Chapter 5

ANU College of Engineering & Computer Science

ANU College of Engineering & Computer Science

Contents

Introduction

The Faculty of Engineering and Information Technology, a constituent part of the ANU College of Engineering and Computer Science, represents the commitment of The Australian National University to developments in engineering and computing. The Faculty has over 1,200 students enrolled in undergraduate and postgraduate degree programs including over 300 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@cecs.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)
- Bachelor of Engineering (Research and Development)
- 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 2008.

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 (Research and Development)	4
Bachelor of Engineering	4
Bachelor of Software Engineering	4
Bachelor of Information Technology	3
Bachelor of Engineering Research and Development/Bachelor of Science	5
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 Andres Cuevas,

M Eng, PhD, *Univ Politecnica Madrid*,
Head of Department

Whereas the study of science is driven by a desire to simply understand, and perhaps predict natural phenomena, engineering is the art and practice of harnessing this knowledge for the benefit of humanity. The roots of engineering practice are traceable to the earliest societies and their development of new technology such as tools, huts and pottery. The development of some technologies, such as the advent of new materials like bronze and iron, were so fundamental in the progress of humanity that whole ages of civilisation are named after them. The progress of engineering depends on the ingenuity, invention, specialist knowledge, and teamwork of individuals involved in development of technological solutions to the challenges facing the society they live in — skills that remain essential to this day, and lie at the core of the ANU engineering degree. An engineer should be an innovative and ingenious person with a natural interest in understanding physical systems coupled with a desire to work for and benefit society as a whole. The Department of Engineering at ANU provides a degree that is unique in the southern hemisphere; one that emphasises the innovative design skills and holistic systems understanding required in a modern engineers role, while also providing specialist technical expertise across a wide range of disciplines. The design focus and interdisciplinary technical foundation is what makes the ANU degree a 'systems engineering' degree; that is, a degree whose graduates are trained to become key members in teams of engineers that provide complete or 'whole system' solutions, rather than simply individuals that contribute sub-system development to someone else's project. The ANU engineering degree puts our graduates at the forefront of national and international engineers.

Engineers have a responsibility to help solve the world's 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' solar concentrator is the largest of its kind in the world. The Department holds several world records for solar cell efficiency. It is also developing a unique thermochemical solar energy system. The solar groups have strong links with industry and several technologies are being commercialised.

Engineering is vital to the productivity of a nation's industry. 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. The Department's telecommunications activities involve both practical and theoretical components, focusing 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 the major BushLAN project, whose purpose is to bring high-speed internet access to remote areas using VHF frequencies.

A 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 department is at the forefront of world research in developing new robotic aerial vehicles, and sophisticated sensor systems that will enhance the safety of passenger vehicles. The systems 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), a one year Masters of Engineering and a two year Masters of Engineering with honours. There are also Masters by research and PhD degree programs available, with projects ranging from highly academic through to heavily industry-based. Undergraduate scholarship support is available for high achieving students.

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 Power. Graduates are employed in a wide range of organisations and companies both in Australia and overseas. The Department is host to the ANU Centre for the Science and Engineering of Materials and to Future Materials and the Centre for Sustainable Energy Systems.

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 (Research & Development)

(Academic Program: 4714 | Academic Plan: 4714HBENG)

Duration: 4 years full-time

Minimum: 192 units

CRICOS Code: 060542F

This program is specifically designed for students who have an interest in undertaking research and development in either industry or an academic environment. The program combines the unique systems engineering focus of the ANU Bachelor of Engineering degree with a more project based, research intensive study mode, also unique to ANU. Students undertake a number of research projects in different research groups at ANU or associated industry in order to obtain a flavour of research in the discipline areas and develop independent research skills.

Students also complete an engineering specialisation which will complement the R&D specialisation and produce a Professional Engineering graduate who has the skills, knowledge and capability to go onto advanced research programs.

Scholarships Scholarships valued at $5,000-$10,000 pa are available to students with a UAI over 99 who enrol in this program.

Bonus points Students may apply to the ANU College of Engineering and Computer Science to be awarded up to two bonus points on the basis of capacity to succeed in a research-based undergraduate degree as demonstrated by success in Olympiads or similar relevant competitions etc.

Program requirements

The Bachelor of Engineering (Research and Development) is a four year full time program with graduates obtaining a Bachelor of Engineering with Honours. Students will have to complete 192 units including:

1. An Engineering core major consisting of 42 units of the following professional development courses:

   ENGN1211 Discovering Engineering

   ENGN2225 Systems Design

   ENGN2226 Engineering Systems Analysis

   ENGN3211 Investment Decision and Financial Systems

   ENGN3221 Engineering Management

   ENGN3100 Practical Experience (0 unit value)

   ENGN4221 Systems Engineering Project

   ENGN4611 Engineering Law
2. 48 units of engineering discipline courses from the Schedule of Engineering Discipline Courses in the Undergraduate Handbook including ENGN1215 Introduction to Materials and ENGN1221 Electromechanical Technologies. This will include the requirements of at least one major listed under the Engineering Majors section of the Undergraduate Handbook
3. 18 units of mathematics being:

