1993 HANDBOOK

UTS
UNIVERSITY
OF TECHNOLOGY
SYDNEY

FACULTY OF MATHEMATICAL AND COMPUTING SCIENCES

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Faculty of Mathematical and Computing Sciences

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UNIVERSITY MISSION STATEMENT

UTS provides higher education aimed at enhancing professional practice, advancing the technologies and generally contributing to the creation, application and extension of knowledge for the benefit of society. The University is concerned to improve educational provision for students from a diversity of backgrounds by valuing exemplary teaching and developing flexible study patterns. It is committed to close interaction with the professions, business, government, science and the human services in promoting scholarship, research, continuing education, consultancy and technology transfer.

Objectives

1. To ensure high standards in teaching and professional experience in all academic programs.

2. To achieve an increased level of research funding and postgraduate research students, and increased research experience of staff.

3. To develop library resources of the highest standard and appropriate to faculty and student needs.

4. To improve links with industry, the professions, and the community through the provision of consultancy and continuing education programs.

5. To develop international linkages in the application of knowledge and learning.

6. To gain and retain an equitable level of funding.

7. To increase the level of entrepreneurial activity.

8. To improve the physical, social and educational environment of students and staff.

9. To provide an efficient, effective and responsible internal management.

FACULTY MISSION STATEMENT

The Faculty of Mathematical and Computing Sciences provides high quality, innovative programs of teaching, research and consulting, and continuing professional education to students of wide backgrounds, both nationally and internationally. It is committed to technology transfer for the benefit of society by interacting closely with industry, business and government in research and development.

To support this mission, the Faculty aims to:

- increase the participation rate of students in postgraduate programs by the introduction of honours years
- encourage and facilitate the participation by staff in research activities
- expand research activities by promoting intra- and inter-faculty collaboration
- foster links with prestigious overseas institutions, particularly those in South-East Asia
- diversify its programs
- maintain strong links with industry, government, business, professional and community organisations
- seek supplementary sources of funding through joint ventures and entrepreneurial activities.

PREFACE

This faculty handbook is intended as a reference for students currently enrolled at the University of Technology, Sydney. In addition to basic general information about the university, it contains detailed information about courses offered by the faculty. The information is correct as at October 1992. Please note that the titles of courses offered by the university have recently been revised. A full list of the university's courses, showing the name, the abbreviation and the title as indicated on the testamur, is provided in the 1993 Calendar.

More detailed information of a general nature is contained in the UAC Information Guide and in the Undergraduate and Postgraduate Studies Guides, available from the UTS Student Information Service. The faculty provides additional information about its courses, methods of assessment, book lists and other information which was not available at time of publication. Students should also make sure to read the student rules and the By-law relating to students, which contain essential information about matters such as minimum rate of progress, variation to approved programs of study, leave of absence, examinations and so on. The rules and By-law are included in the University Calendar, a companion volume to this handbook. Copies are held in the library and in the faculty offices, and are available for sale in the Co-op Bookshop.

It is university policy to provide equal opportunity for all, regardless of sex, race, marital status, physical ability, sexual preference, age, political conviction or religious belief. The university has also adopted an ethnic affairs policy to ensure that all aspects of university life are sensitive to the multicultural nature of Australian society and to cultural diversity within the university.

Freedom of information (FOI) legislation gives people the legal right to obtain access to information held by State Government agencies (universities are regarded as government agencies for this purpose), to request amendments to personal records which are inaccurate, and to appeal against any decision not to grant access or amend personal records. The university will make every attempt to meet all reasonable FOI requests.

The names and telephone numbers of people to contact for further information are given throughout this handbook. If in doubt – ask!

We wish you well in your program of study this year.

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GENERAL INFORMATION

ACADEMIC OFFICE

The Academic Office is responsible for administering the rules which relate specifically to the student body at UTS. The branches within the Academic Office are:

- UTS Student Information Service
- Course promotions
- Undergraduate admissions (includes external award and extension study)
- Postgraduate studies and scholarships
- Enrolments and Undergraduate studies (includes examinations, graduation, HECS and student records)
- Student systems
- Facilities Hire
- Kuring-gai Student Administration Centre

The rules may be found in the University Calendar and cover all areas of undergraduate, postgraduate and non-award (external and extension) study. Details include admission, registration and enrolment, fees and charges, identification, conduct, attendance and study requirements, postgraduate supervision, examinations, progression, appeals, exclusion, leave of absence, internal course transfer, readmission, graduation and awards.

INFORMATION

The **UTS Student Information Service** provides information and assistance regarding all administrative matters. It is the principal point of contact between students, the public and the central administration. The UTS Student Information Service is located in the foyer area of the Tower Building at 15-73 Broadway and in the foyer area at the Kuring-gai campus in Eton Road, Lindfield. The postal address for enquiries is: UTS Student Information Service, University of Technology, Sydney, PO Box 123, Broadway 2007. Telephone enquiries should be directed to (02) 330 1222 or (02) 330 5555.

Further details regarding academic and administrative matters may be obtained from the branches listed above or from the following:

UTS Undergraduate Studies Guide
UAC Information Guide
UTS Postgraduate Studies booklet
UTS Postgraduate Scholarships Guide
UTS Calendar and Faculty handbooks.

APPLICATION

Applications for most undergraduate and postgraduate courses may be obtained from the UTS Student Information Service during the main application period, August, September, and October, for admission in the following year. Closing dates and application requirements vary for UTS courses, and applicants are encouraged to make early enquiries.

In general, most undergraduate applications through the Universities Admissions Centre (UAC) close on the last working day of September. Applications for some UAC courses are accepted during October, but require payment of a late fee. Certain undergraduate courses accept applications direct to the university. Applications for these courses and most postgraduate courses close on the last working day of October.

A smaller mid-year application period occurs for some courses during April and May, with applications closing on the last working day of May.

International fee paying applicants must apply through the International Programs Office. Specific information can be found in the following pages.

Formerly enrolled UTS students seeking readmission should lodge a new application during the application period. Currently enrolled UTS students who wish to transfer to another UTS course must complete an internal transfer application, available from the UTS Student Information Service.

Full details on application requirements and closing dates for all undergraduate and postgraduate courses are available from the UTS Student Information Service.

ADMISSION

To be eligible for admission to a course at UTS, all applicants must:

satisfy the rules relating to undergraduate and postgraduate admission (see the Calendar), and
be selected in competition with other eligible applicants for that course.

Applicants must have an adequate background in English. A minimum level such as 2-unit General English in the HSC is recommended. If the majority of an applicant's education was undertaken in a language other than English, completion of an English Test may be required.

UTS accepts the results of two tests: the Combined Universities Language Test (CULT), conducted by the Institute of Languages at the University of New South Wales, in which a minimum pass of 65% is required; and the International English Language Testing System (IELTS), conducted through the UTS International Programs Office. A minimum score of 6.5 overall, with at least 6.0 in writing, is required.

No application for admission will be considered until proficiency in English, where requested, has been demonstrated.

Admission is based on the quota of places available in each course, and the number and quality of eligible applicants applying for each course. Selection is determined through the order of merit of each applicant in competition with other eligible applicants.

Special admission schemes are available for Aboriginal and Torres Strait Islander applicants (SCATS) and those applicants with high academic potential whose education has been disadvantaged by circumstances beyond their control (inpUTS). Information concerning these schemes is given below.

Further details regarding all aspects of admission may be obtained from the UTS Student Information Service.

ENROLMENT

New students receive offers of enrolment by mail. Each successful applicant must enrol as indicated in the information enclosed with the offer or that offer will lapse. Other information enclosed covers dates for enrolment, student service fees and course fees, the Higher Education Contribution Scheme (HECS), admission with advanced standing or with subject exemption, and information on deferment.

Continuing students are required to re-enrol annually. Information regarding re-enrolment is sent with each continuing student's Spring semester results, usually by late December. Information is also forwarded to students regarding their student service fees and course fees or HECS charges.

The main enrolment period each year is from mid January to late February. A smaller enrolment period in July follows any mid-year offers.

Those who cannot enrol on the specified enrolment dates may be permitted to enrol at a later date subject to payment of a late enrolment fee. These students must contact the UTS Enrolments Office to explain their situation and gain permission for a late enrolment.

The location of enrolment may vary, but the main sites are at the City (Broadway) campus and the Kuring-gai campus.

Student Service Fees

Compulsory annual fees and charges are payable to the University Union and Students' Association. The 1992 fees were $252 for new students and $232 for re-enrolling students. In 1992 this amount included a Student Accommodation Levy of $35, which has increased to $42 for 1993 and is expected to increase to $50 for 1994. All fees and charges may vary from year to year.

Higher Education Contribution Scheme (HECS) Charges

HECS was introduced in 1989 by the Commonwealth Government to collect a contribution from certain categories of higher education students towards the cost of their education.

As a part of enrolment, all students who are liable to pay the HECS charge are required to nominate their status as either an "upfront" or "deferred" payer. If nominating "upfront" payment, students are then notified by the university of the amount owing and the date by which payment is required. If a "deferred" payer, students are advised of the amount owing to the Australian Taxation Office. All amounts are determined according to the subject load which HECS eligible students are undertaking for the coming semester. Students who nominate the "upfront" option but do not make payment by the due date will have their enrolment terminated.

Course Fees

Certain categories of students are not required to pay the above HECS charges. These students, unless enrolled under an approved scholarship or HECS exempt program, will be required to pay course fees. Course fee information is available during each application period.

Admission with Advanced Standing or with Subject Exemption

Applicants who receive an offer of enrolment to UTS and have previously completed appropriate subjects of courses at recognised tertiary education institutions or Australian technical colleges may apply for subject exemptions in their offered UTS course.

An exemption application form with instructions is forwarded to all new students with their offer letter. Admission with advanced standing or with subject exemption may be approved by a faculty subject to rules 2.29.1 to 2.29.5.

Deferment

All new undergraduate students will receive a deferment application form with their offer letter. With the exception of three courses (Bachelor of Accounting, Bachelor of Information Technology and Bachelor of Manufacturing Management) offers of admission to all other undergraduate courses can be deferred on request. Deferred enrolment will be approved for up to one year; however, a deferred

place will lapse if the student enrols in an undergraduate or postgraduate degree, diploma or associate diploma course during the period of approved deferment.

All students must re-apply as directed upon completion of their approved deferment period.

Deferment of enrolment in postgraduate courses at UTS is not permitted.

Full details regarding student fees, HECS charges, course fees, admission with advanced standing or with subject exemption, and deferment may be obtained from the UTS Student Information Service.

ACADEMIC ATTENDANCE AND PROGRESSION

Course and Subject Variation

Students wishing to add or delete subjects must apply on the appropriate form as obtained from Faculty or School offices or the UTS Student Information Service. Specific dates apply (see *Principal Dates* below) and students are reminded that HECS or postgraduate course fees still apply after the HECS Census dates of 31 March and 31 August.

Academic transcripts will indicate a fail against subjects where students have not withdrawn by the due date.

Examinations and Results

Formal examinations are held at the end of each semester. Preliminary timetables for examinations will be displayed on noticeboards near Faculty and School offices and in the foyer areas of the Tower Building at Broadway and Kuring-gai campus. Such timetables are on display for two weeks from calendar week 19 for the Autumn semester and calendar week 40 for the Spring semester.

Students who identify concerns with these preliminary timetables must write to the Academic Registrar immediately. Final timetables showing dates, times and location will be displayed in the areas indicated above for two weeks prior to the commencement of the examination period.

Students will be notified by mail of their semester results in mid July and late December each year. Results will also be displayed on noticeboards in the areas indicated above.

Formal enquiries or concerns regarding results must be expressed in writing to the Academic Registrar. Initial enquiries may be made in person at the UTS Student Information Service on the City (Broadway) or Kuring-gai campuses. No information will be given by telephone.

All students are advised to read carefully rules 2.15 to 2.24 to understand the regulations concerning examinations.

Assessment Review and Appeals

Where students are not satisfied with their assessment, they may lodge an appeal of assessment at the UTS Student Information Service. In cases of appeal, a Student Assessment Appeals Committee of the relevant Faculty Board considers the appeal following the criteria and procedures approved by Academic Board.

Full details of appeals against assessment may be found under rule 2.26.

Progression, Probation and Exclusion

Full details regarding student progression, probation and exclusion are provided in rules 3.1.13 to 3.1.19.

Readmission after Exclusion – Undergraduate

A student can re-apply to the course from which he or she was excluded following the specified period of exclusion. Readmission is not automatic and the student must compete with other eligible applicants for that course during the given admission period. Where readmission to the previous course is achieved, the student will be reinstated in the progression category which applied prior to exclusion.

Where a former student's first application for readmission to the course from which he/she was excluded is refused, an appeal may be lodged with the Academic Registrar. Full details are forwarded to such students following lodgement of their application for readmission. Each submitted appeal against refused readmission is forwarded to the relevant Dean for reconsideration. Where such a reconsideration is recommended for dismissal by the Dean, the appeal is forwarded to the Appeals Committee of Academic Board for final decision.

Where the Dean or the Appeals Committee upholds the appeal, the student will be reinstated in the progression category which applied prior to exclusion.

Further details may be obtained from the Undergraduate Admissions Branch.

Discontinuation of Registration – Postgraduate

Students at the Graduate Diploma, Masters or Doctoral level may have their registration discontinued if they fail to complete all prescribed work within a given period of time or if the specific Faculty Board is dissatisfied with the student's progress.

Full details regarding this and the subsequent appeal regulations may be found under rules 3.2, 3.3, 3.4 and 3.5.

Readmission after Discontinuation of Registration – Postgraduate

A student can re-apply to the course from which her or his registration was discontinued following the specified period of exclusion. Readmission is not automatic and the student must compete with other eligible applicants for that course during the given admission period. Where readmission is successful a maximum number of semesters for completion shall be nominated by the University.

Rules for postgraduate students regarding appeal against refused readmission after a period of discontinued registration vary. Full details may be found rules 3.2, 3.3, 3.4 and 3.5.

Further details may be obtained from the Postgraduate Studies Branch.

AWARDS AND GRADUATION

All students who believe they will qualify for an award of the university at the end of their current semester must complete an *Application for Award* form, available from the UTS Student Information Service. A specific lodgement date applies and students are encouraged to make early enquiries at the UTS Student Information Service.

Graduation ceremonies are conducted during a specific period in April - May and September - October each year. Information regarding graduation will be forwarded to eligible students following receipt of the above application form.

Academic dress can be hired from the university. The faculty colour for the Faculty of Mathematical and Computing Sciences is Electric Blue, PMS 3015.

ACADEMIC MISCONDUCT

The University has strict rules relating to the conduct of students. Examples of academic misconduct are cheating in examinations, and the use of plagiarism, which is an attempt to present another person's work as your own by not acknowledging the source. "Work" includes written materials such as books, journals and magazine articles or other papers, and also includes films and computer programs. The two most common types of plagiarism are from published materials and other students' work.

Published materials

In general, whenever you use anything from someone else's work, whether it is an idea, an opinion or the results of a study or review, you should use a standard system of referencing. Examples of plagiarism may include a sentence or two, or a table or a diagram that have been taken from a book or article without acknowledgment. There have been cases when an entire paper consisted of material copied from a book, with only a few sentences added by the student. Both these examples are plagiarism. The first, however, may be treated as a simple failure to cite the references, while the second is more likely to be seen in the same way as cheating in an examination.

Most assignments are likely to require the use of the works of other people. To avoid plagiarism, you should keep a detailed record of where various ideas and findings came from, and to make sure that these sources are always clearly indicated in your work. At the tertiary level of education, assignments should not consist simply of bits and pieces copied from books and articles.

Other students' work

It is not unusual for students to pass round relevant articles and to discuss their ideas before writing an assignment. However, unless the assignment is clearly to be done on a group basis, students should write their own paper. Examples of this type of plagiarism include the inclusion of identical or very similar sentences, paragraphs or sections. When two students submit the same or similar papers, both are likely to be penalised.

Penalties

Alleged cheating or plagiarism during formal examinations is investigated by an examinations conduct committee, which may recommend to the Vice-Chancellor an appropriate penalty from the range of penalties which apply to breaches of discipline under the university By-law. Any instance of plagiarism associated with informal examinations or any other form of assessment is also treated as a breach of discipline, and is subject to the same range of penalties. The relevant provision is in Chapter 8, Division 2 of the By-law; and the relevant rules are 2.17, 2.23 and 2.24 of the student rules. The By-law and rules are set out in full in the University Calendar. Please refer also to the Faculty's *Statement of Good Practice and Ethics in Informal Assessment*, below.

SPECIAL ASSISTANCE ADMISSION SCHEMES

inpUTS

The inpUTS Special Admission Scheme is designed to assist certain applicants to gain entry to UTS undergraduate courses. A reserve quota is

established for most undergraduate courses for applicants with high academic potential whose education has been disadvantaged over a long time by circumstances beyond their control.

Applications must be received by 30 September each year in order for a working party of the Equity and Access Committee of Academic Board to assess eligibility for admission. Applications are forwarded to ACT and NSW high schools and TAFE colleges during July and are available from the UTS Student Information Service from August each year.

The scheme is aimed at those persons who have not had the opportunity to attempt tertiary studies. It is open to all applicants who satisfy the University rules as described under 3.1.1 to 3.1.12.

SCATS

Under the direction of Jumbunna Aboriginal Education Centre at UTS a special admission scheme (SCATS), incorporating a supplementary course leading to degree studies, is available for Aboriginal and Torres Strait Islander applicants. All Aborigines and Torres Strait Islanders who are considering tertiary education are encouraged to apply. Jumbunna assesses all applications to determine if supplementary studies are required.

SKATE (Street Kids Access Tertiary Education)

The target group for the SKATE program is disadvantaged young people with a high potential for a life of abuse, violence, crime and self-destruction, who wish to change their lifestyle and regain access to education. Entry criteria: those who are aged between 16 and 25 years; have little or no family support; have not completed secondary school; and have had experience of or been involved in homelessness, unemployment, drug/alcohol abuse, property offences or violence.

The program follows Board of Secondary Education NSW content and is backed by an extensive bio-social support system.

Tertiary entry status is not automatic and students apply as category B students. No formal arrangements for acceptance of graduates exists with other institutions; however, personal initiatives with support of the SKATE program director have achieved successful entries. For further information contact the Director on 330 5337.

INSEARCH LANGUAGE CENTRE

Insearch Language Centre, University of Technology, Sydney is an ELICOS (English Language Intensive Course for Overseas Students) and Asian Languages Centre operating in its premises on Levels 2 and 3, Prince Centre, 8 Quay Street, Ultimo. ILC also has a second campus at 187-189 Thomas Street (opposite the Prince Centre), ILC was established in October 1987 and since that time there has been a phenomenal growth in student numbers and courses on offer in both the ELICOS and Asian Languages Departments. In the ELICOS department ILC offers courses in General English, English for Academic Purposes (EAP), English for International Business (EIB), English for Matriculation and Foundation Studies (EFS), English for Test Preparation - IELTS, Tertiary Orientation Program (TOP), Evening English and Holiday English.

The ELICOS Department also offers teacher training courses leading to the Cambridge University/Royal Society of Arts Certificate or Diploma in Teaching English as a Foreign Language to Adults.

The Asian Languages department offers individual and group tuition as well as corporate development programs in Japanese, Korean, Thai, Indonesian, Mandarin, Cantonese and Vietnamese.

Courses are offered in the above languages for beginners through to advanced level students.

In the Japanese language area the ILC also offers HSC coaching, Japanese for teachers, advanced conversation and reading – which helps to prepare students for the *Japanese Proficiency Test* and teacher training.

The European Languages Department offers individual and group tuition in French, Italian and Spanish.

For more information contact: Insearch Language Centre, Level 3, Prince Centre, 8 Quay Street, Sydney NSW 2000 Australia, telephone (02) 281 4544, fax (02) 281 4675.

