodynamics and heat transfer. It continues with a thorough examination of fluid dynamics and the second law of thermodynamics, emphasising energy analysis. Also included are quantitative economic and environmental analysis of design choices and thermo-economic optimisation (energy systems engineering). Generation of electric power is used as a systems theme for the course.

Proposed Assessment: Laboratories (30 per cent); Field Trip (5 per cent); Quizzes (15 per cent); Final Exam (50 per cent)

Digital Communications ENGN3226 (6 units) B

Later year course
Semester 2

Coordinator: Dr H. Jones

Prerequisites: ENGN3214 or ENGN3215

Corequisites: ENGN2223 or ENGN2228

Syllabus: Signal Basics: Random processes; Complex envelope representation of bandpass signals and systems; Sampling theory; Nyquist criterion.
System Concepts: Structure and definition of digital communication systems.
Transmitter: Basic Digital Modulation Techniques: ASK; MPSK; FSK; MSK; Performance analysis; Power spectra calculation; Coding basics: Fundamentals of information theory; Linear block codes; Convolutional codes.
Channel: Bandlimited channels; Equalisation. Receivers: Matched filter; Correlator; Digital detection: Maximum a posteriori detection (MAP); Maximum likelihood sequence detection (MLSD); Viterbi algorithm

Proposed Assessment: Assignments (20 per cent); Quiz (5 per cent); Laboratories (5 per cent); Final Exam (70 per cent)

Analogue Electronics ENGN3227 (6 units)

Later year course
Semester 2
Coordinator: Dr S. Durrani
Prerequisites: ENGN2211

Syllabus: This course aims to develop an understanding of the fundamental principles of analysis, design and implementation of analogue electronic circuits. The course focuses on analogue electronic circuits based on the operational amplifier and related integrated circuits.

Specific topics include:
1. Basic op-amp circuits: Op-amp characteristics, differential amplifer, comparators.
2. Communication circuits: Sampling circuits, ADC and DAC converters, oscillators and timer circuits.
3. Active op-amp filter circuits: Filter responses types (low-pass, high-pass, band stop and band-pass), filter design methods (Butterworth response), Sallen-Key filter implementations.
4. Special purpose op-amp circuits: Voltage regulators, instrumentation and measurement amplifiers, isolation amplifiers, simple modulation circuits.
5. Multistage power amplifier circuits: Classification (A, B, C).

Application areas discussed include telecommunications and control systems. MATLAB and PSPICE are used extensively in the design and implementation.

Proposed Assessment: Laboratories (20 per cent); Project (25 per cent); Final Exam (55 per cent)

Research and Development Scholars Program 3 ENGN3900 (6 units)

Later year course
Semester 1, Semester 2, Summer Session

Coordinator: Dr J. Kim

Syllabus: This course is taken with the approval of the R&D Scholars Program Coordinator and is subject to appropriate supervision being available. Research projects are available in the Faculty and also in the Research Schools of the ANU. Research projects require approval by the Head of the Department of Engineering.

Proposed Assessment: Written details of the assessment are approved by the Head of the Department of Engineering on the recommendation of the R&D Scholars Program Coordinator and given in writing to the student at the start of the period of study for the course.

Requisites: Acceptance into the Research and Development Scholars Program

Individual Project ENGN4200 (6 units)

Later year course
Semester 1, Semester 2, Summer Session
Students must enrol in Semester 1 and 2.

Coordinator: Dr H. Jones

Prerequisites: ENGN3221 The normal expectation is that students enrolling are completing their final year.

Syllabus: Students undertake an individual engineering project, with supervision.

Students are encouraged to put forward their own ideas for the individual project, or they may select a project from a range of ideas offered by researchers across ANU. If the student initiates an idea, he or she must find a supervisor to accept the project. Students and their respective supervisors must jointly sign-off on acceptance of the project concept as part of the project registration process.