   MATH1115 Mathematics and Applications 1 Honours

   MATH1116 Mathematics and Applications 2 Honours

   MATH2305 Calculus and Differential Equations
4. 6 units of computing being:

   COMP1100 Introduction to Programming and Algorithms
5. 6 units of physics being: PHYS1101 Advanced Physics 1
6. 36 units of courses offered by the university (ie university electives) and the degree program may not contain more than 60 units of 1000-series courses.
7. A 42 unit R&D major made up of ENGN4221 Systems Engineering Project and 36 units of project based courses made up of 6 unit, 12 unit, 18 unit and 24 unit courses listed below and of which one must be at least 12 units. These can be taken in years 1,2,3 and 4 of the program.

   ENGN1706 R&D Project 1 (Methods) (6 units)

   ENGN2706 R&D Project (6 units)

   ENGN3706 R&D Project (6 units)

   ENGN4712 R&D Project (12 units)

   ENGN4718 R&D Project (18 units)

   ENGN4724 R&D Project (24 units)

Degree structure

Standard Bachelor of Engineering (Research and Development) recommended program pattern

	Semester 1	**Semester 2**
Year 1 48 units	ENGN1211 Discovering Engineering COMP1100 Introduction to Programming & Algorithms MATH1115 Mathematics & Applications 1 Honours PHYS1101 Advanced Physics I	ENGN1215 Introduction to Materials ENGN1221 Electromechanical Technologies ENGN1706 R&D Project 1 (Methods) MATH1116 Mathematics & Applications 2 Honours
Year 2 48 units	ENGN2226 Engineering Systems Analysis MATH2305 Calculus and Differential Equations COMP1100 Introduction to Programming and Algorithms R&D Project*	ENGN2225 System Design R&D Project* Engineering major University elective
Year 3 48 units	ENGN3211 Investment Decisions & Financial Systems Engineering major 2 x University elective	ENGN3221 Engineering Management R&D Project* Engineering major University elective
Year 4 48 units	ENGN4221 Systems Engn Project R&D Project* Engineering major University elective	ENGN4611 Engineering Law R&D Project* Engineering major

* R&D Projects: A number of R&D Project offerings are available in unit weighting and semester availability. Students should refer to Program Requirements above and discuss options with the Research & Development Convenor. If a R&D Project is not taken in a semester it may be replaced by an Engineering major or University Elective to meet the Program Requirements above.

The Bachelor of Engineering (Research & Development) degree with honours

Honours grades in the BE (R&D) 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 R&D Project results. To determine the global APM, the first year average mark is weighted by a factor 0.1, and the combined average of years 2, 3 and 4 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, MATH1115 Mathematics and Applications 1 Honours, MATH1116 Mathematics and Applications 2 Honours, PHYS1101 Advanced Physics I, and COMP1100 Introduction to Programming and Algorithms.

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 the courses relating to the R&D major, which are 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.

Combined Degrees

The BE (Research and Development) can be combined with the Bachelor of Science. This is a 5 year program comprising 240 units.

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 (BE) 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

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 2 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://cecs.anu.edu.au/students/future/undergrad/BEng

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 Algorithms (6 unit) and

   COMP1110 Introduction to Software Systems (6 unit) or

   COMP2750 Java Programming for New Media (6 unit)

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.

Students should note that all completed majors will be listed on their academic transcript.

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

Manufacturing and Management Systems Major		
ENGN1215	Introduction to Materials	6 unit
ENGN2214	Mechanics of Materials	6 unit
ENGN2221	Systems 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		
ENGN1215	Introduction to Materials	6 unit
ENGN2214	Mechanics of Materials	6 unit
ENGN2221	Systems 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		
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		
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		
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		
COMP1110	Foundations of Software Engineering	
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		
SRES1001 or SRES1007	Resources, Environment & Society or The Blue Planet	6 units
SRES2001	Human Ecology	6 units
	Five courses from the themes of Social Science, Global Change Science or Landscape Systems as approved by the School of Resources, Environment & Society	36 unit
TOTAL		42 units

Photonic Systems Major		
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

Degree Structure

Standard Bachelor of Engineering recommended program pattern

	Semester 1	Semester 2
Year 1 48 units	ENGN1211 Discovering Engineering MATH1013 Mathematics & Applications 1 PHYS1101 Advanced Physics I COMP1100 Introduction to Programming &tAlgorithms OR University Elective	ENGN1215 Introduction to Materials ENGN1221 Electromechanical Technologies MATH1014 Mathematics & 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 & Algorithms	ENGN2225 System Design Engineering major Engineering elective University elective OR COMP1110 Introduction to Software Systems
Year 3 ODD 48 unit	ENGN3211 Investment Decisions & 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 & 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

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 3 and 4. It is recommended that students finalise their elective choices and planned enrolment patterns for years 3 and 4 at the end of year 2 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 2, 3 and 4 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; or COMP2750 Java Programming for New Media.