EXCHANGE PROGRAMS

The university, through individual faculties, has an extensive exchange program arrangement which include the following institutions:

Wirtschaftsuniversitat, Vienna, Austria
University of Waterloo, Canada
Aarhus School of Business, Denmark
Insa de Lyon, France
Fachhochschule, Wiesbaden, Germany
Technical University of Budapest, Hungary
Tilburg University, The Netherlands
Dr Soetomo Press Institute, Indonesia
Yonsei University, Seoul, Korea
South China Institute of Technology, Guangzhou, People's Republic of China
Tilburg University, The Netherlands
Oregon State University, USA

In the United Kingdom: University of Brighton, De Montfort University, University of Humberside,

University of Portsmouth and Saint Martin's School of Art

In Thailand: Pranakorn Teachers' College, Chiang Mai University, Mahidol University, and King Mongkut's Institute of Technology, Thonburi

Interested persons should make initial enquiries through the International Programs Office or faculty offices.

INTERNATIONAL STUDENTS PROGRAM

Fee-paying international students are encouraged to apply for admission to selected undergraduate and postgraduate courses on a fee-paying basis.

Application for Admission

Application will be assessed on the basis of academic results in high school, post-secondary studies or university.

International students who are studying for an Australian Year 12 examination (either in Australia or overseas) should apply to UTS through the Universities Admissions Centre.

International students who are studying for a Bachelor degree at an Australian university and wish to transfer to UTS should also apply through the Universities Admissions Centre.

All other international students (undergraduate and postgraduate) should apply direct to the International Programs Office.

Note: Australian citizens or those who have permanent residency status should contact the University's Student Information Service.

Documentation

The following comments must be included with an application:

- an original (or properly certified* copy) of the applicant's **official** transcript or results sheet
- an original (or properly certified* copy) of the applicant's **official** school leaving diploma or certificate
- a certified* official translation of any document not in English
- a certified* copy of any scholarship.

*Note: a properly certified copy means a copy certified by either the issuing institution or a statutory body (e.g. Public Notary). Copies certified by a Justice of the Peace or a lawyer are not acceptable.

The applicant should include any relevant letters of support from his or her employers.

English Language

All international students are required to provide evidence of English language proficiency. UTS prefers students to have a satisfactory score on the IELTS test (6.5 overall with a minimum of 6.0 in writing). Details and application forms for the IELTS test are available from the International Programs Office.

Course Fees 1993

Fees for selected courses offered to fee-paying students range from $A10,000 to $A16,500 per annum, depending on the course. Fees are normally paid on a six-monthly basis.

Financial Assistance

UTS is unable at this time to offer any scholarships or financial assistance to international students.

The Australian Government offers some scholarships under the John Crawford Scholarship Scheme (JCSS) and the Overseas Postgraduate Scholarship Program (OPRS). Details and application forms for JCSS are available only at Australian Embassies and Australian Education Centres overseas. Details and application forms for OPRS are available from the International Programs Office.

Student Visas

Following offer of a place at UTS and payment of first semester fees, International Programs will provide an acceptance advice form which is required when applying for a student visa. Visitors to Australia on a visitors' visa are unable to change their visa status whilst in Australia but must leave the country and apply for a student visa from outside Australia.

Additional Information

For further information and application forms for undergraduate or postgraduate courses please contact the International Program office, Level 5, Tower Building, Broadway.

Postal address: University of Technology, Sydney, International Programs, PO Box 123, Broadway NSW 2007, Australia, telephone (61 2) 330 1531, fax (61 2) 330 1530.

ASSISTANCE SCHEMES

AUSTUDY

AUSTUDY provides income support to financially disadvantaged students over 16 years of age undertaking approved courses of study in higher education institutions. Maximum benefit rates are

age-related and aligned with those for relevant Social Security payments (Job Search and Newstart Allowances). Benefits are paid to 16-17 year old students with higher rates for those 18 years old and over, and those aged over 21 years in special categories. This assistance is provided subject to parental and personal income and assets tests for dependent students or personal and spouse income tests for independent students. AUSTUDY is also subject to academic progress rules.

Following consideration of the review of AUSTUDY commissioned by DEET, fundamental changes are to be made to the program.

A supplementary scheme will be introduced from 1 January 1993, to provide flexibility for tertiary students to tailor assistance to their individual needs.

Under the proposed arrangements, tertiary students eligible for AUSTUDY and ABSTUDY will have the option of "trading-in" part of their grant assistance for a repayable income supplement of twice the amount, up to a maximum of $4000 per annum. A similar repayable income supplement of up $2000 will also be available to tertiary students whose parental income, while excluding them from receiving grants through the parental income test, is less than $50,000 a year, provided other eligibility criteria are met.

How to apply: the Student Welfare Officer located in the Student Services Unit at Broadway and Kuring-gai campuses will be able to supply all forms and will help with other problems or queries that may arise when filling in forms. To make an appointment telephone 330 1177 or 330 5342 for any assistance.

ABSTUDY

ABSTUDY assists Aboriginal and Torres Strait Islander students by providing income support and other assistance tailored to their needs. The basic rates of assistance are similar to AUSTUDY, with additional assistance available to part-time students, pensioners and those over 21 years of age. Aboriginal tertiary students will also be eligible for the voluntary "loan" scheme. ABSTUDY payments are not subject to assets tests. The staff in the Aboriginal Education office, Jumbunna, will be happy to help with any queries. Telephone 330 1905 and ask for the Student Services Officer.

Postgraduate Assistance

The Commonwealth Government offers each year a limited number of awards for full-time postgraduate study at Australian higher education institutions.

Australian Postgraduate Course Awards at the University of Technology, Sydney are available to students undertaking a Masters Degree by coursework. A good academic record is essential and preference is given to those with relevant employment experience. Applications close at the end of October 1992.

Australian Postgraduate Research Awards are tenable for full-time postgraduate research leading to the degree of Master or Doctor of Philosophy at UTS. Applications close at the end of October of the year prior to the year of study.

The awards are available to Australian citizens and those who have been granted permanent resident status and lived in Australia continuously for the last 12 months. Applicants should have completed a four-year undergraduate degree with at least Second Class Honours, Division One, or equivalent.

Application forms may be obtained from the UTS Student Information Service or the Postgraduate Studies and Scholarships Office, Level 5, Tower Building.

University Research Scholarships

These Scholarships, including the R L Werner Postgraduate Scholarship and University of Technology, Sydney Doctoral Scholarship, are normally available to an applicant of the highest academic calibre for full-time research at UTS.

Applications must be made on the prescribed form and close with the Academic Registrar at the end of October of the year prior to which applicants intend to commence candidature.

Further information and conditions of award may be obtained from the Postgraduate Studies and Scholarships Office, Level 5, Tower Building.

Commonwealth Scholarship and Fellowship Plan Awards

The awards are intended for postgraduate study or research and are tenable in the United Kingdom, Canada, Hong Kong, India, Jamaica, Malaysia, Malta, Nigeria, Sri Lanka, Trinidad and Tobago.

Applications from UTS graduates must be made on the prescribed form, and close with the Academic Registrar in early October of the year to which applicants intend to study overseas.

Further information may be obtained from the Postgraduate Studies and Scholarships Office, Level 5, Tower Building.

STUDENT OMBUDSMAN

Enrolled or registered students with a complaint against decisions of university staff may seek assistance from the Student Ombudsman. The position of the Student Ombudsman was created by

the University Council of the old UTS in 1989 for a trial period of one year, and the scheme has now been extended to all campuses.

The university policy on the role of the Student Ombudsman is published in the Calendar.

The Student Ombudsman's office is located in Room 402, Building 2 on the City campus at Broadway, telephone 330 2575/76.

All matters are treated with the strictest confidence.

LEARNING CENTRES

Jumbunna Aboriginal Education Centre

Located on the City campus at Broadway, Jumbunna Aboriginal Education Centre was established in 1987 with only two indigenous students. Today it has more than 250 Aboriginal and Torres Strait Islander students and a staff of 10.

The Centre was conceived to afford indigenous Australians the opportunity to gain access to tertiary studies through the provision of academic and cultural support programs. The name *Jumbunna* comes from the Aboriginal word meaning a *meeting place*.

Jumbunna Centre is predominantly staffed by black Australians and offers a range of award courses, many unique to UTS. Owing to its programs, its support system and its caring environment, Jumbunna Centre has fast gained a reputation among the indigenous community as being a most desirable place to study. Jumbunna's courses include: adult education, tourism and leisure, business studies, social sciences, design, life sciences and nursing, law, media studies, architecture and building.

For further information contact the Jumbunna Centre on 330 1902.

ELSSA Centre

ELSSA, the English Language and Study Skills Assistance Centre, provides free English language and study skills courses for students enrolled at UTS and University staff. These include communication electives for award to degrees, intensive vacation courses and weekly workshop courses. The Centre runs courses on essay writing, report writing, advanced grammar, critical thinking, discussion skills, seminar presentation, effective reading, pronunciation and writing at postgraduate level.

Students may make an appointment for an individual consultation with a lecturer at the Centre to discuss difficulties with academic work. The Centre also has books and tapes for self-study. Brochures with further details of ELSSA programs are available at school offices and at the Centre.

For further information and appointments, telephone 330 2327, fax 330 2321, Level 18, Tower Building, Broadway.

Student Learning Centre

The major role of the Student Learning Centre is to assist students to realise their academic potential for tertiary studies. The Centre fosters the development of student learning and encourages student autonomy through access to the Centre's resources. It provides individual and group tuition to students from various faculties of the university in areas of language and study skills such as time management, writing essays, ESL, presenting seminars, taking part in tutorials, examination preparation, and in mathematics, statistics, and problem-solving strategies. Bridging and preparatory programs are held during the year. Qualified and experienced staff members are committed to an ethic of service in helping students succeed at the highest level.

Students may visit the Centre on their own initiative or on a voluntary basis when referred by academic staff. The Centre is located in rooms 2.520-2.522 above the main Library on the Kuring-gai campus. Telephone 330 5160 (Language and Study Skills), and 330 5186 (Mathematics).

SERVICES

THE UNIVERSITY LIBRARY

The University Library houses more than half a million books, journals and audiovisual items and provides services to staff and students through five campus libraries.

Balmain Campus – Design Library
The Design Library is managed as a joint library service with the Sydney College of the Arts, and houses materials relating to visual arts and design. It is located on the corner of Mansfield and Batty Streets, Rozelle.

City Campus – Markets Library at Haymarket
The Markets Library collects materials in a wide range of subject areas including architecture, building, business, computing science, education, engineering, humanities, law, mathematics, physical sciences, social sciences. It is located in the Haymarket area on the corner of Quay Street and Ultimo Road.

Kuring-gai Campus – George Muir Library
The George Muir Library is located at the Kuring-gai campus in Eton Road, Lindfield. The library's collection is broad: major subject areas include business, education, leisure, information and communication studies and nursing. The library also has a curriculum collection associated with education studies.

St Leonards Campus – College of Law Library
This library provides services for staff and students undertaking courses in practical legal training and is located at 2 Chandos Street, St Leonards.

St Leonards Campus – Gore Hill Library
This library collects materials in the areas of life sciences and nursing. It is located on the corner of the Pacific Highway and Westbourne Street, Gore Hill.

The library's collection is recorded in the UNILINC catalogue which is available as an up-to-date on-line catalogue, and as a compact disc catalogue with enhanced search features. The catalogue can be accessed in each of the libraries as well as in offices and laboratories throughout the university. Access to library information and other bibliographic and numeric databases is extended nationally and internationally through high speed communications networks such as AARNet (the *Australian Academic and Research Network*). Access within Australia is extended through participation in ABN (the *Australian Bibliographic Network*) and the Linked Library System which links the university libraries in New South Wales and the ACT.

The library has a firm commitment to provide the best possible information service and has established a team of Faculty and School Liaison Librarians who, in partnership with academic staff, assist users in achieving their objectives in education and information. The Liaison Librarian for the Faculty of Mathematical and Computing Sciences is

Mireille Eid (City)

Services provided include loans, reservations, intercampus document delivery, interlibrary loans from Australian and international sources, reciprocal borrowing with other institutions, user education, and on-line, compact disc and print-based information retrieval services.

Service guides can be obtained from the libraries. Opening hours are posted in the libraries.

INSTRUCTIONAL TECHNOLOGY SERVICES

In 1992 a new unit, Instructional Technology Services (ITS), was created. Initially this unit will concentrate on establishing a high standard of classroom audiovisual services across the university's campuses. It is also intended that it will deliver a high quality technical and maintenance service, as well as a production capacity.

Services currently available include provision of a one-stop booking service, enhanced presentation lecture theatres, reticulated video services, a trolley service for audiovisual equipment, videotape duplication services and a mediawatch service for current affairs programs.

At present ITS has offices at the Kuring-gai campus and in the Bon Marche Building, City campus. Administratively, the Service is controlled by the University Librarian.

COMPUTING SERVICES

The Computing and Communications Services Division provides a comprehensive range of facilities and services to meet the major computing requirements of academic and administrative areas of the university.

Equipment

The academic facilities consist of four large Sun SPARCserver computers and an Amdahl 5860 mainframe computer. These systems provides the academic community with a wide range of programming languages and application packages. They run the Unix operating system, and can be accessed by users from public PC and Macintosh laboratories operated by the Division.

A Prime 9955-II computer, running the PRIMOS operating system, which has provided academic facilities on the Kuring-gai campus, has been replaced by a Sun SPARCserver 630 system on the Broadway campus.

Other central academic computing facilities consist of 12 PC laboratories, four Macintosh laboratories and three terminal rooms. It is also planned to install two Sun workstation laboratories for use in 1993.

A Data General MV20000, a Sun 4/470 and a Sequent S2000/200 systems support administrative data processing, while a Data General MV15000 services office automation and systems development work.

All computer systems are connected to the university's Local Area Network (UTSnet), which covers the City, Kuring-gai, Balmain and St Leonards campuses. Connected to the network are personal computers and terminals located in the public Laboratories and Terminal Rooms, as well as various School minicomputers.

Location of Facilities

Located on Level 9 of Building 1 at Broadway are the Sun, Amdahl, Sequent and Data General systems, as well as Computing and Communications Services Division staff offices.

Public laboratories and terminal rooms are located on the following campuses:

City Campus
Building 1
Room 1017 - 15 x Macintosh SE
Room 1313A - 20 x PC XT

Building 2
Room 421 - 25 x PC XT
Building 4
Room 104 - 20 x PC 486SX
Room 438 - 20 x Terminal
Room 440 - 20 x Terminal
Room 444 - 20 x PC XT
Building 5
Room A209- 15 x PC XT
Room A210 - 20 x PC XT
Bon Marche
Room 439 - 20 x Macintosh LCII

Balmain Campus
Balmain North Basement - 20 x Macintosh LC
Block A

St Leonards Campus
Dunbar Building
Room 507 - 20 x Macintosh LC
Room 511 - 16 x PC XT

Kuring-gai Campus
Stage 2
Room 461 - 20 x Terminal
Room 524 - 20 x PC 386SX
Stage 3
Room 338 - 20 x PC 386SX
Room 339 - 20 x PC XT
Room 340 - 18 x PC XT
Room 341 - 20 x PC 386SX
General enquiries should be directed to the Response Centre, Room 913, Level 9, Building 1, City campus (telephone 330 2111).

Services

Services provided by the Computing and Communications Services Division include:

- academic and administrative computer processing
- consulting on programming languages, application packages and system usage
- consulting on use of microcomputer hardware and software
- installation, maintenance and support of data communications equipment, terminals and microcomputers
- connection to the University's Local Area Network
- connection to the University's Voice Communications (Telephone) Network
- design, development and support of administrative data processing systems
- operation of a help desk for user enquiries and problems
- production of newsletters and technical documentation
- operation of a retail Microcomputer Shop

Microcomputer Shop

The Computing and Communications Services Division operates a Microcomputer Shop. This shop is a self-supporting, non-profit retail outlet that aims to provide the university and its staff and students with microcomputers and microcomputer software at the lowest possible prices. Purchases from the shop are restricted to university schools/units and to registered students and staff.

The shop stocks hardware and software from the following vendors:

Apple	Microsoft
Ashton-Tate	Mitsui
Borland	Netcomm
Claris	Novell
Data Flow	SourceWare
Hyundai	Star
InfoMagic	Tech Pacific
IBM	Techflow
Ipex	WordPerfect
Lotus	

Other services include Macintosh rentals.

The shop is located on Level 27, Room 2713 of Building 1 at Broadway, telephone 330 2474. Trading hours for the shop are 9am to 5pm Monday to Friday.

UTS UNION

UTS Union is the community centre for the university. It provides food and drink services, lounges and recreational areas, comprehensive social and cultural programs, sports facilities and programs, stationery shops, newsagency and car park. The union also provides student accommodation, runs the University Careers and Appointments Service, provides a legal service with a full-time solicitor, and operates a large ski lodge at Jindabyne.

MANAGEMENT

The union is controlled by a Board of 15 persons consisting of eight students, three staff representatives, three Council appointees and one Alumni nominee. Annual elections are usually held in September and all students and staff are eligible to stand for a position on the Board. The union employs a staff of about 150, headed by the Secretary/Manager.

MEMBERSHIP

All registered students and university staff are members of the union.

FEES

All students pay an annual fee to the union and new students pay a joining fee as well. Staff fees are paid by the university.

Fee Exemptions

Students who have paid seven annual fees to the union are entitled to exemption from further fees. For further information, please contact the Union Office (not the university).

ENQUIRIES

For general information, contact the Union Receptionist in the Broadway Union Centre or Union Centre at Kuring-gai campus. For information about membership, fees or management, contact the Union Office on Level 6 of the Tower building. For all sporting enquiries, contact the Sports Office in the Union Sports Centre at Broadway.

Telephone Numbers

The telephone number for the Union Receptionist, Union Office and all other branches of the union at Broadway is 330 1444. The union's telephone number at Haymarket is 330 1444. The union's telephone number at Haymarket is 330 3369, Gore Hill is 330 4048, at the Faculty of Nursing 330 4375 and at Kuring-gai 330 5011.

CATERING SERVICES

The union operates food services on all campuses except Balmain, where the service is provided by the Sydney College of the Arts Students' Association.

Licensed bars are provided at Broadway, Haymarket and Kuring-gai.

Functions Catering Service

The Functions Catering Service can cater for lunches, buffets, dances dinners, weddings, etc. Most of these are held in the Gallery Function Centre on Level 6 of the Tower building or at Kuring-gai. Ask about the special discount rates which apply for student and other union groups.

UNION SHOPS

There are union shops at Broadway, Haymarket, Balmain and Gore Hill with a wide range of items to meet course requirements, including calculators, stationery and technical drawing equipment. The Union Shop at Broadway also carries a range of university sweaters, pennants and memorabilia.

ACTIVITIES

The Union Activities Department arranges the social and cultural programs at UTS. These include dances, concerts, films, barbecues, creative leisure courses, art exhibitions, plays and lunchtime speakers. Faculty clubs and societies and hobby and social clubs (the Activities Clubs) receive financial and other support from the Activities Department. The Activities Officers are located in the Bornholt Room in the Broadway Union Centre. The Activities Officer at Kuring-gai is located in the Union Centre, telephone 330 5013.

PUBLICATIONS

The union produces a monthly magazine *Plexus*, the weekly *Union News* and a diary which is given to all students and staff at the beginning of the year and many other publications.

SPORT

Facilities

The Union Sports Centre at Broadway contains five squash courts (with special discount rates for union members) gymnasium, weights room, men's and women's saunas, change rooms with lockers and showers, sports office, sports clinic and sports shop. There is also an open air basketball/volleyball court on the roof of the squash courts. The Sports Centre is located on the lower ground floor of Building 4, extending into the quadrangle.

The union runs squash courts at Kuring-gai and can also arrange the hire of tennis courts. The Sports Department at Kuring-gai can be contacted on 330 5012.

Fitness Classes and Programs

The union runs daily fitness classes at Broadway and Kuring-gai. Contact the Sports Office for further information.