Project selection is normally completed as part of ENGN3221 - Engineering Management, by week three of the semester prior to commencement of ENGN4200. The planning phase of the project is integrated into the Engineering Management course, providing a deliberate foundation for the project execution phase that is ENGN4200.

Students are expected to manage all aspects of their individual project from conceptualization through the planning phase to the monitoring and control of the project performance and the ultimate achievement of the following deliverables:

- a thesis documenting the project
- a seminar describing the project
- a poster illustrating the project.

Proposed Assessment: Individual Project Thesis (75 per cent); Seminar (15 per cent); Project Notebook (5 per cent); Extended abstract (5 per cent)

Systems Engineering Project ENGN4221 (6 units)

Later year course
Semester 1

Coordinator: Prof M. Cardew-Hall

Prerequisites: ENGN3221. The normal expectation is that students enrolling are completing their final year.

Syllabus: This course is designed to mimic an industrial design problem as closely as practical in a university setting. Students are assigned to teams and given an ill-defined problem statement. From the problem statement, the students are responsible for developing the full set of requirements and key performance indicators to guide the design. The students then proceed through a systems design process including conceptual design, sub-system requirements, and quantitative tradeoff analyses, using the full range of engineering science and professional skills developed during the degree course. The course emphasises teamwork (both team leadership and membership), communication skills (formal and informal, written and oral), and team and personal management and a professional approach to engineering design.

Proposed Assessment: Planning Report (10 per cent); Requirements Report (15 per cent) Design Report (30 per cent); Poster (10 per cent); Oral (15 per cent); Final Exam (20 per cent)

System Theory ENGN4226 (6 units)

Later year course
Semester 1

Coordinator: TBA

Prerequisites: Departmental consent required to enrol in this course

Syllabus: Graduate level system theory course with "typical" contents along the lines of: Linear theory: internal and external descriptions, solution of state equations, controllability and observability, realizations, pole assignment, observers, modern compensator design. Disturbance localization and decoupling. Least-squares control. Least-squares estimation; Kalman filters; smoothing. The separation theorem; LQG compensator design. Selected additional topics in non-linear system theory.

Proposed Assessment: Assignments (50 per cent); Oral Examination (50 per cent)

Fibre Optics Communications Systems ENGN4513 (6 units) C

Later year course
Semester 1

Coordinator: Prof J. Love

Prerequisites: PHYS1201 (PHYS2016 and PHYS2017 are also recommended)

Incompatible: PHYS3060, PHYS3050 and PHYS3051

Syllabus: Optical fibres now constitute the backbone of the worlds long-distance telecommunications systems and are also being used increasingly in other areas, such as sensing, biophotonics, automotive, etc. The course sets out to provide a basic understanding of optical transmission systems concentrating on light propagation along fibres and light processing using fibre- and planar waveguide-based devises. Light propagation includes: modal propagation and Maxwell's equations; ray tracing, Snell's and Fesnel's Laws; single-mode, multi-mode and special fibres; pulse propagation and dispersions; nonlinear effects; fibre and planar waveguide fabrication; analytical and numerical techniques; birefringence and bend loss. Light processing devices include: couplers and splitters; gratings and arrayed waveguide gratings; Mach-Zehnder and multimode interferometers; optical amplifiers and attenuators; polarisers. Laboratory work covers both hands-on fibre-based experiments and numerical simulations.

Proposed Assessment: Examination (50 per cent); Laboratories (30 per cent); Assignments (20 per cent)

Energy Resources and Renewable Technologies ENGN4516 (6 units)

Later year course
Semester 2

Coordinator: Prof A. Cuevas

Prerequisites: ENGN3211 (or equivalent) or approval of Head of Engineering

Syllabus: The introductory phase of this course is dedicated to the global aspects of energy production and demand in the world, with particular attention to the environmental and social aspects of energy usage, including climate change. Australia's energy resources and consumption patterns are specifically addressed. The rest of the course is dedicated to studying the main renewable energy technologies; biomass, geothermal, hydroelectric, solar thermal, photovoltaic, and wind, including technical and economical issues. Experts in different aspects of energy production and use give invited lectures on selected topics. Objectives of the unit include gaining reliable information on available energy resources and their associated

environmental and climatological impacts, and to understand the potential and limitations of renewable energy technologies.