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.

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 specialising 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 as well as 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 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 such as cryptography and abstract graph theory. Experimental computer science is a disciplined approach to discovering and improving new concepts such as the virtual machinery underlying Java. 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 finding it is likely to be as revolutionary as was the introduction of the web. Alternatively, the Bachelor of Philosophy (Honours), 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.

In Software Engineering, the Department of Computer Science aims to produce graduates with a professional education through 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 arts 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 Arts, or with the Bachelor of Laws programs.

The Department aims to produce graduates with a fundamental scientific education in the Bachelor of Science with a major in Computer Science. In this way, students can combine study of a Science subject with as much computing as they wish. The specialised Bachelor of Computational Science (Honours) program (described under the Faculty of Science entry) goes further and combines the study of computing and mathematics with their application to modelling in the physical sciences.

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 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.

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.

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

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 takenby students with no previous background in computing orinformation technology. COMP1710 and COMP2720 are coursesthat introduce students to the development and generalized useof IT tools in new media. COMP1710 studies tools used for newmedia and the web, while COMP2720 deals with script-levelprogramming in the context of new media. COMP1710 is alsoan information technology service course offered to students inother faculties, which provides a university-level introductionto applied computing for students in any area who wish touse computers in their studies or their careers but do notnecessarily need to study computer programming. COMP1200provides a broad perspective on the field of computing forthose with a deeper interest in the underlying science andtechnology, and it is a required part of the InformationTechnology programs.

COMP1100 provides an introduction to computer programming,both as a service course and as a foundation for all furtherstudies in information technology. It assumes a prior knowledgeof secondary college advanced mathematics, but does notrequire any previous computing experience. COMP1110 providesfurther study of programming and software engineering, with afocus on the construction of larger programs. It leads to furthersoftware 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 totheir underlying technology. This course can be used as part ofa major in Commerce as well as contributing to InformationTechnology 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

Degree Structure

BCS (Honours) possible enrolment pattern

	Semester 1	Semester 2
Year 1 (48 units)	COMP1130 Data Structures & Algorthims I (6u) COMP2300 Introduction to Computer Systems (6u) MATH1115 Mathematics and Applications 1 Honours (6u) University Elective (6u)	COMP1140 Data Structures & 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) 2000/3000/4000-series Maths (6u) University Elective (6u) University Elective (6u)	COMP2310 Concurrent & Distributed Systems (6u) COMP3600 Algorithms (6u) COMP3610 Principles of Programming Languages (6u) MATH2303 Algebraic Systems & Coding Theory or MATH2322 Algebra 1 Honours (6u)
Year 3 (48 units)	COMP3130 Group Project (6u) Schedule 1 CS Elective (6u) 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

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.

The Bachelor of Computer Science Honours homepage: http://cecs.anu.edu.au/students/future/undergrad/BCS

Scholarships Scholarships valued at $5,000-$10,000 pa are available to students with a UAI over 99 who enrol in this program.

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 Systems 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.

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://cecs.anu.edu.au/students/future/undergrad/BSE

Program Requirements

The BSEng degree requires completion of 192 units including

(a) completion of 120 units of prescribed courses as follows:

COMP1100 Introduction to Programming and Algorithms

COMP1510 Introduction to Software Engineering

COMP2300 Introduction to Computer Systems

COMP2310 Concurrent and Distributed Systems

COMP2400 Relational Databases

COMP2500 Software Construction for Software Engineers

OMP2510 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

COMP4130 Managing Software Quality and Process

COMP4500 Software Engineering Practice OR COMP4540 Software Engineering Research Project

COMP4800 Industrial Experience

ENGN1211 Discovering Engineering

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)	COMP4500 Software Engineering Practice (6u) COMP4130 Managing Software Quality and Process (6u) 3000/4000-series COMP (6u)[2] Elective (6u)[1]	COMP4500 Software Engineering Practice (6u) COMP4800 Industrial Experience 3000/4000-series COMP (12u)[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.

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 24 units of 3000/4000-series COMP courses, other than those prescribed in (a). This must include COMP4211 Engineering Law, if COMP4540 Software Engineering Research Project is chosen 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. These are 5 year programs.

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://cecs.anu.edu.au/students/future/undergrad/BCS

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 COMP1110 Introduction to Software Systems)

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

And at least four courses from the following:

COMP3300 Operating Systems Implementation

COMP3320 High Performance Scientific Computation

COMP3750 Project Work in Computer Systems

COMP4300 Parallel Systems

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 & 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) COMP3000/4000-series IT (12u)[2] Elective (6u)[1]

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

[2] Choose four courses from: COMP3300 Operating Systems Implementation, COMP3320 High Performance Scientific Computation, COMP3750 Project Work in Computer Systems, COMP4300 Parallel Systems, COMP4330 Real-Time and Embedded Systems, ENGN3213 Digital Systems and Microprocessors and ENGN3215 Communications Technologies.