Intervarsities and Interfaculty

The union sponsors teams to state and national intervarsity meetings. As well, numerous interfaculty competitions are organised within the university throughout the year.

Clubs

There are many sporting clubs affiliated with the union. They receive financial support from the union and new members are most welcome.

Kookaburra Lodge

Kookaburra Lodge, which is owned and operated by the union, is located in Jindabyne at the foot of the Snowy Mountains, The Lodge, which overlooks the lake, is fully renovated and offers 30 rooms (some with en suites), heated pool, comfortable dining room and large recreation room. The union offers numerous weekend and mid-week trips during the ski season, with prices for members well below commercial rates.

In the off season, bed and breakfast is available from as little as $20 per night, so Kookaburra Lodge is also an excellent base for those interested in bush-walking and non-winter activities in the Snowy Mountains.

All bookings are made through the Broadway Sports Office, phone 330 2444.

UTS Haberfield Rowing Club
Formed after a merger between Haberfield Rowing Club and the union, the UTS Haberfield Rowing Club caters for beginners through to elite rowers.

The club is located in Dobroyd Parade, Haberfield, less than15 minutes by car from the City campus.

For further information, phone the club on 797 9523.

STUDENT ACCOMMODATION

The union has its own student residence, the *Imperial,* at 54-58 City Road, Chippendale. Just 10 minutes walk from the City Campus, Broadway, the *Imperial* offers high quality, low cost accommodation in single and double rooms. Preference is given to first and second year students from outside the metropolitan area. For further information, contact the Union Housing Office at Broadway, on 330 1509.

CAREERS AND APPOINTMENTS SERVICE

The UTS Careers and Appointments Service is a division of the union and provides the following services:

- A directory of employers seeking full-time, part-time and casual staff.
- Advice on employment skills such as interview techniques, personal presentation and resume writing.
- A register of students seeking employment, linked to a mailing and telephone contact service.
- A career counselling service aimed at assisting students and graduates in clarifying and focusing their career objectives.
- Ongoing campus interview programs which introduce final year students to a range of leading employers.

The Careers and Appointments Service is located on Level 5 of the Tower Building at Broadway, telephone 330 1500, and at Kuring-gai in the Union Centre, telephone 330 5016. To take full advantage of the services offered, all students are urged to register with the Careers and Appointments Service at the earliest opportunity.

LEGAL SERVICE

The union employs a full-time solicitor who provides a range of legal services, in most cases free of charge, to members.

Free advice and assistance in any matter is available, especially those involving criminal charges, motor vehicle claims, family law, tenancy disputes, consumer and debt claims and welfare matters.

Representation in Local Courts is normally available free of charge to full-time students and students on low incomes.

Members can discuss any problems at the Solicitor's Office on level 5 of the Tower Building, telephone 330 1511, where all enquiries are dealt with in the strictest confidence. The solicitor is available at Kuring-gai campus one day a week, telephone 330 5017.

WORK EXPERIENCE INSURANCE

At UTS students who participate in approved work experience programs are insured by the university for "workcare" benefits (other than weekly payments) arising out of work related injuries sustained anywhere in Australia. The scheme is administered by UTS Union on behalf of the university. To obtain a letter of confirmation, or for further information, or to make a claim, contact the Union Office on Level 6 of the Tower Building, telephone 330 1642.

CHILD CARE

UTS Child Care Inc. is an incorporated Association which coordinates the operation of all child care services at UTS. The Board of UTSCC Inc. comprises representatives of the University, the union, the Students' Association and parent users of the centres. The Board plans new child care facilities for UTS, and aims at providing a variety of services at each campus. It also sets operational policies to ensure that child care services are of high quality and meet the needs of members of the university community.

Each child care centre is managed by a Director who reports to a Management Committee, the majority of whose members are elected parent representatives. All parents are invited to become involved in the management of the centres.

Operating costs for the various children's services are provided by State and Federal Funding: 8%, UTS sources (Union/SA/University): 10% and parent fees: 73%.

Under the Federal Government Fee Relief Scheme, families earning under $440 per week pay minimum fees. Parents earning between $440-$1150 (approx) per week receive some fee relief benefit according to a sliding scale. Those with incomes greater than $1150 per week pay full fees.

Access to child care facilities is open to all staff and students under "Priority of Access" guidelines. Priority is given to working and studying parents.

There are waiting lists at each centre which take into account various factors including family circumstance, length of time on the waiting list and the family's need for care, in establishing priority of access to the centres. Waiting time varies depending on the family circumstances, the child's age, and the type of care required. There is little or no wait for night care or for vacation care.

Kuring-gai Kuring-gai Campus Child Care Centre is situated next to the oval on campus, and provides 45 day care places for babies to five year olds, from 8am until 6pm for 50 weeks each year. There are also 10 evening care places for babies to 10 year olds, until 10pm Monday - Friday during semester periods only. Enrolment is available on a full-time, regular part-time, evening only, semester only, or emergency basis. Some occasional care may be available during the December-February period. Occasional weekend care can be provided (by prior arrangement) when the university hosts conferences and seminars. Vacation care for school aged children is available during school holiday period. Telephone 330 5105 for information.

Balmain UTS supports Allen Street Glebe Child Care Centre which is attached to Sydney College of the Arts (Sydney University). Enrolment is available on a full-time or part-time basis daily.

City Campus Magic Pudding Child Care Centre is behind Building 1 on the Broadway campus, and provides 40 day care places for babies to five year olds, from 8am until 6.30pm for 51 weeks each year. There are also 15 evening care places for babies to 10 year olds, until 10pm Monday-Friday during semester periods only. Enrolment is available on a full-time, regular part-time, evening only, semester only, or emergency basis. Some occasional care may be available during the December-February period. Occasional weekend care can be provided (by prior arrangement) when the university hosts conferences and seminars. Vacation care for school aged children is available during the Christmas and July school holiday periods.

Telephone 330 1456 for information.

St Leonards St Leonards Campus Child Care Centre is situated just off the Pacific Highway opposite the Dunbar Building at Gore Hill. It provides 25 day care places for babies to five year olds, from 8am until 6pm for 48 weeks each year. Enrolment is available on a full-time, regular part-time, semester only, or emergency basis. Some occasional care may be available during non-semester periods. Telephone 330 4023 for information.

STUDENT SERVICES

Student Services staff are employed by the university to cater for students' health, counselling, and welfare needs. Staff also assist in the development of study skills and provision for students with disabilities. All interviews are strictly confidential.

Welfare

Welfare Officers offer assistance with personal financial matters. Central to their work is administration of the Student Loan Fund, financial counselling and advising on AUSTUDY claims and appeals.

Health

The Health Service has two locations: level 3A of the Tower Building at Broadway and level 5 of Kuring-gai campus. The practice offers a free service to students with an emphasis on health education and promotion.

Counselling

Counsellors are available on all campuses. The service is full-time at City and Kuring-gai and part-time at Balmain and St Leonards campuses. The counsellors are experienced in dealing with all kinds of personal difficulties and can advise on administrative matters in relation to the university, such as appeals against exclusion.

International Student Counsellor

The International Student Counsellor can help students from overseas and from non-English speaking backgrounds with personal, practical and administrative problems while studying at UTS.

Learning Skills

The Learning Skills Counsellor helps students to understand how best they can learn. Advice is given on time management, writing assignments, reading effectively and preparing for exams. As well as individual consultations, workshops are held during both semesters.

Special Needs Coordinator

The Special Needs Coordinator works with other university staff to ensure appropriate support is available for students with disabilities and students admitted through the inpUTS Special Admission Scheme. Students with physical, sensory and learning disabilities are encouraged to contact the Coordinator. The Coordinator can also provide information and advice to prospective students who have disabilities.

To contact Student Services:

Broadway. Level 3A Tower Building, telephone 330 1177, fax 330 1172, TTY 330 1166
Health Service Appointments: 330 1166

Balmain. Student Centre, appointments 330 1177.

Kuring-gai. Level 5, telephone 330 5342, fax 330 5537.

St Leonards. appointments 330 5342.

STUDENTS' ASSOCIATION

The Students' Association (SA) is the elected representative body of students at the UTS: it is an organisation run by students for students. All students become members of the Students' Association upon enrolment. It is the only body in the university which can legitimately claim to truly represent the concerns, issues and problems students face on a day-to-day basis whilst at this university. All students have the right to stand for election of the SA and to vote in the annual elections. There are 23 general representatives on the Council that makes policy for the Students' Association. It also has specialised portfolios and office bearers to deal with a range of issues: the environment, women, students with special needs, gay and lesbian rights, overseas students and postgraduates.

The Students' Association maintains close links with student organisations from other universities. Its political role is to defend and extend educational standards and conditions for students both within the university and the tertiary sector as a whole. Campus committees deal with campus-specific issues. This has proved to be the most effective and equitable means of ensuring that all students from all campuses are adequately represented in the make-up of the Students' Association. At this level, campus conveners carry out the directions of campus committees, which are also elected annually.

In general the Students' Association plays a representative and advocacy role on behalf of students. It acts as the voice of the student body. As part of this function it produces a fortnightly newspaper,*Vertigo,* and a weekly radio show on 2SER *Student Voice*. It liaises closely with the University Union, which provides services to students (e.g. the cafeteria, reading and leisure areas) and the Student Services Unit, which is funded by the University to provide welfare advice and counselling, loan assistance and medical services. The Students' Association also employs specialised education staff to assist in enquiries about Austudy, HECS, appeals against exclusion and assessment grades and any other problems that students encounter at UTS. The Students' Association has lots to offer all students and welcomes student involvement.

Locations and Services

City campus 330 1155
The main office of the Students' Association is located on the City campus, Broadway on Level 3A of the Tower Building (near the bar and cafeteria) and offers the following services:

- General student representatives
- Elected office bearers
  - Women's officers
  - Overseas students' officers
  - Special needs officers
  - Gay and lesbian officers
  - Environment officer
  - Postgraduate officer
- Specialist education, research and welfare staff
- General student enquiries
- Academic coaching service
- Photocopying
- Funding of PERC Clubs

Haymarket Resource Centre
This is located in Room B110 and its services include:

- Computer, fax
- Photocopying
- Secondhand books

Design School Student Centre 330 2958
This is located on the Balmain campus, Mansfield Street, Balmain and is open Tuesday to Friday and offers:

- Photocopying
- Computer facilities

Gore Hill Resource Centre 330 4040
This is located in Room 1/18 in the Dunbar Building and its services include:

- Photocopying
- Secondhand books
- Computer facilities

Kuring-gai Campus 330 5237
Located next to State Bank, the services offered include:

- General and campus representatives
- Specialist education, research and welfare staff
- General student enquiries

RADIO STATION 2SER-FM

In conjunction with Macquarie University, UTS operates Sydney Educational Broadcasting Ltd (2SER-FM), Sydney's first mass coverage educational radio station thus expanding the institution's role in education to a wide community audience. The station, on air 24 hours a day, broadcasts a variety of spoken word educational programs covering arts and sciences. In addition to a small

core of paid staff, some 400 volunteers, including UTS staff and students, are involved in programming the station.

THE CO-OP BOOKSHOP

The Bookshop is located next to the Tower Building on Broadway. While committed to supplying textbooks for all timetabled courses it also attempts to cater to the needs of the university community for general books, stationery, calculators and computer books and software.

Through its extensive computer system linking over 40 branches in Australia, the bookshop can often get hold of hard-to-get titles. Students and staff are welcome to place special orders, and charge accounts are available for approved customers.

At the start of each semester the bookshop runs temporary branches at the City campus, Haymarket (Room C117) and Gore Hill. The Kuring-gai campus is also serviced by a permanent Co-op Bookshop specialising in texts used on that campus.

The Broadway bookshop is open from 9am till 6pm Monday to Thursday, 9am till 5pm on Friday and 9am till 1pm on Saturday. There are normally extended hours at the beginning of each semester. The Bookshop can be contacted on 212 3078 or 330 2163.

STATE BANK

Full branches of the State Bank are situated on Level 4 of the Tower Building, Broadway, and at Kuring-gai campus. A complete range of banking services is provided. Normal banking hours apply all year at Broadway and the hours at Kuring-gai are 10am to 3pm.

The State Bank also offers complete banking services at Gore Hill, St Leonards and Haymarket, operating through the UTS union facilities.

THE FACULTY OF MATHEMATICAL AND COMPUTING SCIENCES

The Faculty of Mathematical and Computing Sciences consists of two Schools – Mathematical Sciences and Computing Sciences. Together, these disciplines form the basis of "enabling technologies" for applications in most other disciplines.

Each School teaches towards its own professional degrees from undergraduate through to doctoral studies. Thus, all the course and student administration, and much of the staff and research management are conducted at the School level. Each School has, as a consequence, developed its own management structure appropriate for the support of its teaching and research programs. Teaching is carried out across all campuses of the university, with the exception of the Balmain campus.

The faculty has a commitment to cooperative education, both of the work experience "sandwich" form, and of the newer style cooperative scholarship format. The faculty is active in research and has close liaison with industry in all aspects of its work.

The structure of the **School of Computing Sciences** reflects the orientation and emphases of its academic work. There are two departments which are made up of two units:

Department of Computer Science
- Computer Methods Unit
- Computer Systems Unit

Department of Information Systems
- Information Systems Technology Unit
- Information Management Unit

The **Key Centre for Advanced Computing Sciences** is one of the seven original Key Centres established by the Commonwealth Government in 1985, and was the first federally funded Centre for Advanced Computing Sciences in Australia. The Key Centre is based in the School of Computing Sciences and the School of Electrical Engineering; it is committed to research in computing, particularly through the development of links with industry.

The School of Computing Sciences presents a selection of Continuing Professional Education courses each semester. These courses include Pascal Programming, Cobol Programming, Unix/C and Auditing Computer Systems. The School also offers a selection of professionally oriented courses from time to time; these courses include database design, expert systems design, distributed databases and capacity planning.

The structure of the **School of Mathematical Sciences** reflects the orientation and emphases of its academic program. There are four units:

Mathematics
Computational Mathematics
Statistics
Operations Research

The School also provides a support service to all students of the university studying in various introductory mathematical or quantitative areas through its **Mathematics Study Centre**. Most of the teaching in the Centre occurs at an individual level and the Centre is open for at least 30 hours each week, with certain times devoted to particular areas of mathematics. Students can obtain help with individual problems, specific to a particular course. Alternatively, students with more systematic problems may study in the Centre on a regular basis, obtaining assistance from a tutor as necessary.

STATEMENT OF GOOD PRACTICE AND ETHICS IN INFORMAL ASSESSMENT

Aims of assignments

In many subjects offered by the faculty, students undertake assessment tasks in the form of assignments. The setting of assignments is intended to promote a number of educational aims, including furthering each student's learning of the subject, particularly the acquisition of practical skills; providing a means for staff to assess each student's learning; providing feedback to the student on his or her progress in learning; and providing feedback to staff on the effectiveness of their teaching.

These aims can be subverted if students deceive staff about the authorship of their work.

Acceptable behaviour

Using sources Whenever anything from someone else's work is used, it is standard practice to indicate exactly where the information comes from. Acknowledgemet is done by using a standard system of referencing, such as footnotes, end notes, the Harvard system, etc. *The Guide to Writing Assignments* (available from the Union Bookshop) explains how to use all these standard systems of reference.

Collaboration In some cases assignment guidelines may permit or require students to cooperate in developing a solution to part or all of an assignment. This may occur formally when a staff member assigns students to groups and indicates which components of the assignment they are to work on as a group and which components they are to work on individually.

It may also occur informally. For example, some assignments may involve an "ideas gathering" phase followed by an "execution" phase. Students may be

permitted to collaborate informally on the preliminary phase(s), but be expected to work completely individually on the subsequent phase(s). In a programming assignment, for example, it is normally acceptable for one student to discuss with another student (or other person) the specifications of the task so as to determine the requirements (see below). Whether this collaboration could extend to subsequent phases (such as the design phase) would depend on the assignment guidelines; normally, collaboration in the design and subsequent phases is not permitted.

Depending on the type of assignment and degree of collaboration permitted it is possible to define several categories of collaboration:

> individual effort (the student is required to work on all phases entirely by himself or herself)
> group effort (the student is required to work on all phases as part of a formal group)
> mixed effort (the student is required or permitted to work on some or all phases as part of a formal or informal group).

Unless assignment guidelines specifically state otherwise, *a student should assume that an assignment requires a completely individual effort.* The forms of cooperative collaborative behaviour that are acceptable under most circumstances are:

> discussing assignment specifications with another student (or other person) with a view to clarifying what is required
> getting help from another student (or other person) on technical matters that are not directly part of the assessment task (e.g. on how to use some facility provided by the computer system, such as the editor)
> getting help from another student (or other person) in debugging a program. This is a comon occurrence in computing.
> obtaining help from a tutor.

Generally, what distinguishes the acceptable cases of collaborative behaviour from the unacceptable ones is the student's intention to deceive. For example, in an assignment requiring a completely individual effort, a student may encounter some snag, such as an unfamiliar compiler diagnostic. If the student were to seek help from another student (or person) to remove the snag, then this would normally be considered acceptable behaviour. If, however, several students designed and coded a solution together, then disguised this collaboration, that would be unacceptable behaviour.

Unacceptable behaviour

Outright lying This is seen most often in programming assignments, where the program does not run, or runs incorrectly, yet the output handed in is correct. The output has been "tailored" using a word processor in an attempt to fool the marker. Lying is never acceptable behaviour.

Plagiarism Plagiarism is the action of taking and using as one's own the thoughts, writings, or inventions of another with the intention to deceive.

For example, if one student is in a computing subject were to obtain a copy of another student's (or other person's) program, were to modify parts of the program (e.g. change variable names) so as to disguise its origin, and then submit the modified program as his or her solution, then this would be considered plagiarism.

As another example, a student may obtain all or a major part of the solution to an assignment problem from a text book and, without acknowledging this, submit the solution as his or her own work.

As a further example, a student may use a source of information in an essay, without acknowledging the source. Such plagiarism may range from a sentence or two, or a table or diagram, to occasional cases where the entire paper consists of material copied from a book with only a few sentences added by the student. The student thus submits another's ideas as his or her own work.

Plagiarism is a form of cheating and is never acceptable.

Collusion Collusion occurs when a student combines with one or more other students (or other persons) to produce a common essay or solution to part or all of an assignment, disguises the shared origin of the solution, and submits the solution as his or her individual work.

Collusion is regarded as a form of cheating and is never acceptable.

SCHOOL OF MATHEMATICAL SCIENCES

The School of Mathematical Sciences offers two undergraduate courses leading to Bachelor degrees, postgraduate courses leading to qualifications at the Graduate Certificate, Graduate Diploma and Masters levels and two research degree programs leading to Masters and Doctoral level qualifications. They are:

the Bachelor of Science in Mathematics, which is offered as a three year pass degree or a four year honours degree
the Bachelor of Mathematics and Finance, offered in conjunction with the School of Finance and Economics as a three year pass degree or a four year honours degree
the Graduate Certificate in Mathematical Sciences
the Graduate Diploma in Statistics
the Graduate Diploma in Operations Research
the Master of Science in Operations Research (by coursework)
the Master of Science, which is awarded on the basis of approved research work and presentation of a thesis
the Doctor of Philosophy, which is awarded on the basis of approved research and presentation of a thesis.

UNDERGRADUATE PROGRAMS

BACHELOR OF SCIENCE IN MATHEMATICS

This degree aims to prepare students for employment in industry, commerce and government and to provide the foundation for higher studies in mathematics. It provides great flexibility by allowing students to follow a course of study which best suits their interests and aspirations. It aims to help students acquire sufficient experience and understanding in a broad range of mathematical disciplines to enable them to apply mathematical and computing techniques to industrial and commercial problems.

The course operates as either a three year pass degree or a four year honours degree. The basic structure of the pass degree is as follows.