Proposed Assessment: Oral Presentation (40 per cent); Coursework (20 per cent); Final Exam (40 per cent)

Offered in Semester 2 in odd years.

Special Topics in Engineering I ENGN4520 (6 units)

Later year course
Semester 1, Semester 2

Prerequisites: Written approval of the Head of Engineering

Syllabus: Within this course, topics may be offered from time to time to take advantage of the expertise of visitors to the University and academic staff in the IAS. Admission to the course is at the discretion of the Head of Engineering.

Special Topics in Engineering 2 ENGN4521 (6 units)

Later year course
Semester 1, Semester 2

Prerequisites: Written approval of the Head of Engineering

Syllabus: Within this course, topics may be offered from time to time to take advantage of the expertise of visitors to the University and academic staff in the IAS. Admission to the course is at the discretion of the Head of Engineering.

Special Topics in Engineering 3 ENGN4522 (6 units)

Later year course
Semester 1, Semester 2

Prerequisites: Written approval of the Head of Engineering

Syllabus: Within this course, topics may be offered from time to time to take advantage of the expertise of visitors to the University and academic staff in the IAS. Admission to the course is at the discretion of the Head of Engineering.

Special Topics in Engineering 4 ENGN4523 (6 units)

Later year course
Semester 1, Semester 2

Prerequisites: Written approval of the Head of Engineering

Syllabus: Within this course, topics may be offered from time to time to take advantage of the expertise of visitors to the University and academic staff in the IAS. Admission to the course is at the discretion of the Head of Engineering.

Biomedical Engineering ENGN4533 (6 units)

Later year course
Semester 1

Coordinator: Dr M. Dwyer, Mr M. Flood

Prerequisites: ENGN3223

Syllabus: This course aims to place biomedical engineering in a systems context and to introduce anatomy, physiology, biocompatibility, biological signal analysis, biomaterials, medical radiation, patient safety and medical device regulation using a case-study approach.

Proposed Assessment: Laboratories, Essays and Final Examination

Offered in Semester 1 in odd years.

Telecommunication Networks ENGN4535 (6 units)

Later year course
Semester 1

Coordinator: Mr R. Edwards

Prerequisites: ENGN3226

Incompatible: COMP3310

Syllabus: The aim of this course is to provide an introduction to communication networks and systems. Topics include: communication network principles, network topologies and circuits, switching. Network architectures and protocols. Multiplexing schemes. Elementary queuing theory. Network standards and management. ISDN and ATM architectures. Communications regulations and standards.

Proposed Assessment: Laboratories (12 per cent); Quizzes (8 per cent); Assignment (10 per cent); Programming Assignment (20 per cent); Final Exam (50 per cent)

Managing for Competitive Advantage ENGN4544 (6 units)

Later year course
Semester 1

Coordinator: Dr M. Rossiter

Prerequisites: 24 units of later-year Engineering courses

Syllabus: The course has two main themes that support the goal of Managing for Competitive Advantage:

1. Crafting Strategy - (Turning Vision into Method) Knowing where you want your organisation to go is a significant achievement, but constructing this vision is only part of the challenge. Being able to craft, implement and manage the strategy by which the vision is realised, is arguably a much tougher task. The theme of crafting strategy will build throughout the course - from understanding the environment through designing the vision to resourcing the strategic plans. A significant team assessment piece will ensure students experience practical application (and the associated difficulties) of crafting strategy.
2. Entrepreneurship and Innovation Management - These topics will be investigated through a series of case-studies and lectures that investigate:
   - the current state of competitive play (locally, nationally and internationally)
   - competitive opportunities (methods of analysis)
   - entrepreneurship (what it takes/support avenues)
   - innovation (creativity + commercialisation. A particular focus of this theme will be to understand the impact of technological innovation, a cradle-to-grave approach that is generally termed 'whole system engineering'.