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 & 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 & Evaluation (6u) 3000/4000-series IT (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 & 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 & 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.

COMP4330 Real-Time and Embedded Systems

ENGN3213 Digital Systems and Microprocessors

ENGN3215 Communications Technologies

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

Bachelor of Information Technology with honours

(Academic Program: 3701 | Academic Plan: 3701HBINFT)

Duration: 1 year full-time

Minimum: 48 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 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.

Course descriptions

Introduction to Programming and Algorithms COMP1100 (6 units) A

First Year Course

Semester 1

Contact Hours: 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. 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

Semester 2

Contact Hours: 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

Contact Hours: 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

Contact Hours: Thirty one-hour lectures, nine two-hour tutorial/laboratory sessions and three two-hour seminars.

Prerequisites: Enrolment in BSEng; COMP1100

Incompatible: COMP1110 and COMP2750

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 & the Web COMP1710 (6 units)

First Year Course

Semester 1

Contact Hours: 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

Contact Hours: 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

Contact Hours: 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

Contact Hours: 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

Contact Hours: 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

Contact Hours: 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 modelling. Effective mapping of a conceptual model to a relational

database schema 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

Contact Hours: 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

Contact Hours: 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 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 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

Contact Hours: 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

Contact Hours: 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

Contact Hours: 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

Contact Hours: Thirty one-hour lectures, six two-hour laboratory sessions.

Prerequisites: COMP1100 or COMP2720

Incompatible: COMP1110 and COMP1510

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)

Computer Science Research Project COMP3006 (6 units)

Later Year Course

Semester 1

Contact Hours: As many hours as necessary for meetings with Supervisors and a nominal 10 hours per week

Prerequisites: Enrolment in BCS(H) of PhB or BE(R&D); 12 units of 3000-series COMP courses

Syllabus: Students will conduct a small research project, under supervision. This will give them experience in research in an area of interest in computer science. 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 Study Contract'.

Proposed Assessment: The assessment arrangements will be specified at the outset using the Department of Computer Science form 'Independent Study Contract'.

Software Engineering Group Project COMP3100 (6 units) C

Later Year Course

Semester 1 and Semester 2

Contact Hours: 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

Contact Hours: 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

Contact Hours: 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 Science Group Project COMP3130 (6 units)

Later Year Course

Semester 1 and Semester 2

Contact Hours: As many hours as necessary for meetings with Supervisors and a nominal 10 hours per week

Prerequisites: Enrolment in BCS(Hons) or PhB or BE (R&D); 12 units of 3000-series COMP courses.

Syllabus: This course provides the students with project experience. It exposes the students to team work, communication skills, project management and profession ethics. Students will work in small groups on a synergistic project that covers at least two of the areas in computer science, such as the following: Applications, Programming Languages and Systems and Theory. This will promote depth of study in at least two different areas of computer science for the students.

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

Operating Systems Implementation COMP3300 (6 units) C

Later Year Course

Semester 2

Contact Hours: Thirty one-hour lectures and twelve two-hour tutorials/laboratory sessions.

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

Syllabus: This course takes a detailed look at the services provided by, and the internals of, an existing operating system to see how each part is constructed and integrated into the whole. The lectures will also address recent literature describing advances in operating systems. The following topics are addressed: system programming and its facilities (including I/O, signals, job control, interprocess communication, sockets, transport layers, remote operations), system calls and their relation to the system libraries, process management and coordination, implementation of message passing, memory management, interrupt handling, real-time clocks, device-independent input/output, serial-line drivers, network communication, disk drivers, deadlock avoidance, scheduling paradigms, file systems, security.

Proposed Assessment: Assignments (24 per cent); Tutorials and Laboratories (4 per cent); Laboratory Test (4 per cent); Mid-semester Exam (8 per cent); Final Exam (60 per cent)

Course offered Semester 2 in alternate, even-numbered years.

Computer Networks COMP3310 (6 units) C

Later Year Course

Semester 1

Contact Hours: 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: ENGN4535

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)

High Performance Scientific Computation COMP3320 (6 units) C

Later Year Course

Semester 1

Contact Hours: Thirty one-hour lectures and six two-hour tutorial/laboratory sessions

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

Syllabus: This course provides an introduction to High Performance Computing with an orientation towards applications in science and engineering. Aspects of numerical computing and the design and construction of sophisticated scientific software will be considered. The focus will be on the C and C++ programming languages, although reflecting the reality of modern scientific computation this course will also touch on other languages such as Python, Java and FORTRAN95. The course will study high performance computer architectures, including modern parallel processors, and will describe how an algorithm interacts with these architectures. It will also look at practical methods of estimating and measuring algorithm/architecture performance.

The following topics will be addressed: the C++ programming language; basic numerical computing from aspects of floating point error analysis to algorithms for solving differential equations; the engineering of scientific software; general high performance computing concepts and architectural principles; modern scalar architectures and their memory structure; performance and programmability issues, and program analysis techniques for high performance computing; parallel computing paradigms and programming using the OpenMP standard; trends in HPC systems.