A core – providing a thorough grounding in the elements of mathematics, statistics, operations research, computing, and their applications. This component, occupying half of the pass degree, is taught during the first two years of the full-time program.
A mathematics major – which occupies half of the third year of the full-time course (or years 5 and 6 of the part-time course) and may be taken in one of the areas of applied mathematics, statistics or operations research. This framework provides for specialised study of a particular area of application. A major in operations research involves topics such as linear programming, simulation and optimisation. The statistics major aims to expose students to realistic statistical problems, preparing them to cope with data and its associated uncertainty and variability. Applied mathematics, particularly since the advent of computers, has developed a large collection of tools for the solution of practical problems. In many cases, these can be unified by a few basic geometric, analytic and algebraic ideas. The applied mathematics majors aim to develop these ideas and apply them in a variety of complex and practical situations.
Electives – which occupy one-third of the course and may be subjects from any School of the university chosen by students to strengthen their understanding in an area of their choice. Common choices are the major in computing offered by the School of Mathematical Sciences, an additional major in mathematics, a sub-major in financial management and various sub-majors in the sciences.

The computing major provides students with both practical and theoretical training in computer science (and its mathematical foundations), information systems and commercial computing, and a wide variety of applications. Because this major occupies the entire elective sequence, students who wish to pursue it are advised to commence it in their first year of study. However, because it is an elective major, students are not obliged to follow it to completion. The major is accredited at Level 1 by the Australian Computer Society and, accordingly, those who do complete it are eligible to apply for Associate Membership of that Society.

The course may be attempted on either a full-time or a part-time basis. Part-time students will be accommodated by the provision of special evening classes, and it is expected that all part-time students will be able to attend classes for one afternoon and two evenings per week.

The standard full-time load is six four credit point subjects each semester and the standard part-time load is three four credit point subjects each semester. Most mathematics subjects involve two hours of lectures and a one hour tutorial per week. Some subjects (especially those in computing) have additional laboratory hours.

FULL-TIME PROGRAM

Credit point rates are shown in brackets.

YEAR 1

Autumn semester

34700 Discrete Mathematics (4cp)
34701 Algebra I (4cp)
34710 Calculus (8cp)
34770 Computing IA (4cp)
Electives (*) (approx 4cp)

Spring semester

34711 Analysis I (4cp)
34751 Statistics I (4cp)
34790 Numerical Computing (4cp)
34802 Algebra II (4cp)
Electives (*) (approx 8cp)

YEAR 2

Autumn semester

34740 Introduction to Operations Research Models (4cp)
34803 Algebra III (4cp)
34815 Ordinary Differential Equations (4cp)
34817 Vector Calculus (4cp)
Electives (*) (approx 8cp)

Spring semester

34812 Analysis II (4cp)
34818 Complex Variables (4cp)
34821 Partial Differential Equations I (4cp)
34852 Statistics II (4cp)
34891 Numerical Methods A (4cp)
Electives (*) (approx 4cp)

YEAR 3

Autumn semester

Mathematics Major (**) (12cp)
Electives (*) (approx 12cp)

Spring semester

Mathematics Major (**) (approx 12cp)
Electives (*) (12cp)

* Students must attempt over the complete program at least 48 credit points of electives, distributed approximately as shown above in terms of credit point load.These electives may be chosen from subjects offered within the university and acceptable to the School of Mathematical Sciences. The most common choice of elective pattern is the computing major. Electives are discussed below.

** The mathematics majors in the third year of the full-time course consist of prescribed sequences of six four credit point subjects taken from one of the four areas of statistics, operations research and physical and modern applied mathematics.

PART-TIME PROGRAM

YEAR 1

Autumn semester

34700 Discrete Mathematics (4cp)
34710 Calculus (8cp)

Spring semester

34701 Algebra I (4cp)
34770 Computing IA (4cp)
Electives (*) (approx 4cp)

YEAR 2

Autumn semester

34711 Analysis I (4cp)
34751 Statistics I (4cp)
Electives (*) (approx 4cp)

Spring semester

34740 Introduction to Operations Research Models (4cp)
34817 Vector Calculus (4cp)
Electives (*) (approx 4cp)

YEAR 3

Autumn semester

34790 Numerical Computing (4cp)
34802 Algebra II (4cp)
Electives (*) (approx 4cp)

Spring semester

34803 Algebra III (4cp)
34815 Ordinary Differential Equations (4cp)
Electives (*) (approx 4cp)

YEAR 4

Autumn semester

34812 Analysis II (4cp)
34821 Partial Differential Equations I (4cp)
Electives (*) (approx 4cp)

Spring semester

34818 Complex Variables (4cp)
34852 Statistics II (4cp)
34891 Numerical Methods A (4cp)

YEAR 5

Autumn semester

Mathematics Major (**)
Electives (*)

Spring semester

Mathematics Major (**)
Electives (*)

YEAR 6

Autumn semester

Mathematics Major (**)
Electives (*)

Spring semester

Mathematics Major (**)
Electives (*)

* Students must attempt over the complete program at least 48 credit points of electives, distributed approximately as shown above in terms of credit point load.These electives may be chosen from subjects offered within the university and acceptable to the School of Mathematical Sciences. The most common choice of elective pattern is the computing major. Electives are discussed below.

** The mathematics majors in years 5 and 6 of the part-time course and year 3 of the full-time course consist of prescribed sequences of six four credit point subjects taken from one of the four areas of statistics, operations research and physical and modern applied mathematics.

Note: for each semester in years 5 and 6 students should choose subjects with an approximate value of 12 credit points.

Major Areas of Study

Students must complete at least one of the mathematics majors which are offered in the areas of statistics, operations research, modern applied mathematics and physical applied mathematics. Students may also choose to complete the elective major in computing.

Statistics

FULL-TIME

YEAR 3

Autumn semester
34953 Statistical Inference (4cp)
34955 Regression Analysis (4cp)
34960 Probability (4cp)
Spring semester
34956 Design of Experiments (4cp)
34957 Industrial Statistics (4cp)
34961 Stochastic Processes I (4cp)

PART-TIME

YEARS 5 AND 6

Autumn semester
34953 Statistical Inference (4cp)
34955 Regression Analysis (4cp)
34961 Stochastic Processes I (4cp)
Spring semester
34956 Design of Experiments (4cp)
34957 Industrial Statistics (4cp)
34960 Probability (4cp)

Operations Research

FULL-TIME

YEAR 3

Autumn semester
34930 Simulation Techniques (4cp)
34931 Linear Programming (4cp)
34938 Financial Modelling Techniques (4cp)
Spring semester
34932 Optimisation Techniques (4cp)
34936 Decision Theory (4cp)
34961 Stochastic Processes I (4cp)

PART-TIME

YEARS 5 AND 6

Autumn semester
34930 Simulation Techniques (4cp)
34938 Financial Modelling Techniques (4cp)
34961 Stochastic Processes I (4cp)
Spring semester
34931 Linear Programming (4cp)
34932 Optimisation Techniques (4cp)
34936 Decision Theory (4cp)

Physical Applied Mathematics (+)

FULL-TIME YEAR 3 and
PART-TIME YEARS 5 AND 6

Autumn semester
34922 Partial Differential Equations II (4cp)
34924 Mechanics (4cp)
34927 Deterministic Optimal Control (4cp)
Spring semester
34916 Mathematical Methods (4cp)
34925 Wave Theory (4cp)
34992 Numerical Methods B (4cp)

Modern Applied Mathematics (+)

FULL-TIME YEAR 3
PART-TIME YEARS 5 AND 6

Autumn semester
34904 Algebra IV (4cp)
34913 Modern Analysis (4cp)
34920 Integral Equations (4cp)
Spring semester
34914 Measure Theory (4cp)
34995 Advanced Numerical Analysis (4cp)
34996 Convexity and Optimisation (4cp)

(+) In order to complete the requirements for either of the two applied mathematics majors, students must complete at least 16 credit points from the major of their choice and select the remainder from the alternative major. Subjects on offer in these majors may vary from year to year and will depend on demand. Students interested in

these majors should discuss their enrolment with the Director of Undergraduate Studies late in the year immediately prior to their intended enrolment.

Computing

FULL-TIME

YEAR 1

Autumn semester

31134 Information Systems (Math Sc) (4cp)

Spring semester

34771 Computing IB (4cp)

34781 Mathematical Foundations of Computing I (4cp)

YEAR 2

Autumn semester

31135 Commercial Programming Development (Math Sc) (4cp)

34872 Computing II (4cp)

Spring semester

34873 Computing III (4cp)

YEAR 3

Autumn semester

34982 Mathematical Foundations of Computing II (4cp)
Elective 1A (#) (4cp)
Elective 1B (##) (4cp)

Spring semester

34984 Language Theory (4cp)
Elective 2A (#) (4cp)
Elective 2B (##) (4cp)

PART-TIME

YEAR 1

Spring semester

34781 Mathematical Foundations of Computing I (4cp)

YEAR 2

Autumn semester

31134 Information Systems (Math Sc) (4cp)

Spring semester

34771 Computing IB (4cp)

YEAR 3

Autumn semester

34872 Computing II (4cp)

Spring semester

34873 Computing III (4cp)

YEAR 4

Autumn semester

31135 Commercial Programming Development (Math Sc)(4cp)

YEARS 5 AND 6

Autumn semester

34982 Mathematical Foundations of Computing II (4cp)
Elective 1A (#) (4cp)
Elective 1B (##) (4cp)

Spring semester

34984 Language Theory (4cp)
Elective 2A (#) (4cp)
Elective 2B (##) (4cp)

\# In each semester of the final year(s) of the computing major, students will undertake one subject (Elective 1A and Elective 2A) from a choice of two, which will be nominated by the School and drawn from Group 1 for the Autumn semester and from Group 2 for the Spring semester. These groups are listed below.

\## The subjects labelled as Elective 1B and Elective 2B may be drawn from either of the Group 1 and Group 2 lists or from subjects offered by the School of Computing Sciences. Students wishing to take the latter option (i.e. electives from the School of Computing Sciences) must consult with the Head of the Computational Mathematics Unit (or his/her nominee) to obtain the necessary approval. Students wishing to take electives in the area of commercial information systems are advised to enrol in subjects in the areas of systems analysis (e.g. 31621 Systems Analysis) and database (e.g. 32201 Database) offered by the School of Computing Sciences.

Group 1

34975 Computer Graphics (4cp)

34976 Neural Networks (4cp)

34986 Cryptology (4cp)

Group 2

34977 Formal Specification (4cp)

34983 Mathematical Foundations of Computing III (4cp)

34985 Digital Image Processing (4cp)

Elective Subjects offered within the BSc in Mathematics degree

There are 48 credit points in the Bachelor of Science in Mathematics program allocated to elective subjects. Students may choose to complete these subjects in a number of ways:

by completing one additional mathematics major, leaving 24 unspecified elective credit points to be completed in the case of most double majors, and 28 unspecified elective credit points to be completed in the case of a

double major in Statistics and Operations Research;
by completing the Computing Major, leaving no unspecified elective hours; or
by completing a total of at least 48 credit points of subjects offered by this School or by other Schools of the university. Common choices of subjects include those forming recognised sub-majors in other disciplines such as financial management, physics and electronics.

Whatever subjects are chosen, it is necessary that the student has satisfied the prerequisite(s) of the chosen subjects; the students enrolment in a subject is approved by the School which offers that subject, and the student's choice of subjects is approved by the School of Mathematical Sciences.

In addition to subjects listed within the descriptions of the majors, the following subjects offered by the School of Mathematical Sciences may be taken as electives.

34692-6	Project (2 - 6 credit points)
34807	History of Mathematics (4cp)
34894	Mathematical and Business Modelling (4cp)
34906	Differential Geometry (4cp)
34909	Seminar in Mathematics (4cp)
34934	Network Optimisation (4cp)
34935	Inventory Control (4cp)
34939	Seminar in Operations Research (4cp)
34959	Seminar in Statistics (4cp)
34979	Seminar in Computing (4cp)

Sub-majors are available in various areas including finance and physics. Students may contact the office of the School of Mathematical Sciences for details.

BACHELOR OF SCIENCE IN MATHEMATICS (HONOURS)

The honours year provides the opportunity for students to develop considerably their level of competence in the area of mathematics chosen as their major in the BSc in Mathematics degree. The honours degree is offered only on a full-time basis and consists of advanced coursework (comprising 75% of the program) and a research project (comprising the remaining 25%). This project provides the opportunity for students to utilise the expertise developed by their coursework in an area of application. Students who complete the honours year will, accordingly, be well prepared to enter the workforce at a high level or to undertake graduate studies.

Admission to the honours year will be assessed individually according to the following criteria.

Students who are eligible to graduate from the BSc in Mathematics degree at UTS with a credit average (i.e. weighted average mark of 65 or more) in Year 2 (full-time) of the core and in their chosen major, and who have satisfactorily completed a third year essay, will be eligible for entry to the honours year, subject only to the approval of the Head of the School of Mathematical Sciences. Alternatively, students who have obtained qualifications equivalent to the BSc in Mathematics degree will be considered for entry, upon application, by the Head of the School of Mathematical Sciences, on the basis of assessed potential to complete the honours course.

The honours course will require the completion of 48 credit points over two semesters in a fourth year of study. Honours will be offered in mathematics, statistics and operations research and will consist of nine coursework subjects each of four credit points and a project of 12 credit points.

Students who wish to enter the honours year will need to make this decision, in consultation with the Honours Coordinator, before beginning Year 3 of full-time studies. This is to enable them to take appropriate honours units in the third year which are prerequisites to some of the fourth year subjects and to complete an essay in an appropriate area of mathematics. Consequently, such students will have to defer some of their third year electives to the fourth year of study. The School may not be able to offer all three honours course programs in any one year.

Students who are deemed eligible for admission will be assigned a supervisor who will monitor their progress and supervise their fourth year research project, which will be assessed by a report and seminar. The third year essay will also be prepared under the guidance of the honours supervisor. Satisfactory completion of this essay is a prerequisite for the fourth year of study.

The students final result will be based on the two honours level subjects taken in the third year as well as the fourth year's studies and projects. Satisfactory completion of the honours program will result in the award of an Honours Degree with the grades of First Class, Second Class (Division 1), or Second Class (Division 2).

The grade of honours will be determined from an average mark of all honours level subjects (subject numbers 340**) and the thesis, weighted by the credit point values of the individual components. Grades of First Class, Second Class Division I and Second Class Division II Honours will be awarded corresponding respectively to weighted average marks of 80 or greater, 65 to 79 and 50 to 64. A weighted average mark of less than 50 will be regarded as a failure for the course and the student will be eligible to graduate with a pass BSc degree. Thesis work that is of outstanding merit may justify an increase in the grade of honours. A student with

First Class Honours and outstanding results may be awarded the University Medal.

COURSE PROGRAM

Listed below are the subjects for honours in Mathematics, Statistics and Operations Research. In view of the need to take certain honours units in the third year and delay various third year electives until the fourth year, both third and fourth year attendance patterns are listed.

Mathematics Honours

YEAR 3

Autumn semester

34922 Partial Differential Equations II (4cp)
34927 Deterministic Optimal Control (4cp)
34961 Stochastic Processes I (4cp)
34013 Modern Analysis (Hons) (4cp)
Electives (approx 8cp)

Spring semester

34916 Mathematical Methods (4cp)
34960 Probability (4cp)
34992 Numerical Methods B (4cp)
34014 Measure Theory (Hons) (4cp)
Electives (approx 8cp)

YEAR 4

Autumn semester

34023 Partial Differential Equations III (4cp)
34062 Stochastic Processes II (4cp)
34087 Analytic Number Theory (4cp)
34096 Convexity and Optimisation (Hons) (4cp)
34098 Project (4cp)
Electives (approx 4cp)

Spring semester

34019 Functional Analysis (4cp)
34028 Stochastic Optimal Control (4cp)
34029 Nonlinear Dynamical Systems (4cp)
34099 Project (8cp)
Electives (approx 4cp)

Note: This program is for students undertaking the Physical Applied Mathematics Major of the BSc in Mathematics degree. A similar program, differing in only two subjects, would apply to the Modern Applied Mathematics major. Details of this program may be obtained from either the Honours Coordinator or the Director of Undergraduate Studies in the School of Mathematical Sciences.

Operations Research Honours

YEAR 3

Autumn semester

34930 Simulation Techniques (4cp)
34931 Linear Programming (4cp)
34938 Financial Modelling Techniques (4cp)
34013 Modern Analysis (Hons) (4cp)
Electives (approx 8cp)

Spring semester

34932 Optimisation Techniques (4cp)
34936 Decision Theory (4cp)
34960 Probability (4cp)
34961 Stochastic Processes I (4cp)
34014 Measure Theory (Hons) (4cp)
Electives (approx 4cp)

YEAR 4

Autumn semester

34033 Dynamic Optimisation (4cp)
34040 Operations Research Models and Methodology (4cp)
34062 Stochastic Processes II (4cp)
34096 Convexity and Optimisation (Hons) (4cp)
34098 Project (4cp)
Electives (approx 4cp)

Spring semester

34031 Large Scale Mathematical Programming (4cp)
34038 Corporate and Financial Decisions and Investment Analysis (4cp)
34099 Project (8cp)
Electives (approx 8cp)

Statistics Honours

YEAR 3

Autumn semester

34953 Statistical Inference (4cp)
34955 Regression Analysis (4cp)
34960 Probability (4cp)
34013 Modern Analysis (Hons) (4cp)
Electives (approx 8cp)

Spring semester

34956 Design of Experiments (4cp)
34957 Quality Control (4cp)
34961 Stochastic Processes I (4cp)
34014 Measure Theory (Hons) (4cp)
Electives (approx 8cp)

YEAR 4

Autumn semester

34062 Stochastic Processes II (4cp)
34065 Time Series Analysis (4cp)
34067 Multivariate Statistics (4cp)
34096 Convexity and Optimisation (Hons) (4cp)
34098 Project (4cp)
Electives (approx 4cp)

Spring semester

34066 Nonlinear Statistical Models (4cp)
34068 Statistical Modelling (4cp)
34069 Linear Models and Experimental Design (4cp)

34099 Project (8cp)
Electives (approx 4cp)

BACHELOR OF MATHEMATICS AND FINANCE

The years since deregulation of the Australian financial system have witnessed many sweeping changes and a considerable increase in the financial and economic activity of many Australian corporations. During this same period there has been an increasing use by major financial institutions of the sophisticated quantitative techniques that have been developed since the early 1970s. As a consequence, there is a demonstrated demand for a new type of graduate trained in both mathematics and finance.

To meet this need, the Bachelor of Mathematics and Finance has been jointly developed by the School of Mathematical Sciences and the School of Finance and Economics and commenced operation in 1991.

Students graduating from the BMathFin will have undertaken an integrated sequence of subjects in mathematics, statistics, finance, economics, accounting, business law and computing and will thus have sound training in both the traditional theory of finance and the mathematical aspects of modern portfolio management techniques.

As a result, graduates should find interesting and rewarding employment in major financial institutions such as merchant banks, insurance companies and government instrumentalities.

The Bachelor of Mathematics and Finance operates as both a three year pass degree and a four year honours degree (described below).

The pass degree operates on both a full-time and a part-time basis. The part-time course begins with normal part-time attendance of two nights and one afternoon per week for four years. A standard program is given below. The final two years, however, may require attendance at morning classes as some subjects, which form parts of other degrees, are not offered to part-time students. Programs will be tailored for students individually to incorporate the 10 subjects of Year 3 of the full-time course over two years.