Proposed Assessment: Team Exercises (40 per cent), Case Study Reports (20 per cent), Final Exam (40 per cent)

Offered in Semester 1 in odd years.

Radiofrequency Engineering ENGN4545 (6 units)

Later year course
Semester 1

Coordinator: Dr G. Borg

Prerequisites: ENGN2228 or ENGN2223

Corequisites: ENGN3215

Incompatible: ENGN4520 or ENGN4521

Syllabus: Introductory topics including electromagnetism, field theory, wave motion and basic electrical concepts; networks, S- and Y-parameters; emitter amplifiers and oscillators; antennas and antenna arrays; transformers and flux minimization; radio propagation; free space propagation and satellite links

Proposed Assessment: Written Assignments (30 per cent), Labs (30 per cent), Exams (40 per cent)

Engineering Materials ENGN4601 (6 units) C

Later year course
Semester 1

Coordinator: Dr Z. Stachurski

Prerequisites: ENGN2214

Syllabus: This subject develops a knowledge of the variety of engineering materials, their properties and characteristics. Equilibrium phase diagrams and kinetic TTT diagrams for predicting microstructure in materials. Properties of alloys (steels, aluminium, magnesium, titanium, and other non-ferrous metals). Ceramic materials: ceramics and glasses; forming of ceramics; structure and defects in ceramics. Characterisation, structure and properties of polymers; polymer processing. Rubber elasticity. Strengthening and toughening mechanisms for materials. Fracture mechanics. Characterisation methods (mechanical and microstructural). Biomaterials and nano-materials.Stereoscopy, surfaces and spatial distributions, analytical and visualisation software. Focal plane, Fraunhofer diffraction, Fourier transform. Reflected optical microscopy, SEM, AFM. Phase identification. Transmission optical microscopy, TEM, EP

Proposed Assessment: Essay (35 per cent); Laboratories (30 per cent); Final Exam (35 per cent)

Offered in Semester 1 in odd years.

Engineering Law ENGN4611 (6 units)

Later year course
Semester 2

Coordinator: Mr G. Tamsitt

Prerequisites: ENGN1211

Incompatible: ENGN4211, BUSN1101, ASHI2268, POLS1002, ECHI1105, ECHI1106

Syllabus: Sources and classification of law; professional engineering legislation, code of ethics, registration and discipline; negligence; contract law; employment law; patent law and submission; environmental law.

Introduction to intellectual property. What is intellectual property? Enforcement of rights. Copyright, trademarks, designs and patents. Intellectual property management.

Commercialising intellectual property. University policy and practice and students' rights. Legal aspects of the Internet and electronic commerce.

Proposed Assessment: Coursework and Final Examination

Digital Signal Processing and Control ENGN4612 (6 units)

Later year course
Semester 2

Coordinator: Prof M.James

Prerequisites: ENGN2223

Syllabus: This course aims to develop an understanding of discrete time signal processing algorithms, technology and applications. Specification and properties of frequency-selective filters (low-pass, high-pass and band-pass filters, group delay, generalised linear phase, minimum phase). Fast Fourier transform. Finite impulse response filter design techniques, computer-aided filter design. Implementation of digital filters, analog-to-digital and digital-to-analog converters and DSP chips. Applications areas discussed include digital audio and video signal processing.

Proposed Assessment: Laboratories (20 per cent); Quizzes (40 per cent); Research Report (40 per cent)

Offered in Semester 2 in odd years.