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

Course offered Semester 1 in alternate, even-numbered years.

Information Technology in Electronic Commerce COMP3410 (6 units) C

Later Year Course

Semester 2

Contact Hours: 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)

Advanced Databases and Data Mining COMP3420 (6 units) C

Later Year Course

Semester 1

Contact Hours: Thirty one-hour lectures and five two-hour tutorials

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

Syllabus: This course examines the design of databases and data warehouses and their use for data mining; and investigates associated issues. Topics may include: relational theory and conceptual modelling; privacy and security; statistical databases; distributed databases; data warehousing; data cleaning and integration; and data mining concepts and techniques.

Proposed Assessment: Two assignments (30 marks each); Final Exam (70 marks)

Software Engineering Individual Project COMP3500 (6 units)

Later Year Course

Semester 1 and Semester 2

Contact Hours: 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

Contact Hours: Thirty one-hour lectures and nine two-hour tutorial/laboratory sessions.

Prerequisites: COMP2100 or COMP2500; 6 units of 2000-level COMP courses or enrolment 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)

Artificial Intelligence COMP3620 (6 units)

Later Year Course

Semester 1

Contact Hours: 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 (50 per cent); Final Exam (50 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 formal languages 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)

Topics in Software Engineering I COMP3700 (6 units) C

Later Year Course

Semester 1 and Semester 2

Contact Hours: 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 and Semester 2

Contact Hours: 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 and 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 and 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 Information 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

Contact Hours: 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 (24 units)

Later Year Course

Semester 1 and Semester 2

Contact Hours: 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 units)

Later Year Course

Semester 1 and Semester 2

Contact Hours: 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)

Managing Software Quality and Process COMP4130 (6 units)

Later Year Course

Semester 1

Contact Hours: Thirty one-hour lectures and five two-hour laboratory sessions

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

Incompatible: Incompatible: COMP4100 and COMP4110

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, and managing the development process itself through software process improvement frameworks and standards.

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

There will be a focus on practical techniques for identifying and removing defects as well as for implementing procedures to track the success or failure of resk and kefect resolutions.

There are several Software Process Improvement (SPI) frameworks and 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. This course 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.

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

Engineering Law COMP4211 (3 units)

Later Year Course

Semester 1

Contact Hours: Fifteen one-hour lectures

Prerequisites: Permission of the Head of the Department of Computer Science

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)

Software Engineering Practice COMP4500 (12 units)

Later Year Course

Semester 1 and Semester 2

Contact Hours: 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: This course exposes students to profession software engineering practice through the development of a software system for an industry, government or university based customer. Students will work in small teams with their customer to plan (define, estimate, schedule) and manage an appropriate set of activities to ultimately deliver a software product according to the customer requirements. The implementation part of the project will include monitoring, measuring, tracking, managing change and ultimately close out of the project.

Within the context of this course, students will be introduced to topics in engineering law including sources and classification of law, professional engineering legislation, code of ethics, registration and discipline, negligence, contract law, employment law, patent law and submission, and environmental law.

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

Software Engineering Research Project COMP4540 (12 units)

Later Year Course

Semester 1 and Semester 2

Contact Hours: 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)

Overview of Logic and Computation COMP4630 (6 units) C

Later Year Course

Semester 1

Contact Hours: 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)

Reinforcement Learning and Planning Under Uncertainty COMP4640 (6 units)

Later Year Course

Semester 2

Contact Hours: Thirteen three-hour lectures

Recommended: COMP3620 Artificial Intelligence and /or

COMP4670 Introduction to Statistical Machine Learning

Syllabus: This course provides an introduction to reinforcement learning (RL) and planning under uncertainty, thereby providing concepts for understanding and developing intelligent systems. For instance, the world-class Backgammon program, TD-Gammon, is based on RL techniques. Topics covered will be the classical MDP model, temporal difference learning, dynamic programming, structured models, approximation algorithms, integrating planning and learning, and the theory of universal rational agents based on sequential decision theory and algorithmic information theory.

Proposed Assessment: Two written assignments (30 per cent each); Oral Examination (40 per cent)

Introduction to Statistical Machine Learning COMP4670 (6 units)

Later Year Course

Semester 1

Contact Hours: 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 modelling; 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)

Introduction to Probabilistic Graphical Models COMP4690 (6 units)

Later Year Course

Semester 1

Contact Hours: Thirteen three-hour lectures

Recommended: Some exposure to statistics

Syllabus: Probabilistic graphical models give the structural aspects of a problem (including dependency, cause and relevance). This course provides a broad but thorough introduction to the methods and practice of probabilistic graphical models. Topics covered will include Bayesian inference and maximum likelihood modelling; undirected (Markov) and directed (Bayesian) graphical models and their analysis and properties; typical applications and graphical patterns used therein, variable elimination, probability computation, and optimisation.