FULL-TIME PROGRAM

YEAR 1

Autumn semester
22105 Accounting A (5cp)
25110 Microeconomics (5cp)
34700 Discrete Mathematics (4cp)
34701 Algebra I (4cp)
34710 Calculus (8cp)

Spring semester
25209 Macroeconomics (5cp)
34711 Analysis I (4cp)
34751 Statistics I (4cp)
34790 Numerical Computing (4cp)
34802 Algebra II (4cp)

YEAR 2

Autumn semester
25210 Microeconomic Policy (5cp)
25308 Financial Institutions and Markets (5cp)
25314 Business Finance I (5cp)
34815 Ordinary Differential Equations (4cp)
34817 Vector Calculus (4cp)
34894 Mathematical and Business Modelling (4cp)

Spring semester
25905 Asset Pricing and Capital Market Studies (Hons) (5cp)
34812 Analysis II (4cp)
34821 Partial Differential Equations I (4cp)
34852 Statistics II (4cp)
34936 Decision Theory (4cp)
79101 Law for Business (5cp)

YEAR 3

Autumn semester
25421 International Financial Management (5cp)
25906 Investment Analysis and Portfolio Management (Hons) (5cp)
34913 Modern Analysis (*) (4cp)
34955 Regression Analysis (4cp)
34960 Probability (4cp)

Spring semester
25502 Current Issues in Finance (5cp)
25606 Financial Time Series Analysis (5cp)
34914 Measure Theory (*) (4cp)
34961 Stochastic Processes I (4cp)
34992 Numerical Methods B (4cp)

* Note that students proceeding to the honours year will be required to substitute 34013 Modern Analysis (Hons) and 34014 Measure Theory (Hons) in place of the two pass level subjects.

PART-TIME PROGRAM

YEAR 1

Autumn semester
34700 Discrete Mathematics (4cp)
34710 Calculus (8cp)

Spring semester
22105 Accounting A (5cp)
25110 Microeconomics (5cp)
34701 Algebra I (4cp)

YEAR 2

Autumn semester

25209 Macroeconomics (5cp)
34711 Analysis I (4cp)
34751 Statistics I (4cp)

Spring semester

25210 Microeconomic Policy (5cp)
34817 Vector Calculus (4cp)

YEAR 3

Autumn semester

34790 Numerical Computing (4cp)
34802 Algebra II (4cp)
79101 Law for Business (5cp)

Spring semester

25308 Financial Institutions and Markets (5cp)
25314 Business Finance I (5cp)
34815 Ordinary Differential Equations (4cp)

YEAR 4

Autumn semester

34812 Analysis II (4cp)
34821 Partial Differential Equations I (4cp)
34894 Mathematical and Business Modelling (4cp)

Spring semester

25905 Asset Pricing and Capital Market Studies (Hons) (5cp)
34852 Statistics II (4cp)
34936 Decision Theory (4cp)

YEARS 5 and 6

25502 Current Issues in Finance (5cp)
25421 International Financial Management (5cp)
25606 Financial Time series Analysis (5cp)
25906 Investment Analysis and Portfolio Management (Hons) (5cp)
34913 Modern Analysis (*) (4cp)
34914 Measure Theory (*) (4cp)
34955 Regression Analysis (4cp)
34960 Probability (4cp)
34961 Stochastic Processes I (4cp)
34992 Numerical Methods B (4cp)

Note: Programs for years 5 and 6 will be tailored for students individually. See the introduction to this section.

* Students proceeding to the honours year will be required to substitute 34013 Modern Analysis (Hons) and 34014 Measure Theory (Hons) for the two pass level subjects.

BACHELOR OF MATHEMATICS AND FINANCE (HONOURS)

The Bachelor of Mathematics and Finance degree is also offered at an honours level, requiring an additional year of advanced study. Honours degree graduates will be particularly sought after and their additional skills would enable them to compete for the top jobs in the banking sector. It is expected that most students will opt to undertake this additional year comprising nine coursework subjects in advanced mathematics, statistics and finance, each of four credit points, and a research project of 12 credit points.

Admission to the honours year will be assessed individually according to the following criteria:

> Students who are eligible to graduate from the BMathFin degree at UTS with a credit average (i.e. weighted average mark of 65 or more) in Years 2 and 3 will be eligible for entry to the honours year, subject only to the approval of the Heads of the Schools of Mathematical Sciences and Finance and Economics;
> Students who have obtained qualifications equivalent to the BMathFin degree will be considered for entry, upon application, by the Heads of the two participating Schools on the basis of their assessed potential to complete the honours course.

The honours year will require completion of 48 credit points over two semesters of full-time study. The year consists of nine coursework subjects of an advanced nature in mathematics, statistics and finance together with a substantial project. The project will involve a major investigation in some area of finance, and will provide students with the opportunity to apply the skills developed in their coursework. The project will be assessed on the basis of a thesis and a seminar presented to the staff of both Schools.

The assessment of students results will take into account the fourth year coursework subjects, the thesis and the seminar, and Honours at the grades of First Class, Second Class (Division 1), Second Class (Division 2) and Third Class will be awarded for the successful completion of the course.

The Honours year will be offered for the first time in 1994.

Listed below is the course program for the BMathFin(Hons) degree. All subjects except the thesis carry four credit points, and require attendance of three hours each week. The thesis carries 12 credit points.

COURSE PROGRAM

YEAR 4

Autumn semester

259** Thesis (8cp)
259** Advanced Microeconomics (4cp)
34062 Stochastic Processes II (4cp)
34065 Time Series Analysis (4cp)
34927 Deterministic Optimal Control (4cp)

Spring semester

259** Thesis (4cp)
259** Futures and Options (4cp)
259** Advanced Corporate Finance (4cp)
34028 Stochastic Optimal Control (4cp)
34029 Nonlinear Dynamical Systems (4cp)
34066 Nonlinear Statistical Models (4cp)

Note: The subjects with numbers begining 259** are those which will be offered only to BMathFin (Hons) students, and numbers have yet to be assigned to them.

POSTGRADUATE PROGRAMS

POSTGRADUATE RESEARCH DEGREES

The Master of Science (by thesis) and Doctor of Philosophy degrees provide the opportunity for graduates to extend and deepen their knowledge in specialised areas of mathematics by undertaking research under the supervision of a member of the academic staff.

The main interests within the School of Mathematical Sciences are in applied and computational mathematics, operations research and statistics. Although a wide range of topics can be covered by the staff, particular interests and specialisations exist in the following areas:

Clinical Trials and the Modelling of Medical Data

Inversion of Raman spectra of living cells; stability and uniqueness in compartmental models for medical applications; diabetic control; insulin sensitivity; modelling of glucose and C-peptide response curses.

Computational Mathematics and Computing

Lattice rules for numerical multiple integration; development of AMPL (A Mathematical Programming Language); database management system for diabetes; computer performance modelling; mathematical foundations of computing; computer aided instruction in mathematics.

Differential Geometry

Topology and Ricci curvature; integral formulas of submanifolds of a Riemannian manifold.

Geophysical Applications of Mathematics

Seismic ray theory for slightly heterogeneous structures; properties of normal rays; seismic wave propagation; seismic velocity inversion; inverse problems; radio frequency propagation in coal seams.

Mathematics Education

PhD education of industrial mathematicians; mathematical education of engineers; tertiary education in applied mathematics

Number Theory

Recurring sequences; odd perfect numbers and related numbers.

Operations Research

Manpower planning; delivery of health services; modelling of energy systems; simulation techniques.

Optics and Electromagnetic Diffraction Theory
Diffraction properties of 1D and 2D periodic structures; optical constants of thin films.

Statistics
Medical applications of statistics; measurement and test design; permissible statistics; stationary Markov sequences; simulation and density estimation.

MASTER OF SCIENCE (BY THESIS)

The Master of Science program provides an opportunity for graduates to acquire research skills and deepen their knowledge in some areas of the mathematical sciences by working under the guidance of a supervisor who is a member of the full-time academic staff of the School. The research program entails survey and mastery of a substantial body of literature in the chosen topic together with original work from the candidate. The degree is examined through the presentation of a thesis. Students are also required to present a seminar during the time of their enrolment and also at the completion of the thesis.

The course is offered full-time, part-time and in the external mode. For full-time enrolments the normal duration of the program is two years; for part-time enrolments it is expected that students will complete the degree within a period of four years. It is further expected that students will be able to devote 20 hours each week to the work towards the degree. All students are expected to maintain regular contact (at least weekly) with their supervisor.

DOCTOR OF PHILOSOPHY

The PhD program provides an opportunity for graduates to acquire high level research skills and substantially deepen their knowledge in an area of the mathematical sciences by working under the guidance of a supervisor. The research program entails survey and mastery of a large body of literature in the chosen topic together with substantial body of high level original work by the candidate. Students are also required to present a seminar during the time of their enrolment and again at the completion of their thesis.

The course is offered full-time, part-time and in the external mode. For full-time enrolments the normal duration of the program is between three and four years; for part-time enrolments it is expected that students will be able to devote 20 hours per week to the work towards the degree. All students are expected to maintain regular contact (at least weekly) with their supervisor.

POSTGRADUATE COURSEWORK PROGRAMS

MASTER OF SCIENCE IN OPERATIONS RESEARCH

Operations research may be defined as the application of the methods of science to complex problems arising in the direction and management of large systems of people, machines, materials and money in industry, business, government and defence. This course aims to prepare graduates for high level professional work in the applications of operations research techniques to the problems of modern society.

The subjects in the program provide students with a suite of advanced techniques, together with the theoretical background for these methods. Studies in the fields of optimisation, mathematical programming, stochastic processes and the theory of finance, together with a broad survey of applications having industrial and social importance, will enable graduates to deal with high level professional work in operations research in business and industry.

The course has a length of 48 credit points and consists of six core subjects (24 credit points), 12 credit points of elective subjects (incorporated to enable students to develop complementary skills) and a substantial project of 12 credit points (requiring students to undertake a survey and a modest level of research in some area of application of the discipline). The normal attendance pattern involves two years of part-time study. However, it is possible to complete the degree through one year of full-time study.

Applicants for this course must be graduates who have high level skills in the mathematical sciences. In particular, they must have:

> a knowledge of statistics equivalent to 34852 Statistics II;
> completion of studies in operations research corresponding to either the Graduate Diploma in Operations Research, the undergraduate major in operations research or its equivalent;
> completion of prerequisites in mathematics which are presumed in the core subjects of the degree.

Applicants not satisfying these prerequisites are advised to consider enrolling in the graduate diploma or the graduate certificate programs offered by the School. Applicants should discuss their eligibility for entry with the Head of the Operations Research Unit or the Director of Postgraduate Studies.

The only penalty for unsatisfactory progress in the course is exclusion. Students who record any three failures in the course will be excluded. All subjects except the report carry four credit points, and require three hours of attendance each week. The report carries 12 credit points and requires nine hours' attendance each week.

PART-TIME PROGRAM

Semester 1	
34033	Dynamic Optimisation
34040	Operations Research Models and Methodology
	Electives (approx 4cp)
Semester 2	
34031	Large Scale Mathematical Programming
34038	Corporate Financial Decisions and Investment Analysis
	Electives (approx 4cp)
Semester 3	
34036	Stochastic Models in Operations Research
34039	Seminar: Applications in Operations Research
	Electives (approx 4cp)
Semester 4	
34097	Report

GRADUATE CERTIFICATE IN MATHEMATICAL SCIENCES

The Graduate Certificate in Mathematical Sciences has been developed in response to a demand for short courses in statistics, operations research, computational and applied mathematics. It provides those employed in industry with access to additional training or retraining in quantitative disciplines.

The course has a flexible structure and the wide range of subjects offered in the other postgraduate and undergraduate courses of the School of Mathematical Sciences would be available to intending students. Students may undertake any sequence of subjects offered by the School with a total weight of 12 credit points, provided that individual subject prerequisites are satisfied. Approved elective subjects from other Schools of the university may also be taken with the consent of the Head of School.

Applicants will normally be expected to hold a Bachelor degree, or higher qualification, from a recognised tertiary institution. Applicants who do not possess such qualifications will be considered on an individual basis. Prior to their admission, all applicants will be required to discuss their preferred program of study with an academic adviser in order to ensure that they have the requisite background knowledge for their chosen subject sequences.

A number of coherent subject sequences in the areas of computational mathematics, applied mathematics, operations research and statistics are possible. Samples of these are listed below. All subjects listed carry four credit points and require attendance of three hours each week. Some computing subjects require extra attendance for laboratories. Details are given in the subject descriptions.

Computational Mathematics

Sequence A
Theme: Numerical Analysis

Presumed Knowledge
Equivalent to tertiary level courses in scientific computing, calculus, linear algebra and differential equations.

Program of Study

34790	Numerical Computing
34891	Numerical Methods A
34992	Numerical Methods B

Sequence B
Theme: Mathematical Computer Science (1)

Presumed Knowledge
Equivalent to an introductory tertiary level course in discrete mathematics.

Program of Study

34770	Computing IA
34771	Computing IB
34781	Mathematical Foundations of Computing I

Sequence C
Theme: Mathematical Computer Science (2)

Presumed Knowledge
This sequence provides for an extension of the material prescribed in Sequence B. It is, therefore, presumed that students will have a working knowledge of Pascal or Modula-2 and abstract data structures, as well as some experience with abstract algebraic structures (such as groups and monoids) and a functional programming language such as Miranda.

Program of Study

34872	Computing II
34873	Computing III
34982	Mathematical Foundations of Computing II

Sequence D
Theme: Mathematical Cryptology

Presumed Knowledge
Equivalent to introductory level courses in calculus, linear algebra and scientific computing.

Program of Study
34790 Numerical Computing
34803 Algebra III
34986 Cryptology

Sequence E
Theme: Neural Networks

Presumed Knowledge
Equivalent to tertiary level courses in programming (e.g. Pascal) and matrix algebra.

Program of Study
34790 Numerical Computing
34802 Algebra II
34976 Neural Networks

Mathematics

Sequence A
Theme: Differential Equations

Presumed Knowledge
Equivalent to tertiary level courses in multivariable calculus, real and complex analysis and linear algebra.

Program of Study
34815 Ordinary Differential Equations
34821 Partial Differential Equations I
34922 Partial Differential Equations II

Sequence B
Theme: Modern and Linear Algebra

Presumed Knowledge
Equivalent to an introductory tertiary level course in matrix algebra.

Program of Study
34700 Discrete Mathematics
34802 Algebra II
34803 Algebra III

Sequence C
Theme: Analysis with applications to Probability Theory

Presumed Knowledge
Equivalent to tertiary level courses in analysis, (ordinary) differential equations, and linear algebra.

Program of Study
34812 Analysis II
34913 Modern Analysis
34914 Measure Theory

Sequence D
Theme: Mathematical Control Theory

Presumed Knowledge
Equivalent to introductory tertiary level courses in calculus and linear algebra.

Program of Study
34815 Ordinary Differential Equations
34817 Vector Calculus
34927 Deterministic Optimal Control

Operations Research

Sequence A
Theme: Financial Modelling

Presumed Knowledge
Equivalent to introductory tertiary courses in statistics and calculus.

Program of Study
34740 Introduction to Operations Research Models
34936 Decision Theory
34938 Financial Modelling Techniques

Sequence B
Theme: Techniques of Mathematical Programming

Presumed Knowledge
Equivalent to introductory tertiary courses in statistics, calculus and matrix algebra.

Program of Study
34740 Introduction to Operations Research Models
34931 Linear Programming
34932 Optimisation Techniques

Sequence C
Theme: Simulation and Decision Support

Presumed Knowledge
Equivalent to introductory tertiary level courses in statistics and elementary scientific computing.

Program of Study
34740 Introduction to Operations Research Models
34930 Simulation Techniques
34936 Decision Theory

Sequence D
Theme: Optimisation and Applications

Presumed Knowledge
Equivalent to introductory tertiary level courses in statistics, matrix algebra and operations research models, together with knowledge of computerised simulation (as in 34930 Simulation Techniques)

Program of Study
34931 Linear Programming
34934 Network Optimisation
34935 Inventory Control

Statistics

Sequence A
Theme: Analysis of Experimental Data

Presumed Knowledge
Equivalent to introductory tertiary level courses in statistics and calculus.

Program of Study
34852 Statistics II
34955 Regression Analysis
34956 Design of Experiments

Sequence B
Theme: Industrial Applications of Statistics

Presumed Knowledge
Equivalent to introductory tertiary level courses in statistics and calculus.

Program of Study
34852 Statistics II
34955 Regression Analysis
34957 Quality Control

Sequence C

Theme: Stochastic Modelling

Presumed Knowledge
Equivalent to introductory tertiary level courses in statistics and calculus.

Program of Study
34852 Statistics II
34960 Probability
34961 Stochastic Processes I

Sequence D
Theme: Mathematical Statistics

Presumed Knowledge
Equivalent to introductory tertiary level courses in statistics and calculus.

Program of Study:
34852 Statistics II
34953 Statistics III
34960 Probability

GRADUATE DIPLOMA IN OPERATIONS RESEARCH

This course is designed to train professional people in the application of operations research principles and methods. It may be regarded as a training or retraining course for graduates from a wide range of disciplines providing they have a sound foundation in mathematics, statistics and computing, to approximately second year level. It is ideally suited for subsequent entry into the Master of Science in Operations Research.

The subjects in the Graduate Diploma provide a coverage of standard operations research techniques and their theoretical foundations. The range of topics covered and the level of presentation is commensurate with that found in senior undergraduate studies in these disciplines.

The length of the course is 48 credit points and comprises 40 credit points of coursework (10 subjects) and a project of eight credit points.

Applicants for this course will be graduates from a variety of disciplines who satisfy the basic entry requirements consisting of a knowledge of statistics equivalent to the content of the subject 34751 Statistics I, a knowledge of basic operations research principles and methods equivalent to the content of the subject 34740 Introduction to Operations Research Models, a knowledge of pure and applied mathematics that is sufficient to satisfy the prerequisite of the core subjects (derived from the Operations Research major) and a knowledge of computer programming equivalent to the content of the subject 34790 Numerical Computing.

Applicants not satisfying these prerequisites are advised to consider enrolling in a graduate certificate course. Applicants for the graduate diploma program should discuss their eligibility with the Head of the Operations Research Unit or the Director of Postgraduate Studies.

The only penalty for unsatisfactory progress in the course is exclusion. Students will be excluded for failure to complete the course in eight semesters from the time of registration in the case of a part-time student, or in four semesters from the time of registration in the case of a full-time student (this is not inclusive of periods of leave of absence) and/or failure in any subject three times.

This course can operate in both full-time and part-time attendance patterns. However, it is expected that the normal pattern of attendance will be part-time. Shown below is the course structure for part-time attendance over a period of two years. All subjects except the project carry four credit points and require attendance of three hours each week. The project carries eight credit points and requires six hours of attendance each week.

PART-TIME PROGRAM

Semester 1	
34852	Statistics II
34930	Simulation Techniques
34931	Linear Programming

Semester 2	
34932	Optimisation Techniques
34936	Decision Theory
34960	Probability

Semester 3	
34935	Inventory Control
34938	Financial Modelling Techniques
34961	Stochastic Processes I

Semester 4	
34934	Network Optimisation
34997	Project

GRADUATE DIPLOMA IN STATISTICS

The Graduate Diploma in Statistics aims to train graduates in the methods and principles of applied statistics. The course provides access to training or retraining in statistics to at least the level of skill attained by students completing the BSc degree with a major in statistics. Students will be expected to already have some exposure to statistics, usually the equivalent of two subjects to the second year level. Some mathematical background is also necessary.

A knowledge of statistical methodology is becoming ever more important for graduates in many disciplines. Degree courses in the sciences, in engineering and in business often do not provide the exposure to statistics which graduates find they need in employment. Thus, this course is suitable for such graduates and also for those who have completed degrees in pure or applied mathematics without a major in statistics.

The subjects in the graduate diploma provide a coverage of standard statistical techniques and their theoretical foundations. The range of topics covered and the level of presentation is commensurate with that found in senior undergraduate studies in these disciplines.

The length of the course is 48 credit points and consists of 40 credit points of coursework (10 subjects) and a project of eight credit points.

Applicants for this course will be graduates from a variety of disciplines who satisfy the basic entry requirements consisting of the core subjects (derived from the Statistics major), a knowledge of computer programming equivalent to the content of the subject 34790 Numerical Computing, a knowledge of statistics equivalent to the content of the subjects 34751 Statistics I and 34852 Statistics II and a knowledge of pure and applied mathematics that is sufficient to satisfy the prerequisites of Numerical Computing.