Robotics ENGN4627 (6 units)

Later year course
Semester 2

Coordinator: Dr R.Mahony

Prerequisites: ENGN2221

Syllabus: This course provides an introduction to the mechanics of robots and spatial mechanics. The theoretical focus is on kinematics and dynamics of robotic manipulators and control design for non-linear mechanical systems. Topics covered include: homogeneous coordinate transformations, representation of spatial orientation, Denavit-Hartenberg link descriptions, forward and inverse kinematics, Jacobian rate and static force relations, singularities, recursive Newton-Euler iteration and Euler-Lagrange derivations of manipulator dynamics, trajectory planning, linear control, computed torque control, passivity based control. The applied component of the course includes experimental work with robotic manipulators and a mechatronic design and build project.

Proposed Assessment: Laboratories (50 per cent); Final Exam (50 per cent)

Offered in Semester 2 in odd years.

Research and Development Scholars Program 4 ENGN4900 (6 units)

Later year course
Semester 1, Semester 2, Summer Session

Coordinator: Dr J. Kim

Syllabus: This course is taken with the approval of the R&D Scholars Program Coordinator and is subject to appropriate supervision being available. Research projects are available in the Faculty and also in the Research Schools of the ANU. Research projects require approval by the Head of the Department of Engineering.

Proposed Assessment: Written details of the assessment are approved by the Head of the Department of Engineering on the recommendation of the R&D Scholars Program Coordinator and given in writing to the student at the start of the period of study for the course.

Requisites: Acceptance into the Research and Development Scholars Program

Exchange Program for Engineering and Inf Technology Students ENGN5920 (6 - 24 units)

Later year course
Semester 1, Semester 2

Syllabus: Students enrol in this course when they have been approved to participate in formal exchange with one of The Australian National University's exchange partners. Please contact your program authority for further details regarding exchanges.

Courses not offered

The following courses will not be offered in 2007. Most will be offered in subsequent years. For the most up-to-date information on when courses will be offered, please go to Study@ANU at http://info.anu.edu.au/studyat or contact the College inolved.

Operating Systems Implementation COMP3300 (6 units) C

Prerequisites: COMP2300 and COMP2310; and 6 units of 2000-level MATH courses or COMP2600

High Performance Scientific Computation COMP3320 (6 units) C

Prerequisites: 12 units of 2000-level COMP courses including COMP2100 or COMP2500 or COMP2300; and 6 units of 2000-level MATH courses or COMP2600

Advanced Databases and Data Mining COMP3420 (6 units) C

Prerequisites: COMP1100 or COMP2720; COMP2400; 6 units of 2000-level IT courses; and 6 units of 1000-level MATH/STAT courses.

Network Security COMP4320 (6 units) C

Prerequisites: 12 units of 3000-level COMP courses including COMP3310, or COMP3400, or COMP3410.

Advanced Algorithms COMP4600 (6 units) C

Prerequisites: 24 units of 3000-level COMP courses including COMP3600

Microelectric and Photonic Technology ENGN4507 (6 units) C

Prerequisites: ENGN2224

Composite Materials ENGN4511 (6 units) C

Prerequisites: ENGN2214

Semiconductor and Optoelectronic Devices ENGN4519 (6 units) C

Prerequisites: ENGN2211

Solar Energy Technologies ENGN4524 (6 units) C

Prerequisites: ENGN2224
Corequisites: ENGN3224

Computer Vision ENGN4528 (6 units)

Prerequisites: ENGN2226

Engineering and Public Policy ENGN4530 (6 units)

Prerequisites: ENGN3221 and ENGN1211

Logistics and Operations Research ENGN4532 (6 units)

Prerequisites: ENGN2226

Wireless Communications ENGN4536 (6 units)

Prerequisites: ENGN2228 and ENGN3215 or ENGN3214
Corequisites: ENGN3226

Finite Element Analysis ENGN4615 (6 units)

Prerequisites: ENGN2214

Power Electronics ENGN4625 (6 units)

Prerequisites: ENGN2211
Corequisites: ENGN3227