Proposed Assessment: Two written assignments (30 per cent each); Oral examination (40 per cent)

Topics in Software Engineering I COMP4700 (3 units)

Later Year Course

Semester 1 and Semester 2

Contact Hours: 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 and Semester 2

Contact Hours: 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 and Semester 2

Contact Hours: 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 and Semester 2

Contact Hours: 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).

Industrial Experience COMP4800 (0 units)

Later Year Course

Semester 1 and 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 fulfill 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 (24 units)

Later Year Course

Semester 1 and Semester 2

Contact Hours: Full Year

Prerequisites: Enrolment in the BInfTech Honours degree.

Syllabus: The honours program consists of a courseworkcomponent and a project component, of equal weight. Astudent's individual course program is selected in consultationwith the BInfTech honours coordinator.The courseworkcomponent involves courses in advanced aspects of thecomputing discipline and information systems. The courseworkis drawn from the fourth year honours courses in ComputerScience (see the COMP4005 course description), InformationSystems (see the entry in Faculty of Economics and Commerce),and other Science departments.

The project component involves a substantial individualconstructive 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 units)

Later Year Course

Semester 1 and Semester 2

Contact Hours: Full Year

Part-Time Intensity

Prerequisites: Enrolment in the BInfTech Honours degree.

Syllabus: The honours program consists of a courseworkcomponent and a project component, of equal weight. Astudent's individual course program is selected in consultationwith the BInfTech honours coordinator.The courseworkcomponent involves courses in advanced aspects of thecomputing discipline and information systems. The courseworkis drawn from the fourth year honours courses in ComputerScience (see the COMP4001 course description), InformationSystems (see the entry in Faculty of Economics and Commerce),and other Science departments.

The project component involves a substantial individualconstructive 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

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 conceptualisation 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

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

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. Modelling 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.

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); 2 Assignments (8 per cent); Final Exam (26 per cent)

Electro section = Pre-lecture Quizzes (5 per cent); Lab Write-Ups (5 per cent); Final Lab Report (10 per cent); Final Exam (30 per cent)

Engineering Research and Development Project ENGN1706 (6 units)

First Year Course

Semester 2

Prerequisites: Enrolment in the Bachelor of Engineering (Research and Development) or approval by the Department of Engineering

Syllabus: This course is one of a suite of research and development courses designed for the BE (R&D) Program. These courses are varying length and are offered at different stages of the degree program and are essentially stand-alone research projects. ENGN1706 is a 6-unit introductory research course designed to introduce the student to research methods and research skills through the completion of a basic research project in an area chosen by the student. The course forms part of the 42-unit R&D major that is a compulsory component of the aforementioned degree program. Each student will have their research supervised by one or more academic supervisors, with the approval of Head of Department or the Delegated Authority. Students are responsible for engaging and obtaining appropriate supervisory support.

Proposed Assessment: Continuous assessment of research

Research & Development Scholars Program 1 ENGN1900 (6 units)

First Year Course

Summer Session 2008, Semester 1 and Semester 2

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

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

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

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 systems momentum 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

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

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

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

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

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: Proposed Assessment: Written Assignments (30 per cent), Labs (10 per cent), Exams (60 per cent)

Engineering Research and Development Project ENGN2706 (6 units)

Later Year Course

Semester 1 and Semester 2

Prerequisites: ENGN1706 and enrolment in the BE (R&D)

Syllabus: This course is on of the suite of research and development courses designed for the BE (R&D) Program. These courses are of varying length and are offered at different stages of the degree program and are essentially stand-alone research projects. ENGN2706 is a 6-unit research course designed to complement the students' basic research skills through non-trivial research work in an area chosen by the student. The course forms part of the 42-unit R&D major that is a compulsory component of the aforementioned degree program. Each student will have their research supervised by one or more academic supervisors, with the approval of Head of Department or the Delegated Authority. Students are responsible for engaging and obtaining appropriate supervisory support.

Proposed Assessment: Continuous assessment of research

Research & Development Scholars Program 2 ENGN2900 (6 units)

Later Year Course

Summer Session, 2008, Semester 1 and Semester 2

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 units)

Later Year Course

Semester 1 and Semester 2

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

Manufacturing Technologies ENGN3212 (6 units)

Later Year Course

Semester 1

Prerequisites: ENGN1215 and ENGN2225

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 1

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

Prerequisites: ENGN1211

Corequisites: 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: 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

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 at 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

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 2

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

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) C

Later Year Course

Semester 2

Prerequisites: ENGN3214 or ENGN3215

Corequisites: ENGN2223 or ENGN2228

Syllabus: This course presents the principles and techniques fundamental to the analysis and design of digital communication systems. It focuses on the basic building blocks of a digital communication system (channel encoder/decoder, digital modulator/demodulator and channel characteristics). The emphasis is on mathematical underpinnings of communications theory along with practical applications. Specific topics include:

1. Probability and Random Processes: Probability distributions, Random variables, Random processes, Statistical averages, Correlation.
2. Digital Modulation Techniques: Complex envelope signal representation, BPSK, MPSK, FSK, Mary orthogonal modulation, bit error rates.
3. Digital Demodulation Techniques: Matched filter, Correlator, Maximum a posteriori detection (MAP), Maximum likelihood sequence detection (MLSD).
4. Channel Encoder/Decoder: Linear block codes, Cyclic codes, Convolutional codes, Viterbi algorithm.
5. Channel Characteristics: Wireline vs. wireless channels, Mathematical models for communication channels, Characterization of multipath channels.
6. Digital Communication Systems: Multiple Access techniques, TDMA vs. CDMA communication systems.