Prospective applicants will be assessed by the Director of Postgraduate Studies and the Head of the Statistics Unit, and those who have not completed the necessary prerequisites will be required to enrol in appropriate subjects, either in a miscellaneous mode of study or as part of a graduate certificate program.

The only penalty for unsatisfactory progress in the course is exclusion. Students will be excluded for failure to complete the course in eight semesters from the time of registration in the case of a part-time student, or in four semesters from the time of registration in the case of a full-time student (this is not inclusive of periods of leave of absence) and or/ failure in any subject three times.

This course can operate in both full-time and part-time attendance patterns. However, the normal pattern of attendance will be part-time. Shown below is the course structure for part-time attendance over a period of two years. All subjects except the project carry four credit points and require three hours of attendance each week.

PART-TIME PROGRAM

Semester 1	
34930	Simulation Techniques
34953	Statistical Inference
34955	Regression Analysis

Semester 2	
34956	Design of Experiments
34957	Quality Control
34960	Probability

Semester 3	
34961	Stochastic Processes I
	Electives (*) (approx 8cp)

Semester 4	
34936	Decision Theory
34997	Project

* The electives are included to enable students to select topics which enhance their knowledge in the application of statistics in their chosen field. Students should discuss possible options with the Head of the Statistics Unit (or nominee).

SUBJECT DESCRIPTIONS

Guide to subject descriptions

The subject descriptions shown below indicate the subject code and name, the number of credit points for the subject (i.e. *3cp*), the duration of the subject, indicated as semester weeks, if applicable, and the number of formal contact hours each week (i.e. *four hpw*); for some subjects, there may also be practical components off-campus, and this is indicated in the text. Also shown are the prerequisites or corequisites if any, the method of assessment and name of the subject coordinator, if known, and a brief outline of the content.

Prerequisites are subjects which must be completed before taking the subject to which they refer. Corequisites may be completed before or be taken concurrently with the subject to which they refer.

33100 DISCRETE MATHEMATICS *(3cp); three hpw*

Formal systems and proof methods. Propositional logic. Quantifiers and predicate logic. Method of induction. Sets and set operations. Indexing, mappings, relations and functions. Equivalence relations. Recursive definition of functions. Partially ordered sets. Semigroups, lattices and Boolean algebras and finite state machines. Basic combinatorial techniques and applications. Isomorphisms. Graphs, trees, sequences.

33101 MATHEMATICS I FOR BIOLOGICAL AND BIOMEDICAL SCIENCES *(3cp); three hpw*

Graphical procedures, linear, logarithmic, power, exponential and trigonometric functions and their use in developing models of biological systems from data or basic assumptions. The use of differential and integral calculus in investigating such systems.

33103 STATISTICS I FOR BIOLOGICAL AND BIOMEDICAL SCIENCES *(3cp); three hpw*

Populations and samples; measures of central tendency and dispersion; probability; binomial, Poisson and normal distributions; standard tests of significance and estimation for means and variances; goodness-of-fit tests.

33105 INTRODUCTORY BIOMETRICS FOR BIOLOGICAL AND BIOMEDICAL SCIENCES *(3cp); three hpw*

Design and analysis of biological experiments; completely randomised design. Regression analysis and correlation; multiple regression; polynomial regression. Randomised block and latin square designs; two factor experiments. Distribution-free tests.

33110 ENGINEERING MATHEMATICS I (ELECTRICAL) *(6cp); six hpw*

Matrices and determinants. Solution of linear equations. Gaussian reduction. Vectors. Products of vectors. Equations of lines and planes. Complex numbers. Polar form. DeMoivres theorem. Limits, continuity and differentiation. Mean value theorem. Curve sketching. Related rates. Maxima and minima. Integration. Riemann sums. Fundamental theorem of calculus. Application to areas and volumes and to lengths of curves. Logarithm and exponential functions. Trigonometric and hyperbolic functions. L'Hôpitals rule. Considerable time will be spent developing proofs of the basic concepts to aid in deep understanding.

33121 ENGINEERING MATHEMATICS IA *(3cp); three hpw*

Matrices and determinants. Vectors. Limits, continuity and differentiation. Applications of differentiation.

33122 ENGINEERING MATHEMATICS IB *(3cp); three hpw; prerequisite 33121 Engineering Mathematics IA*

This subject is a continuation of 33121. The two subjects cannot be taken concurrently. The following topics will be covered: integration and applications, elementary functions, methods of integration, sequences and series, complex numbers.

33170 BASIC SCIENCE MATHEMATICS *(3cp); three hpw*

Basic mathematics for scientists. Quadratic and linear equations. Functions; limits; continuity; derivatives. Trigonometric functions. Introduction to integral calculus.

33171 SCIENCE MATHEMATICS I *(4cp); four hpw; prerequisite 33170 Basic Science Mathematics*

A subject which develops the essential mathematical tools used in the physical sciences. Determinants and matrices. Differentiation. Trigonometric functions. Implicit differentiation. Integration. The natural logarithm and exponential functions. Inverse trigonometric functions. Sequences and series. Complex numbers.

33172 SCIENCE MATHEMATICS II *(3cp); three hpw; prerequisite 33171 Science Mathematics I*

An introduction to areas of application of differential and integral calculus in the physical sciences. Applications of differentiation; maximising

functions; Newtons method for finding roots. Applications of integration; areas, volumes, mass centres, arc lengths. Techniques for integrating; integration by parts; use of trigonometric identities; partial fractions. Functions of many variables; partial differentiation; chain rule. Variable separate differential equations; applications.

33173 SCIENCE MATHEMATICS III *(3cp); three hpw; prerequisite 33171 Science Mathematics I or 33175 Science Mathematics I; corequisite 33172 Science Mathematics II*

Mathematical techniques for the physical sciences. Matrices; inverses; eigenvalues and eigenvectors. Three dimensional coordinate geometry; vectors. Hyperbolic and inverse hyperbolic functions. Linear and exact first order differential equations. Infinite sequences and series.

33210 ENGINEERING MATHEMATICS II (ELECTRICAL) *(6cp); six hpw; prerequisites 33110 Engineering Mathematics I (Electrical), 33100 Discrete Mathematics (recommended)*

Methods of integration. Sequences and their convergence. Series and their convergence. Tests for convergence. Power series. Radius of convergence. Taylor series. Vector spaces. Linear independence. Bases. Inner products. Linear transformations. Rank of a matrix. Ordinary differential equations. First-order linear and variable separate equations. Solution of linear equations by auxiliary equation and undetermined coefficients. Systems of linear equations. Application of matrix exponentials. Partial derivatives. Gradient. Lagrange multipliers. Laplace transforms. Application to ordinary differential equations. Convolution theorem. There will be emphasis on formally proving the fundamental results.

33221 ENGINEERING MATHEMATICS IIA *(3cp); six hpw; prerequisite 33122 Engineering Mathematics IB*

Partial derivatives. Double and triple integrals. Applications of multiple integrals. Ordinary differential equations.

33222 ENGINEERING MATHEMATICS IIB *(3cp); three hpw; prerequisite 33221 Engineering Mathematics IIA*

This subject is a continuation of 33221. The two subjects cannot be taken concurrently. The topics covered are: Laplace transforms, series solutions of differential equations, boundary value problems, vector calculus.

33310 ENGINEERING MATHEMATICS III (ELECTRICAL) *(6cp); four hpw; prerequisite 33210 Engineering Mathematics II (Electrical)*

Series solution of linear differential equations. Ordinary and regular singular points. Bessel functions. Boundary value problems for one dimensional heat and wave equations. Laplace equation in a circle. Circular drum. Double and triple integrals. Polar, cylindrical and spherical coordinates. Line and surface integrals. Greens theorem. Divergence theorem and Stokes theorem. Analytic functions. Cauchy-Riemann equations. Conformal mapping. Cauchys integral theorem. Taylor and Laurent series. The residue theorem. Inverse Laplace transforms. There will be emphasis on formally proving the fundamental results.

33330 PHYSICAL MATHEMATICS *(3cp); three hpw; prerequisite 33221 Engineering Mathematics IIA*

Vector calculus; vector fields. Line and surface integrals. Conservative fields. Greens theorem. Divergence and curl. Gauss theorem and the equation of continuity. Stokes theorem and circulation. Ordinary Differential Equations: series solutions of linear equations with non-constant coefficients. Legendres and Bessels equations and functions. Boundary value problems: one-dimensional heat and wave equations. Separation of variables. Fourier sine and cosine series. Vibrating circular membrane.

34013 MODERN ANALYSIS (Honours) *(4cp); three hpw; prerequisite 34812 Analysis II, 34802 Algebra II*

As for 34913 Modern Analysis. Additional content: topological spaces, continuous functions, compactness, separation properties.

34014 MEASURE THEORY (Honours) *(4cp); three hpw; prerequisite 34013 Modern Analysis (Honours)*

As for 34914 Measure Theory. Additional content: the pi-lambda theorem, Fubinis theorem, Hahn decomposition, Radon-Nikodym theorem and conditional probability.

34019 FUNCTIONAL ANALYSIS *(4cp); three hpw; prerequisite 34014 Measure Theory (Honours)*

Banach spaces. Bounded linear transformations. Spectrum. Dual space. Adjoint operator. Hahn-Banach theorem. Compact operators. Riesz theory. Fredholm integral equations. Fredholm alternative. Application to potential theory. Hilbert spaces. Operators and adjoints. Riesz representation theorem. Orthogonality. Orthonormal bases.

Abstract Fourier theory. Self-adjoint operators. Projections. Compact operators. Spectral theory for compact operators. Application to Sturm-Liouville theory. Fourier series.

34023 PARTIAL DIFFERENTIAL EQUATIONS III *(4cp); three hpw; prerequisite 34922 Partial Differential Equations II*

First order equations. Classification of second-order linear equations. Wave equation. DAlemberts formula. Poissons formula. Huygens principle. Heat Equation. Maximum principles. Regularity of solutions. Nonlinear problems. Laplaces equation. Properties of harmonic functions. Greens function. Method of images. Integral equations. Fredholm theory. Application to Dirichlet and Neumann problems. Introduction to scattering theory. Scattering of plane waves by cylinders.

34026 FRACTAL GEOMETRY *(4cp); three hpw; prerequisite 34914 Measure Theory or 34014 Measure Theory (Honours)*

Review of relevant aspects of metric space theory, compactness, and contraction mappings. The space of fractals. Collage Theorem. Chaotic dynamics on fractals. Fractal dimension; theoretical and experimental determination. Fractal interpolation. Julia sets; attractors of iterated function systems, applications to Newtons method. Parameter spaces and Mandelbrot sets. Measures on fractals. Application to computer graphics.

34028 STOCHASTIC OPTIMAL CONTROL *(4cp); three hpw; prerequisites 34927 Deterministic Optimal Control, 34062 Stochastic Processes II*

Formulation of stochastic control problems. Examples of controls. The Hamilton-Jacobi-Bellman equation. Necessary and sufficient conditions. Reduction to Markov controls. Dynamic portfolio strategies. The optimal portfolio selection problem. Discussion of solutions in various particular cases.

34029 NONLINEAR DYNAMICAL SYSTEMS *(4cp); three hpw; prerequisites 34815 Ordinary Differential Equations, 34013 Modern Analysis (Honours)*

Review of linear systems. Nonlinear systems. Phase plane analysis. Linearisation. Local stability and instability. Global asymptotic stability. Stable and unstable manifolds. Limit cycles and strange attractors. Introduction to chaos theory. Asymptotic methods. The methods of Poincaré and Lindstedt. The method of averaging. Applications to the theory of finance.

34031 LARGE SCALE MATHEMATICAL PROGRAMMING *(4cp); three hpw; prerequisite 34932 Optimisation Techniques*

Theory and computational methods for optimising large scale linear and nonlinear programs, exploitation of special structure, data handling. Dantzig-Wolfe decomposition. Bender's decomposition, surrogate programming, multidivisional problems, combinatorial problems, stochastic problems and dynamic problems.

34033 DYNAMIC OPTIMISATION *(4cp); three hpw; prerequisites 34790 Numerical Computing, 34931 Linear Programming, 34961 Stochastic Processes I*

Bellmans principle of optimality. Recursive relations. Production scheduling. Resource allocation. Equipment replacement. Two or more state variables. Continuous state variables. Application to linear and nonlinear programming. Computational feasibility. Stochastic state space. PDP formulations. Markov decision processes. Approximation in policy space with discounting.

34036 STOCHASTIC MODELS IN OPERATIONS RESEARCH *(4cp); three hpw; prerequisites 34931 Linear Programming, 34033 Dynamic Optimisation, 34961 Stochastic Processes I*

Stochastic linear programming (two-stage linear programming formulations and change-constrained programming), finite horizon probabilistic dynamic programming, Markov chains and Markovian decision processes and probabilistic inventory models (infinite horizon continuous review).

34038 CORPORATE AND FINANCIAL DECISIONS AND INVESTMENT ANALYSIS *(4cp); three hpw; prerequisite 34938 Financial Modelling Techniques (or equivalent)*

Options: concepts and valuation models; current issues and developments. Capital structure and theory of the firm: the effects of personal and corporate tax; current issues. Dividend policy.

34039 SEMINAR: APPLICATIONS IN OPERATIONS RESEARCH *(4cp); three hpw; prerequisites by consent. Normally completion of three core operations research subjects is expected.*

Recognition of problem areas in the health field which can be solved and/or raised by operations research techniques such as simulation, queueing theory, mathematical programming and inventory

control. Human resources planning and scheduling in companies and facilities (such as the health system). Cohort analysis, Markov-based examples, effects of computerisation and technological change. Application to areas of the public sector including location of emergency services, capacity planning over time and service level decisions. Class discussion of on-going and prospective applications of operations research. Students will prepare and present a 15 minute talk on a paper from the literature on a topic not normally covered.

34040 OPERATIONS RESEARCH MODELS AND METHODOLOGY *(4cp); three hpw; prerequisites all subjects (or their equivalent) from the third year major in operations research in the Bachelor of Science (Mathematics) degree*

Students will be required to critically analyse recent studies from the literature, from the point of view of the OR methodology used. They will be required to develop alternative formulations of the problems and their solutions. Cases will be selected to cover the basic model prototypes (linear, network, dynamic and stochastic). At least one case study will involve the use of continuous and/or discrete event simulation using a high level language such a SimScript II.5.

34062 STOCHASTIC PROCESSES II *(4cp); three hpw; prerequisites 34960 Probability, 34961 Stochastic Processes 1, 34014 Measure Theory (Honours)*

Formal definitions of probability space and stochastic processes. Martingales. Riemann-Stieltjes integration. Brownian motion and related processes. Stochastic calculus and stochastic differential equations. Financial applications.

34065 TIME SERIES ANALYSIS *(4cp); three hpw; prerequisites 34960 Probability, 34961 Stochastic Processes I*

Model identification, estimation, diagnostic examination and forecasting for time series. Nonseasonal/ seasonal, stationary/nonstationary and linear/ nonlinear time series are considered. Models covered are Box-Jenkins, time series regression, exponential smoothing, transfer functions and classical regression.

34066 NONLINEAR STATISTICAL MODELS *(4cp); three hpw; prerequisites 34955 Regression Analysis, 34065 Time Series Analysis*

Nonlinear regression; least squares estimation; hypothesis testing. Use of SAS. Multivariate nonlinear regression. Nonlinear simultaneous equation models; method of moment estimators.

34067 MULTIVARIATE STATISTICS *(4cp); three hpw; prerequisite 34955 Regression Analysis*

Multivariate normal distribution: definition; moments; characteristic function; estimation of mean and covariance matrices; Wishart distribution; Hotellings T^2. Multivariate linear regression. principal components. Factor analysis. Cluster analysis.

34068 STATISTICAL MODELLING *(4 cp); three hpw; prerequisite 34956 Design of Experiments*

Revision of linear models and exponential families. Generalised linear models. Applications including logistic regression and contingency tables. Modelling using statistical distributions; continuous distribution models; discrete distribution models.

34069 LINEAR MODELS AND EXPERIMENTAL DESIGN *(4cp); three hpw; prerequisites 34956 Design of Experiments, 34067 Multivariate Statistics*

The subject provides the linear model theory for experimental design models and presents advanced experimental designs. Topics include: linear models – the linear model of less than full rank, the analysis of variance, completely randomised and randomised block designs, response surfaces, incomplete block designs, repeated measures designs.

34087 ANALYTIC NUMBER THEORY *(4cp); three hpw; prerequisites 34803 Algebra III, 34818 Complex Variables*

Divisibility, prime numbers and the fundamental theorem of arithmetic; arithmetical functions and Dirichlet multiplication; some asymptotic analysis involving arithmetical functions. Characters of finite Abelian groups; Dirichlet's theorem on primes in arithmetic progressions. The Riemann zeta funtion; analytic proof of the prime number theorem.

34096 CONVEXITY AND OPTIMISATION (HONOURS) *(4cp); three hpw; prerequisite 34013 Modern Analysis (Honours)*

As for 34996 Convexity and Optimisation. Additional content general constrained optimisation theory. Application to calculus of variations. Introduction to applications in optimal control theory.

34097 REPORT *(12cp); prerequisites completion of at least six subjects of the Masters degree course*

An applied or theoretical study in an area chosen in consultation with the project supervisor who will be appointed by the Head of School.

34098 PROJECT (Honours) *(4cp); Autumn semester)*

34099 PROJECT (Honours) *(8cp); (Spring semester)*

Prerequisite admission to the BSc(Hons) program

Students will perform an independent investigation of an area of the mathematical sciences chosen in consultation with a supervisor who will be appointed by the Head of School. The project commences in the Autumn semester of the honours year and students will enrol in the three-hour unit 34098. The project continues in the Spring semester with the six-hour unit 34099. At the end of the Spring semester identical results will be awarded for both 34098 and 34099 (based on assessment consisting of the presentation of a report and seminar).

34692-34696 PROJECT *(2-6cp); prerequisite by consent*

An investigation of a topic selected by the student with the approval of the Director of Undergraduate Studies or his or her representative. A formal report must be submitted and a seminar presented. Although this is a final year subject, consideration should be given to the selection of a topic in the preceding year.

34700 DISCRETE MATHEMATICS *(4cp); three hpw*

Graphs, paths, trees. Set operations. Indexing and recurrence relations. Propositional and predicate calculus. Semigroups, lattices and Boolean algebras. Permutations, combinations, partitions, counting and allocation problems.

34701 ALGEBRA I *(4cp); three hpw*

Complex numbers: polar form; de Moivres theorem; exponential form; regions in the complex plane. Polynomials: remainder and factor theorems; synthetic division; Descartes Rule of Signs; relations between roots and coefficients. Systems of linear equations: Gaussian elimination; homogeneous systems. Matrices: matrix algebra; elementary matrices; inverse matrix; application to systems of linear equations; LU decomposition. Determinants: definition and properties; methods of evaluation; Cramers Rule; adjoint form for inverse matrix; characteristic equation. Vectors: algebra of vectors; dot and cross products; triple products; applications to trigonometry and three-dimensional coordinate geometry.

34710 CALCULUS *(8cp); six hpw*

Graphical introduction to limits, continuity and differentiation. Graphical introduction to the Mean Value Theorem. Applications of differentiation. Riemann integration and the Fundamental Theorem of Calculus. Applications of integration to areas, volumes, length of curves and surface areas. Logarithmic and exponential functions. Trigonometric and inverse trigonometric functions. Hyperbolic and inverse hyperbolic functions. Methods of integration. Improper integrals.

34711 ANALYSIS I *(3cp); three hpw; prerequisite 34710 Calculus*

Convergence of sequences, limit theorems. Points sets; the least upper bound axiom, nested interval property and Bolzano-Weierstrass theorem; application to sequences. Limit of a function; limit theorems; continuity; discussion in terms of sequences. Properties of continuous functions on a closed interval. Differentiation; the Mean Value Theorem. Taylors Theorem with remainder; L'Hôpitals rule. Infinite series; convergence tests for series of positive terms; absolute and conditional convergence; alternating series. Improper integrals; convergence tests. Power series and radius of convergence. Taylor and Maclaurin series; associated numerical problems.

34740 INTRODUCTION TO OPERATIONS RESEARCH MODELS *(3cp); three hpw; corequisite 34751 Statistics 1*

Introduction, formulation of problems, construction of models. Examples from linear and other mathematical programming, network models, dynamic programming, inventory control, Bayesian decision analysis, financial techniques, stochastic processes, simulation, heuristics, game theory and queueing theory.

34751 STATISTICS I *(4cp); three hpw; prerequisite 34710 Calculus*

Descriptive statistics. Probability. Random variables; expectation. Standard probability distributions. Concepts of sampling. Confidence intervals and hypothesis testing. Inference about means, variances and proportions. Goodness of fit tests. Non-parametric tests. Linear regression and correlation.

34770 COMPUTING IA *(4cp); six hpw; corequisite 34700 Discrete Mathematics*

An introduction to a disciplined approach to problem-solving and algorithm development using modern functional (MIRANDA) and imperative (MODULA-2) programming languages. Informal introduction to algebraic methods of specification, development and proof of programs. Use of MIRANDA to implement equational specifications: guarded equations, block structure, lists and list comprehensions, types, polymorphism, abstract data types, currying and higher order functions (map, filter fold), lazy evaluation and infinite lists. Introduction

to functional programming in an imperative language. Elementary syntactic features of MODULA-2: control structures, external modules, procedures, scope of identifiers, scalar and elementary structured data types.

34771 COMPUTING IB *(4cp); six hpw; prerequisites 34700 Discrete Mathematics, 34770 Computing IA; corequisite 34781 Mathematical Foundations of Computing I*

Further investigation and use of the syntactic and semantic features of MIRANDA and MODULA-2 and the continued development of formal specification and refinement techniques appropriate to these languages. Emphasis will be placed on modular design and the investigation of a range of algorithms and recursively defined data types.

34781 MATHEMATICAL FOUNDATIONS OF COMPUTING I *(4cp); three hpw; prerequisites 34700 Discrete Mathematics, 34770 Computing IA*

Historical overview of computing machinery; introduction to deterministic finite automata; design of combinatorial circuits and clocked sequential circuits; the von Neumann architecture; elementary data types, representation of values and realisation of operators; registers, arithmetic and logic units, data path; the fetch-execute cycle. Introduction to the theory of computation: algorithms as function definitions; the halting problem, Churchs thesis; introduction to the lambda calculus.

34790 NUMERICAL COMPUTING *(4cp); six hpw; prerequisites 34710 Calculus; corequisite 34711 Analysis I*

Coverage of the elements of the C language including control structures, functions, arrays and I/O. Basic program design techniques and their implementation in C. Preprocessor facilities, standard libraries, function prototyping and restricted identifier scope. An introduction to numerical computing includes treatment of errors, simple algorithms for solving nonlinear equations in one variable (bisection and Newtons methods), linear equations in several variables (Gaussian elimination, iteration), and algorithms for performing numerical integration (trapezoidal and Simpsons rules, extrapolation). Non-numerical applications include sorting, searching, and text processing.

34802 ALGEBRA II *(4cp); three hpw; prerequisite 34701 Algebra I*

Vector spaces: Euclidean and general vector spaces; subspaces; linear independence; basis and dimension; row and column space; inner product spaces; the Gram-Schmidt process; change of basis. Linear transformations. Eigenvalues and eigenvectors: diagonalisation; similarity; symmetric matrices; applications to quadratic forms, conic sections, powers of a matrix and difference equations. Complex vector spaces: complex inner product spaces; unitary, normal and Hermitian matrices.

34803 ALGEBRA III *(4cp); three hpw; prerequisite 34802 Algebra II*

Sets, relations and functions. Order relations. Posets and lattices. Semigroups. Generators. Quotient semigroups. Finite state machines. Languages. Monoids. Groups. Normal subgroups. Quotient groups. Lagranges theorem. Homomorphisms. Permutation groups, orbits and symmetries. Rings and ideals. Quotient rings. Fields. Introduction to finite fields and coding theory.

34807 HISTORY OF MATHEMATICS *(4cp); three hpw*

A brief account of the whole history of mathematics from antiquity until the late 20th century. Topics will include Greek mathematics and the works of Eudoxus, Euclid, Archimedes, Appolonius and Pappus. Renaissance mathematics – cubics and quartics. The rise of analysis – Newton, Leibnitz, the Bernoullis, Euler. Early modern mathematics – Langrange, Laplace, Legendre, Carnot, Desargues. The 19th century – from Gauss to Klein. Some 20th century developments.

34812 ANALYSIS II *(4cp); three hpw; prerequisite 34711 Analysis I; corequisite 34821 Partial Differential Equations I*

Cauchy sequences; cluster points of sequences; convergence of Cauchy sequences; sequential compactness of the real line; continuous and uniformly continuous functions; further properties of continuous functions on a closed interval; Mean Value Theorem and Fundamental Theorem of Calculus; sequences and series of functions; uniform convergence; continuity, integrability and differentiability of series of functions; Weierstrass M-test; power series; Fourier series; applications to ordinary differential equations and boundary value problems.

34815 ORDINARY DIFFERENTIAL EQUATIONS *(4cp); three hpw; prerequisite 34710 Calculus; corequisite 34802 Algebra II*

First-order equations. Theory of linear equations. Auxiliary equations and undetermined coefficients. Variation of parameters. Laplace transforms, step functions, convolution. Eigenvalues and matrix exponentials. Qualitative properties of solutions. Phase plane. Stability. Linear and nonlinear systems. Predator-prey problems.

34817 VECTOR CALCULUS *(4cp); three hpw; prerequisite 34710 Calculus*

Partial derivatives. Multiple integrals. Vector fields. Line and surface integrals. Greens, Gauss and Stokes theorems.

34818 COMPLEX VARIABLES *(4cp); three hpw; prerequisites 34711 Analysis I, 34817 Vector Calculus*

Analytic functions of a complex variable. Cauchys integral theorem. Laurent series. Singularities of analytic functions. The residue theorem. Contour integration. Conformal mapping.

34821 PARTIAL DIFFERENTIAL EQUATIONS I *(4cp); three hpw; prerequisite 34815 Ordinary Differential Equations; corequisite 34817 Vector Calculus*

Solution of boundary value problems by separation of variables. Sturm-Liouville theory. Fourier series. Two dimensional problems. Infinite domain problems. Fourier integrals and Fourier transforms. Greens function methods. Laplace transform methods for elementary boundary value problems.

34852 STATISTICS II *(4cp); three hpw; prerequisite 34751 Statistics I*

Probability distributions. Moment generating functions. Bivariate distributions. Distribution of functions of random variables. Order statistics. Standard sampling distributions. Central Limit Theorem. Properties of point estimators. Maximum likelihood estimation.

34872 COMPUTING II *(4cp); five hpw; prerequisite 34771 Computing IB*

The aim of this subject is to develop further a disciplined approach to the specification, design, implementation and testing of software using imperative and functional languages. Topics include: abstract data types (ADTs) (list, stack, queue, dequeue, tree, graph, etc); formal specification of ADTs; static and dynamic implementation in an imperative language; requisite features of C and C++; introduction to order notation and efficiency considerations; algorithm analysis (examples include searching and sorting algorithms). Functional programming: functional implementation of ADTs; recursion and induction on lists.

34873 COMPUTING III *(4cp); five hpw; prerequisites 34711 Analysis I, 34872 Computing II; corequisite 34803 Algebra III*

Consolidation and extension of the work on specification of abstract data types, together with advanced implementation issues. Systematic techniques of algorithm design and analysis, together with associated mathematical methods, will deal with issues of complexity, efficiency and program verification. A wide range of advanced applications will be examined via case studies, both in formal lectures and practical assignments. In addition to existing imperative and functional languages, an object-oriented language will be introduced and employed extensively in practical assignments and in the implementation of flexible and reliable software.

34891 NUMERICAL METHODS A *(4cp); five hpw; prerequisites 34711 Analysis I, 34790 Numerical Computing, 34802 Algebra II*

Solution of nonlinear equations. Analysis of convergence. Error analysis. Lagrange interpolation, cubic splines, Bezier curves. Numerical differentiation and integration: Newton-Cotes adaptive methods, Gaussian quadrature, methods involving Richardsonian extrapolation. Approximation theory: least squares and orthogonal polynomials, economisation of power series using Chebychev polynomials, rational approximations. Vector and matrix norms. Numerical linear algebra: LU factorisation, iterative methods – Jacobi method. Householder reduction, QR algorithm. Initial value problems for ordinary differential equations: introductory material including Taylor series methods, open Runge-Kutta methods and multistep methods. This subject is heavily oriented towards practical applications.

34894 MATHEMATICAL AND BUSINESS MODELLING *(4cp); five hpw; prerequisites 34751 Statistics I, 34790 Numerical Computing*

Modelling topics will be drawn from linear programming, simulation, project management, decision trees, input-output tables and elementary financial modelling, together with their application to decision making in business and other areas. Numerical work will be conducted in the environment of a commonly available spreadsheet such as Lotus 1-2-3. The subject will also provide a coverage of elementary spreadsheet facilities, the use of high level features such as graphics, optimisation and regression functions, database facilities and programming in the macro language.

34904 ALGEBRA IV *(4cp); three hpw; prerequisite 34803 Algebra III*

Polynomials in splitting fields; Euclidean constructions; finite fields; normal extensions, Galois fields, primitive and cyclotomic polynomials; latin squares; modular arithmetic; elements of graph and coding theories.

34906 DIFFERENTIAL GEOMETRY *(4cp); three hpw; prerequisites 34802 Algebra II, 34815 Ordinary Differential Equations, 34817 Vector Calculus*

In general terms the content consists of the development of the geometry of n dimensional surfaces in $n + 1$ dimensional space. Specific topics are: Graphs and level surfaces. Vector fields. The tangent space. Surfaces. Vector fields on surfaces. Orientation. The Gauss map. Geodesics and parallel transport. The Weingarten map. Curvature of plane curves. Curvature of surfaces. Arc length and line integrals. Parametrised surfaces. Local equivalence of surfaces and parametrised surface. Rigid motions and congruences. Isometries.

34909 SEMINAR: MATHEMATICS *(4cp); prerequisite by consent*

34913 MODERN ANALYSIS *(4cp); three hpw; prerequisites 34802 Algebra II, 34812 Analysis II*

Metric space axioms. Open and closed sets. Interior and closure. Sequences in a metric space. Sequential compactness. Contraction mapping theorem. Application to existence theorems for differential equations. Continuous mappings between metric spaces. Normed linear spaces. Banach spaces. Bounded linear maps. Operators and functionals. Dual spaces. Hilbert spaces.

34914 MEASURE THEORY *(4cp); three hpw; prerequisite 34913 Modern Analysis or 34013 Modern Analysis (Honours)*

Measures and outer measures. Measure spaces. Lebesgue measure on the real line. Measurable functions. Step functions. Definition of the abstract Lebesgue integral. Monotone convergence theorem. Dominated convergence theorem. Probability spaces. Independence. Borel-Cantelli lemmas. Laws of large numbers.

34916 MATHEMATICAL METHODS *(4cp); three hpw; prerequisite 34922 Partial Differential Equations II*

Theory of distributions. The Fourier transform and applications to partial differential equations. Introduction to the calculus of variations. Euler-Lagrange equations. The brachistochrone problem. Eigenvalue problems. Lagrangian and Hamiltonian mechanics. Lagranges equations of motion. Hamiltons principle. The principle of least action.

34920 INTEGRAL EQUATIONS *(4cp); three hpw; corequisite 34913 Modern Analysis or 34013 Modern Analysis (Honours)*

Existence theory for Fredholm and Volterra integral equations using contraction mappings. Compact integral operators. Greens functions.

34922 PARTIAL DIFFERENTIAL EQUATIONS II *(4cp); three hpw; prerequisites 34818 Complex Variables, 34821 Partial Differential Equations I*

Bessels equation and Bessel functions. Boundary value problems for partial differential equations involving Bessels equation. Legendres equation and Legendres associated equation. Legendre functions and associated Legendre functions. A thorough treatment of Laplace transforms. Inverse Laplace transforms using complex variable methods.

34924 MECHANICS *(4cp); three hpw; prerequisites 34815 Ordinary Differential Equations, 34817 Vector Calculus*

Kinematics and dynamics of a particle. Projectile motion. Oscillations. Conservative forces and central forces. Theory of planetary motion. Rigid bodies.

34925 WAVE THEORY *(4cp); three hpw; prerequisite 34922 Partial Differential Equations II*

Acoustic waves in fluids. Waves on a liquid surface. Elastic waves in solids. Electromagnetic waves.

34927 DETERMINISTIC OPTIMAL CONTROL *(4cp); three hpw; prerequisites 34815 Ordinary Differential Equations, 34817 Vector Calculus*

Introduction to optimal control problems for ordinary differential equations. Linear problems and bang-bang controls. Nonlinear problems and Pontryagins maximum principle. Necessary conditions. Sufficient conditions. Various endpoint conditions. Calculus of variations. Dynamic programming. Infinite horizon problems. Applications to optimal economic growth and to optimal investment and consumption decisions.

34930 SIMULATION TECHNIQUES *(4cp); three hpw; prerequisite 34751 Statistics I; corequisite 34790 Numerical Computing*

Survey of the types of problems amenable to study by simulation. Use of Activity Cycle Diagrams to describe systems of interacting entities. Statistical models. Input data analysis. Output analysis. Verification and validation. Comparison of system designs. Random number generation. Tests for random numbers. Random variate generation. Investigation of variance reduction techniques. Application of simulation techniques to specific operations research problems such as inventory control, queueing theory etc. Simulation with SEESIM, SIGMA and SIMSCRIPT II.5.

34931 LINEAR PROGRAMMING *(4cp); three hpw; prerequisite 34740 Introduction to Operations Research Models; corequisite 34802 Algebra II*

Formulation of linear problems. Revision of the simplex method and its variants. Applications of linear programming. Use of computer packages in solution. The revised simplex method and Karmarkar's method. Duality and the dual simplex method. Sensitivity analysis and parametric programming. Goal programming and integer programming using simplex method-based techniques. Advanced techniques.

34932 OPTIMISATION TECHNIQUES *(4cp); three hpw; prerequisites 34711 Analysis I, 34931 Linear Programming*

A unified treatment of the solutions of models derived from real-life situations: use of classical optimisation techniques. Derivation and application of Kuhn-Tucker theorem. Selected algorithms of non-linear programming. Quadratic programming, separable programming. Integer programming, Branch and Bound technique. Geometric programming.

34934 NETWORK OPTIMISATION *(4cp); three hpw; corequisite 34931 Linear Programming*

Transportation problems. The transportation simplex method. Assignment problems. Transshipment problems. Shortest path problems. Maximum flow problems. Project planning and scheduling. CPM cost models. Network simulation models. Minimum cost network flow problems. The network simplex method.

34935 INVENTORY CONTROL *(4cp); three hpw; corequisite 34930 Simulation Techniques*

Economic order quantity. Production lot size. Quantity discounts. Shortage models. Single period model. Safety stock approach. Service level approach. Periodic review system. ABC classification. Simulation models. Dynamic EOQ. Wagner-Whitin algorithm and Silver-Meal heuristic. Classical optimisation methods. Materials requirements planning.

34936 DECISION THEORY *(4cp); three hpw; prerequisite 34751 Statistics I*

Influence diagrams. Sensitivity analysis. Using sample information. Normal prior distributions. Beta prior distributions. Risk analysis. Value of information. Preferences. Multi-attribute utility. Classical vs Bayesian methods.

34938 FINANCIAL MODELLING TECHNIQUES *(4cp); three hpw; prerequisites 34711 Analysis I, 34751 Statistics I*

Introduction of some stylised models of the standard problems of financial management and the mathematical techniques for their solution. Models covered include asset and liability management, planning day-to-day operations and the firms financing and investment decisions. Topics include the concept of net-present value, the present value of income streams; the capital budgeting problem – investment under certainty, investment decisions under uncertainty; the debt-capacity decision; debt maturity and timing decisions; dividend policy, internal financing and growth.

34939 SEMINAR: OPERATIONS RESEARCH *(4cp); prerequisite by consent*

34953 STATISTICAL INFERENCE *(4cp); three hpw; prerequisite 34852 Statistics II*

Estimation: sufficiency; completeness. Hypothesis testing: decision problems; Neyman-Pearson lemma; best tests; uniformly most powerful tests; sequential probability ratio test; minimax and Bayesian tests. Distribution free methods: estimation and hypothesis testing. Further theory of inference.

34955 REGRESSION ANALYSIS *(4cp); three hpw; prerequisite 34852 Statistics II*

Simple linear regression. Analysis of Variance. Multiple regression. Polynomial regression. Regression diagnostics. Model building. Introduction to generalised linear models. Use of computer packages such as SAS, SPSS, MINITAB and GLIM, and the use of APL.

34956 DESIGN OF EXPERIMENTS *(4cp); three hpw; prerequisite 34955 Regression Analysis*

Single factor analysis of variance: completely randomised design; fixed effects model; expected mean squares; relation to multiple regression model; random effects model. Further analysis: orthogonal contrasts; multiple range tests. Randomised block design. Latin squares. Factorial (crossed) experiments; interaction; mixed models. Nested factors. Cross-nested designs. 2^f factorials; Yates' method; confounding; fractional replication. Further topics: analysis of covariance; split-plots; power. Use of computer packages MINITAB, SPSS, SAS and GLIM.

34957 QUALITY CONTROL *(4cp); three hpw; prerequisite 34852 Statistics II*

Total quality control. Statistical Process Control. Acceptance sampling. Taguchi methods. Reliability. Repeatability and reproductibility.

34959 SEMINAR: STATISTICS *(4cp); three hpw; prerequisite by consent*

34960 PROBABILITY *(4cp); three hpw; corequisite 34852 Statistics II*

Probability; axioms including sigma-fields. Combinatorics; occupancy problems; probability of a union. Conditional probability. Independence. Random variables. Expectations. Conditional expectation. Central limit theorem. Weak and strong laws of large numbers.

34961 STOCHASTIC PROCESSES I *(4cp); three hpw; prerequisite 34852 Statistics II*

Markov chains; classification of states; limiting properties. Poisson process. Markov processes; birth-death processes; limiting distributions; application to queueing models. Brownian motion.

34975 COMPUTER GRAPHICS *(4cp); three hpw; prerequisites 34790 Numerical Computing, 34802 Algebra II*

Hardware: capabilities of typical devices such as plotters and raster scan instruments. Standard system software including point plotting and line drawing (Bresenhams algorithm), transformations (scaling, translations, rotations) in two dimensions, clipping and windowing. Area filling algorithms: flood-fill, raster scan. Three-dimensional drawing: transformations, projections (orthogonal and perspective), homogeneous coordinates, floating horizon hidden surface algorithm. Curve and surface interpolation – cubic splines, Bezier curves and surfaces, B-splines. Graphic standards: GKS, PHIGS.

34976 NEURAL NETWORKS *(4cp); three hpw; prerequisites 34751 Statistics I, 34790 Numerical Computing, 34802 Algebra II, 34817 Vector Calculus*

Fundamental concepts: theories of mind and brain (ancient to modern), cybernetics (deterministic systems, feedback, communication, control, adaptation), brain theory (neurons, brain structures, representation), rise of connectionism (the Von Neumann bottleneck, the parallel distributed processing paradigm). Neural network models and learning algorithms, the latter in parentheses: associative nets (Hebbian learning), the Perceptron (error-correcting rule), multi-layer networks (back-propagation, Boltzmann machines), interactive activation and Grossberg models (competitive learning), Barto model (reinforcement learning). Applications: travelling salesman problem, NETtalk (a network that learns to talk).