Simulink/Matlab is used extensively in the analysis and design.

Proposed Assessment: Labs (15 per cent), Project (20 per cent), Mid-Semester Exam (15 per cent), Final Exam (50 per cent)

Analogue Electronics ENGN3227 (6 units)

Later Year Course

Semester 2

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 amplifier, 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 & Development Scholars Program 3 ENGN3900 (6 units)

Later Year Course

Summer Session, 2008, Semester 1 and Semester 2

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

Summer Session, 2008, Semester 1 and Semester 2

Contact Hours: Students must enrol in both Semester 1 and 2.

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 the 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 3 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 conceptualisation 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

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 trade-off 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 2

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)

Microelectric and Photonic Technology ENGN4507 (6 units) C

Later Year Course

Semester 1

Prerequisites: ENGN2224

Syllabus: This is a strongly laboratory-oriented course that provides hands-on experience with the most common technologies used to fabricate electron devices: photolithography, epitaxy, oxidation, diffusion, ion implantation, thin film deposition, plasma deposition and laser technologies. Researchers from the Research School of Physical Sciences and Engineering participate in the course, offering invited lectures and laboratory experiments in their particular field of expertise. Training in clean room operation and semiconductor processing equipment is provided. The physical grounds and mathematical models for the technologies mentioned above are used in a semiconductor device design exercise. The device is fabricated in the laboratory and its electrical performance is evaluated.

Proposed Assessment: Quiz (15 per cent); Laboratories (20 per cent); Class Presentations (15 per cent); Final Exam (50 per cent)

Offered Semester 1, in even years.

Composite Materials ENGN4511 (6 units) C

Later Year Course

Semester 1

Prerequisites: ENGN2214

Syllabus: This course provides a broad overview of engineering composites with a specialisation towards fibre reinforced matrix materials. Emphasis is placed on composite constituents, interfaces, all aspects of composites manufacturing, processing and composite mechanics (geometric aspects, laminate theory, strength and fracture theory). Practical composites design, environmental aspects and specialised composites are also introduced, geared towards recent developments. Laboratory practice gives hand-on experience in laminate fabrication and knowledge of composite microstructures.

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

Offered Semester 1 in even years.

Special Topics in Engineering I ENGN4520 (6 units)

Later Year Course

Semester 1 and 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 and 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 and 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 and 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.

Solar Energy Technologies ENGN4524 (6 units) C

Later Year Course

Semester 1

Prerequisites: ENGN2224

Corequisites: ENGN3224

Syllabus: Photovoltaic and solar thermal electric systems have become an important area of engineering and are a major research area in FEIT. They are an example of interdisciplinary systems engineering, where basic electronic materials science or thermodynamics and heat transfer are combined with power electronics, mechanical design, control systems and economic optimisation. The course will give an overview of the solar energy resource and examine two different approaches to conversion to electricity in detail. The physics and fabrication of silicon solar cells, including a discussion of the trade-offs between cost, fabrication complexity and performance will be discussed. Computer modelling of solar cell operation using the program PC1D will be used to reinforce the physical understanding and as a tool for device design. The presentation of solar thermal systems will look at alternative approaches to concentration and conversion of energy, focal region flux prediction and measurement, plus modelling of steady state and dynamic thermal behaviour.

Proposed Assessment: Laboratories; Final Exam

Offered in Semester 2 in even years.

Computer Vision ENGN4528 (6 units)

Later Year Course

Semester 1

Prerequisites: ENGN2226

Syllabus: This subject introduces the problems of computer vision and means for their solution. Topics include: image acquisition, sampling and quantisation; image segmentation, point, line and edge detection, and thresholding; geometric frameworks for vision, single view and two views; camera calibration; stereopsis, the correspondence problem and epipolar geometry; motion and optical flow; recognition, invariants, appearance and geometric-based identification; pose estimation in perspective images.

Proposed Assessment: Laboratories (10 per cent); Assignments (40 per cent); Final Examination (50 per cent)

Offered in Semester 1 in even years.

Logistics and Operations Research ENGN4532 (6 units)

Later Year Course

Semester 1

Prerequisites: ENGN2226

Syllabus: This subject aims to develop an understanding of the factors that affect the performance of human-activity systems and their management. The impact of variation, in external conditions and internal operations, will be a particular focus. The subject involves hands-on work using computer-based simulations. Case studies are taken from production, manufacturing and service industries and from natural resource management. Specific topics covered include: probability and distributions, queuing theory, discrete event simulation, system dynamics, task networks and work flow, and the impact of variation.

Proposed Assessment: Assignment (40 per cent); Final Examination (60 per cent)

Offered in Semester 1 in even years.

Telecommunication Networks ENGN4535 (6 units)

Later Year Course

Semester 1

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)

Wireless Communications ENGN4536 (6 units)

Later Year Course

Semester 2

Prerequisites: ENGN2228 and ENGN3215 or ENGN3214

Corequisites: ENGN3226

Syllabus: Rayleigh fading; multipath models (eg Rician and Nakagami models); Huffman coding; Shannon capacity; diversity reception; maximum gain combining; satellite mobile systems; antenna arrays; broadband and UWB technologies.

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

Offered in Semester 2 in even years.

Engineering Law ENGN4611 (6 units)

Later Year Course

Semester 2

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

Finite Element Analysis ENGN4615 (6 units)

Later Year Course

Semester 2

Prerequisites: ENGN2214

Syllabus: The subject introduces finite element analysis. Topics covered include principles of virtual work and energy methods for stress analysis; derivation of stiffness matrices for one-dimensional problems, plane stress and plane strain problems, axisymmetric problems and general three-dimensional continuum elements; solution methods, effect of mesh densities and convergence criteria; variational approach for finite element formulation; use of commercial finite element software; application of finite element analysis to problems in solid mechanics and steady-state field problems.

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

Offered in Semester 2 in even years.

Power Electronics ENGN4625 (6 units)

Later Year Course

Semester 2

Prerequisites: ENGN2211

Corequisites: ENGN3227

Syllabus: This course covers the important aspects of power electronic circuits, components and design. Topics include device characteristics, heat dissipation, failure modes and discrete transistor circuits. Power magnetic devices are examined, together with their associated drive circuitry and snubbers. Techniques for designing DC-power supplies, static power inverters and universal power supplies, DC-DC converters, and switch-mode power supplies are discussed.

Further information available from www.rsphysse.anu.edu.au/~bdb112/ENGN4625_6625

Proposed Assessment: Assignments and Presentation (15 per cent); Laboratories (35 per cent); Quiz (10 per cent); Final Exam (40 per cent)

Offered in Semester 2 in even years.

Research & Development Scholars Program 4 ENGN4900 (6 units)

Later Year Course

Summer Session, 2008, Semester 1 and Semester 2

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 & Information Technology Students ENGN5920 (6 units)

Later Year Course

Semester 2 and Semester 1

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 2008. 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.

Principles of Programming Languages
COMP3610 (6 units) C

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

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

Prerequisites: 12 units of 2000-series COMP or 12 units of 2000-series PSYC.

Work Integrated Learning Experience
COMP3810 (6 units)

Prerequisites: Departmental consent required.

Software Quality Management
COMP4100 (6 units)

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

Software Process Improvement
COMP4110 (6 units)

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

Milestone Papers in Computing
COMP4200 (3 units) C

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

Parallel Systems
COMP4300 (6 units) C

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

Network Security
COMP4320 (3 units) C

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

Real-Time & Embedded Systems
COMP4330 (6 units)

Prerequisites: COMP2300 and COMP2310; or ENGN2211 and ENGN2223.

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

Advanced Algorithms
COMP4600 (6 units) C

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

Course offered in alternate, even-numbered years commencing in 2008.

Computer Graphics
COMP4610 (6 units) C

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

Fibre Optics Communications Systems
ENGN4513 (6 units) C

Prerequisites: PHYS1201 (PHYS2016 and PHYS2017 are also recommended)

Incompatible: PHYS3060, PHYS3050 and PHYS3051

Energy Resources and Renewable Technologies
ENGN4516 (6 units)

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

Offered in Semester 2 in odd years.

Semiconductor and Optoelectronic Devices
ENGN4519 (6 units) C

Prerequisites: ENGN2211

This course is not currently offered.

Biomedical Engineering
ENGN4533 (6 units)

Prerequisites: ENGN3223

Offered in Semester 1 in odd years.

Managing for Competitive Advantage
ENGN4544 (6 units)

Prerequisites: 24 units of later-year Engineering courses

Offered in Semester 1 in odd years.

Radiofrequency Engineering
ENGN4545 (6 units)

Prerequisites: ENGN2228 or ENGN2223

Corequisites: ENGN3215

Incompatible: ENGN4520 or ENGN4521

Engineering Materials
ENGN4601 (6 units) C

Prerequisites: ENGN2214

Offered in Semester 1 in odd years.

Digital Signal Processing and Control
ENGN4612 (6 units)

Prerequisites: ENGN2223

Offered in Semester 2 in odd years.

Robotics
ENGN4627 (6 units)

Prerequisites: ENGN2221

Offered in Semester 2 in odd years.