34977 FORMAL SPECIFICATION *(4cp); three hpw; prerequisite 34982 Mathematical Foundations of Computing II*

An introduction to the mathematical basis of formal specification theory, including linguistic systems and models of specification systems. Software development by linguistic transformations. A comparative study of the principles and practices of important formal specification methods used in modern software construction, including algebraic specification, the Vienna Development Method and Z.

34979 SEMINAR: COMPUTING *(4cp); prerequisite by consent*

34982 MATHEMATICAL FOUNDATIONS OF COMPUTING II *(4cp); three hpw; prerequisites 34803 Algebra III, 34873 Computing III*

An introductory but systematic survey of the logical, algebraic and categorical foundations of formal program semantics, together with associated verification methods. Operational and denotational semantics, and the axiomatic methods of Floyd, Hoare and Dijkstra will be introduced. The theoretical basis of algebraic semantics will be fully established and its implications considered. The lambda and combinatorial calculi will be developed within the context of the semantics of functional programming languages.

34983 MATHEMATICAL FOUNDATIONS OF COMPUTING III *(4cp); three hpw; prerequisite 34982 Mathematical Foundations of Computing II; corequisite 34984 Language Theory*

Additional topics in the denotational semantics of applicative and imperative programming languages. Further topics in algebraic semantics: initial and final algebra approaches to specification of data types, as well as the initial algebraic specification of languages. Selected topics in the theory of computation will include computability, Turing machines, the Church-Turing thesis, decidability, complexity issues, completeness and tractability.

34984 LANGUAGE THEORY *(4cp); three hpw; prerequisite 34982 Mathematical Foundations of Computing II*

Chomskys categorisation of grammars; regular and context-free grammars and languages; finite state recognisers; parsing strategies; recursive descent and table-driven parsers; operational semantics and program transformation; language design, translation and implementation of a simple, block-structured

imperative language; issues in the implementation of functional languages (combinator compilation, strict and lazy evaluation, supercombinators).

34985 DIGITAL IMAGE PROCESSING *(4cp); three hpw; prerequisites 34802 Algebra II, 34790 Numerical Computing*

Preliminaries: human vision, digital image models, image geometry and transformations, display devices. Image transforms: the Fourier transform, convolution, cross correlation and auto correlation, basic transform theorems. The discrete Fourier transform and its properties: fast Fourier transform implementation, aliasing, leakage. The 2-dimensional transform and its associated implementation. Image enhancement and restoration: histogram modification techniques, low, high and band-pass filters, image sharpening and smoothing, psuedo-colouring. Models of degradation, inverse filtering, removal of linear blur, frequency modification. Image segmentation: point, line and edge detection, the Hough transform, thresholding and region segmentation.

34986 CRYPTOLOGY *(4cp); three hpw; prerequisite 34790 Numerical Computing*

Divisibility and prime numbers; the fundamental theorem of arithmetic; congruences; applications; Fermats Theorem. Applications to primality testing and factorisation; Fermats and Pollards p-1 methods. Multiplicative functions; Eulers function, sum and number of divisors; perfect numbers. Cryptology: block ciphers, exponentiation ciphers, public key cryptography, knapsack ciphers. Continued fractions, application to factorisation.

34992 NUMERICAL METHODS B *(4cp); three hpw; prerequisites 34790 Numerical Computing, 34821 Partial Differential Equations I*

Solution of ordinary differential equations, including some revision of earlier work. Initial value problems: single step and multi-step methods. VSVO, extrapolation and implicit methods. Stiff differential equations and methods appropriate thereto. Stability theory. Boundary value problems: shooting, finite difference and finite element methods. Differential eigenvalue problems. Solution of partial differential equations: finite difference and finite element methods. Optimisation: methods for unconstrained nonlinear optimisation, steepest descent, damped Newton-Raphson and matrix updating techniques. Overdetermined systems.

34995 ADVANCED NUMERIC AL ANALYSIS *(4cp); three hpw; prerequisites 34913 Modern Analysis or 34013 Modern Analysis (Honours)*

Differentiation in normed linear spaces. Mean Value Theorem and Taylors Theorem in Banach spaces. Product spaces and partial differentials. Nonlinear equations and the Newton-Kantorovich method.

34996 CONVEXITY AND OPTIMISATION *(4cp); three hpw; prerequisites 34913 Modern Analysis or 34013 Modern Analysis (Honours)*

Convex sets in a linear space. Affine sets and hyperplanes. Algebraic interior and closure. Separation theorems. Geometric Hahn-Banach theorem. Convex functions. Epigraphs. Subdifferentiability and differentiability. Duality. Polars. Support functions. Linear and convex programming. Kuhn-Tucker conditions.

34997 PROJECT (Graduate Diploma) *(8cp); prerequisite completion of at least six subjects of the Graduate Diploma course*

An applied study in an area chosen in consultation with a project supervisor appointed by the Head of School.

SUBJECTS OFFERED BY OTHER FACULTIES

22105 ACCOUNTING A *(5cp); three hpw*

The subject has two sections: (a) introduction setting out the nature of accounting and its relationships together with double entry bookkeeping's unique ability to record market activity, (b) the body of the course dealing with the accounting process (journals to ledger), double entry bookkeeping, definition of the elements of financial statements, using control accounts, control of cash, using accrual accounting, inventory, non-current assets, preparation of financial statements and the so-called limitations of the historical cost model.

25110 MICROECONOMICS *(5cp); three hpw*

Basic market theory; demand theory; elasticity of demand; short-run cost theory; short-run supply theory and long-run cost theory; resource market theory; perfect and monopolistic competition; oligopoly and monopoly; firm behaviour – theory of competition policy; theory of trade; market failure theory; income redistribution; industry policy; regulation.

25209 MACROECONOMICS *(5cp); three hpw; prerequisite 25110 Microeconomics*

Inflation and unemployment; aggregate supply and demand; national accounts; elementary income determination theory; interest rates and expenditure; the monetary sector; combining money and expenditure sectors; the balance of payments; prices, wages and the Phillips curve; stagflation.

25210 MICROECONOMIC POLICY *(5cp); three hpw; prerequisite 25110 Microeconomics*

The need for public regulation and/or control of business activity; microeconomic policy formulation; theory of firms and markets; restrictive trade practices; consumer protection; small business; industry policy; tariffs and structural change; foreign investment; resources policy.

25308 FINANCIAL INSTITUTIONS AND MARKETS *(5cp); three hpw; prerequisites 25110 Microeconomics, 25209 Macroeconomics*

Financial intermediation; interest rate determination; financial market theory; bond pricing; foreign exchange market futures; options and swaps; the financial system and the Reserve Bank; introduction to banking; equity market.

25314 BUSINESS FINANCE I *(5cp); three hpw; prerequisites 22105 Accounting A, 25110 Microeconomics, 34751 Statistics 1; corequisite 25308 Financial Institutions and Markets*

Consumption/investment decision; investment decision and techniques for evaluation; factors affecting investment; the concept of risk; the pricing of risk; investment decisions under risk; the financing decision; sources of finance, leasing; capital structure theories; dividend policy.

25421 INTERNATIONAL FINANCIAL MANAGEMENT *(5cp); three hpw; prerequisite 25314 Business Finance I*

International financial management: mechanics and functions of foreign exchange markets; exchange rate determination and parity relationships; forecasting, measurement of foreign exchange risk; multinational working capital management; trade finance; financing foreign operations; long term asset and liability; international taxation management.

25502 CURRENT ISSUES IN FINANCE *(5cp); for details, consult the Faculty of Business*

25606 FINANCIAL TIME SERIES ANALYSIS *(5cp); for details, consult the Faculty of Business*

25905 ASSET PRICING AND CAPITAL MARKETS STUDIES (HONOURS) *(5cp); three hpw; prerequisite 25314 Business Finance I*

The contribution of Markowitz and others to modern portfolio theory and the CAPM, including market equilibrium and efficient market assumptions; empirical tests relating to the CAPM and its derivatives; arbitrage pricing theory; pricing models for contingent claims, in particular, options and futures; efficient capital markets–theory and evidence.

259 INVESTMENT ANALYSIS AND PORTFOLIO MANAGEMENT (HONOURS)** *(5cp); for details, consult the Faculty of Business*

259 FUTURES AND OPTIONS (BMathFin)** *(4cp); for details, consult the Faculty of Business*

259 ADVANCED CORPORATE FINANCE (BMathFin)** *(4cp); for details, consult the Faculty of Business*

79101 LAW FOR BUSINESS *(5cp); three hpw*

Legal philosophy; legal history; constitutional law; torts; crime; property; contracts and consumer protection.

SCHOOL OF COMPUTING SCIENCES

The School offers the following courses:

Undergraduate
Bachelor of Science in Computing Science
Bachelor of Information Technology
Postgraduate
Graduate Diploma in Data Processing
Master of Science in Information Science (by coursework)
Master of Science (by thesis)
Doctor of Philosophy
The following Graduate Certificate courses will be offered for the first time in Autumn 1993.
Applied Computing
Information Systems
Computer Science
Advanced Information Technology
Software Quality Assurance

UNDERGRADUATE COURSES

BACHELOR OF SCIENCE IN COMPUTING SCIENCE

The aim of the course is to provide a sound education in all aspects of computing for students who intend to make a career in the profession. It is intended that the course will provide a suitable background covering all aspects of computing science, short of the actual design and construction of "hardware" systems.

The course has been designed to provide for the study in depth of computing science and its applications, and, in addition, support subjects are included to enable the graduate to fulfil an appropriate function in the sphere of business activity. It is intended that the formal studies will be treated in a manner which will encourage initiative. Not only will the course provide a suitable framework for a professional career, but it will also form a basis from which postgraduate studies may begin.

The course consists of six academic semesters of full-time study or the equivalent in part-time attendance and a period of industrial training.

Holders of the degree are granted exemption from the Associate examinations of the Australian Computer Society.

Electives

By way of electives, the course allows students to include in their program some advanced computing subjects, subjects of personal interest which need not be related to computing, or a sub-major in another discipline. A total of 40 credit points is allocated to elective subjects.

Students must take elective subjects offered within the School of Computing Sciences totalling at least 16 credit points (normally four subjects). These are the Computer Science/Information Systems (CS/IS) electives. Students must take a further 24 credit points worth of elective subjects which may be selected from other electives offered by the School, from the many sub-major disciplinary sequences offered by other Schools within UTS, or a combination of electives offered by the School and individual approved electives offered by other Schools within UTS or at other universities.

Industrial Training

All students in the BSc(Computing Science) are required to pass the two Industrial Training subjects. There are a substantial number of prerequisites for Industrial Training which are noted in the subject description section. Full-time students normally undertake Industrial Training after completing Semester 4; the Industrial Training subject numbers for the full-time attendance pattern are 31696 and 31697. Part-time students normally undertake Industrial Training after completing Stage 4; the Industrial Training subject numbers for the part-time attendance pattern are 31698 and 31699.

To gain credit for Industrial Training, students are required to obtain an approved, full-time job within the Information Industry. The duration of Industrial Training is nine months for full-time students and 18 months for part-time students. During Industrial Training students are required to behave in a professional manner, and, to enable the School to assess their experience, are required to keep the School informed of the status of their employment at all times. Each year the School of Computing Sciences publishes an *Industrial Training Student Guide* which sets out in detail what is required to pass these two subjects; students are advised to obtain a copy of this guide and to study it carefully.

Although the securing of suitable employment during Industrial Training is the student's responsibility, the School will assist students in obtaining a placement.

Students who wish to benefit from the direct assistance of the School in finding an Industrial Training position should obtain a copy of the *Industrial Training Student Guide* from the School Office and carefully study the procedure to be followed.

Those who wish to seek an Industrial Training position without the direct assistance of the School

should first make an appointment to see the School's Cooperative Education Officer who will provide a description of the requirements of an Industrial Training position. If a student finds employment an appointment should be made to see the School's Cooperative Education Officer and to obtain certification that the employment is suitable for Industrial Training.

Industrial Training students are assessed by senior members of the academic staff.

In general, students find Industrial Training extremely beneficial in relating the final year of coursework to the practical needs of the Information Industry, and this experience can be cited when applying for graduate career positions.

Laboratory Sessions

These sessions are designed to give students formal tuition in using computer systems and to give practical experience of the coursework. Every laboratory session is attached to a specific subject. (For example, Commercial Programming Development involves five hours attendance each week, lectures and tutorials being scheduled for three hours and the laboratory session being two hours.) Full-time students have laboratory sessions totalling six hours per week scheduled in each semester, excluding the Industrial Year, and part-time students have laboratory sessions of three hours per week scheduled in each semester.

Exemptions

Exemptions may only be granted on the basis of recent academic study towards an incomplete degree. The student must be able to demonstrate that the knowledge is current. Exemptions for core subjects may be granted where subjects successfully studied previously coincide with BSc subjects. For further information consult the current School Handbook.

Exemptions are usually processed by the School immediately following enrolment.

The following exemptions are granted to holders of TAFE Associate Diplomas:-

ASSOCIATE DIPLOMA OF BUSINESS (COMMERCIAL DATA PROCESSING)

31611 Information Systems (4cp)
2402C Systems Analysis and Design I
2402D Computing I

51370 Human Communication (3cp)
8559C Business Communication

31669 Social Implications of Computers (3cp)
2402Y Computers in Business and Society

31622 Commercial Programming Development (4cp)
2402A Programming Concepts
2402B COBOL I
2402E COBOL II
2402J Programming Workshop

31648 Business Tools and Applications (4cp)
2402K Development Tools I
2402H Microcomputer Packages
2402S Database Systems

31621 Systems Analysis (4cp)
2402F Systems Analysis and Design II
2402R Systems Analysis and Design III

31641 Systems Design (4cp)
2402R Systems Analysis and Design III
2402X Systems Development Workshop

Unspecified IS/CS Electives (16cp)

TOTAL 42CP

ASSOCIATE DIPLOMA OF BUSINESS (MICROCOMPUTER SYSTEMS)

31611 Information Systems (4cp)
8519K Business Systems
2403AG Data Fundamentals

31648 Business Tools and Applications (4cp)
2403AA Microcomputer Systems Usage
2403AC Single-user Operating Systems
2403AD Electronic Spreadsheets
2403AE Database Packages

51370 Human Communications (3cp)
8559H Business Communication Writing
8559J Business Communication Organisational

Unspecified Electives (24cp)

TOTAL 35CP

ASSOCIATE DIPLOMA OF BUSINESS (RECORDS AND INFORMATION SYSTEMS)

31611 Information Systems (4cp)
2402H Microcomputing
2421M Business Information Flows
2421P Information Retrieval
2421U Data Collection and Analysis

51370 Human Communications (3cp)
8559H Business Communication Writing
8559J Business Communication Organisational

Unspecified Electives (24cp)

TOTAL 31CP

ASSOCIATE DIPLOMA OF ENGINEERING (ELECTRICAL ENGINEERING)

31613 Computer Systems Architecture I (4cp)
2840BC Computer Principles
2840CN Digital Computers 1
2840CP Digital Computers 2

31632 Communications and Networks (4cp)
2840AL Electronic Communications Systems
2840BB Computer and Data Communications 1
2840CG Computer and Data Communications 2
31888 Logic Design (4cp)
2840AE Digital Electronics 1
2840BG Digital Electronics 2
Unspecified Electives (24cp)

TOTAL 36CP

RECOMMENDED FULL-TIME PROGRAM

Credit point values are shown in brackets.

YEAR 1

Autumn semester
31611 Information Systems (4cp)
31613 Computer Systems Architecture I (4cp)
31614 Programming Principles (5cp)
31615 Discrete Mathematics (4cp)
31617 Accounting Fundamentals (4cp)
51370 Human Communication (3cp)
Spring semester
31621 Systems Analysis (4cp)
31622 Commercial Programming Development (4cp)
31623 Computer Systems Architecture II (4cp)
31624 Data Structures and Algorithms (4cp)
31625 Software Engineering (4cp)
31626 Probability and Statistics (4cp)

YEAR 2

Autumn semester
31631 Database (4cp)
31632 Communications and Networks (4cp)
31633 Operating Systems (4cp)
31636 Simulation and Modelling (4cp)
CS/IS Elective 1 (4cp)
Elective 1 (4cp)
Spring semester
31641 Systems Design (4cp)
31642 On-Line Systems (4cp)
31647 Management Control Systems (4cp)
31648 Business Tools and Applications (4cp)
CS/IS Elective 2 (4cp)
Elective 2 (4cp)

YEAR 3

Autumn semester
31696 Industrial Training (0cp)
Spring semester
31697 Industrial Training (0cp)

YEAR 4

Autumn semester
31653 Communications Software (4cp)
31655 Theory of Computer Science (4cp)
31658 Project Management (4cp)
CS/IS Elective 3(4cp)
Elective 3 (4cp)
Elective 4 (4cp)
Spring semester
31662 Information Systems Case Study (5cp)
31666 Performance Evaluation (4cp)
31669 Social Implications of Computers (3cp)
CS/IS Elective 4 (4cp)
Elective 5 (4cp)
Elective 6 (4cp)

RECOMMENDED PART-TIME PROGRAM

YEAR 1

Autumn semester
31611 Information Systems (4cp)
31615 Discrete Mathematics (4cp)
31617 Accounting Fundamentals (4cp)
Spring semester
31613 Computer Systems Architecture I (4cp)
31614 Programming Principles (5cp)
51370 Human Communication (3cp)

YEAR 2

Autumn semester
31621 Systems Analysis (4cp)
31622 Commercial Programming Development (4cp)
31623 Computer Systems Architecture II (4cp)
Spring semester
31624 Data Structures and Algorithms (4cp)
31625 Software Engineering (4cp)
31631 Database (4cp)

YEAR 3

Autumn semester
31632 Communications and Networks (4cp)
CS/IS Elective 1 (4cp)
Elective 1 (4cp)
Spring semester
31633 Operating Systems (4cp)
31648 Business Tools and Applications (4cp)
31626 Probability and Statistics (4cp)

YEAR 4

Autumn semester
31641 Systems Design (4cp)
31642 On-Line Systems (4cp)
CS/IS Elective 2 (4cp)
Spring semester
31636 Simulation and Modelling (4cp)
31647 Management Control Systems (4cp)
Elective 2 (4cp)

YEAR 5

Autumn semester

31655 Theory of Computer Science (4cp)
31658 Project Management (4cp)
CS/IS Elective 3 (4cp)
31698 Industrial Training (0cp)

Spring semester

31653 Communications Software (4cp)
Elective 3 (4cp)
Elective 4 (4cp)
31698 Industrial Training (0cp)

YEAR 6

Autumn semester

31669 Social Implications of Computers (3cp)
31666 Performance Evaluation (4cp)
CS/IS Elective 4 (4cp)
31699 Industrial Training (0cp)

Spring semester

31662 Information Systems Case Study (5cp)
31699 Industrial Training (0cp)
Elective 5 (4cp)
Elective 6 (4cp)

DOUBLE DEGREE IN BUSINESS AND COMPUTING SCIENCE

A double degree in Business and Computing Science has been offered since 1989. Students enrol initially in the normal Bachelor of Business degree and take the Computing Science sub-major. On satisfactory completion of the Business Degree and the Computing Science sub-major, a student should then apply to be admitted to the Bachelor of Science in Computing Science. On admission, the student would be granted advanced standing in view of (a) the student's Computing Science sub-major and (b) part of the student's Business major which would be used in lieu of the requirement for external electives in the BSc(CompSc). Students could expect to complete the double degree in approximately six years full-time or the part-time equivalent.

BACHELOR OF INFORMATION TECHNOLOGY

This course is a cooperative education program in computer information systems and has been developed by the School of Computing Sciences in co-operation with a group of private and public sector employers. The course is of three years' duration and involves four semesters of full-time study at the university and two semesters of full-time study and practical experience in industry. The industry semesters are of 24 weeks duration, and a 42-week academic year is the norm for the course.

Year	Semester 1	Semester 2
1	UTS	Industry
2	UTS	UTS
3	Industry	UTS

The program differs from existing cooperative education courses in that, during the industry-based semesters, students will follow a structured program designed jointly by the university and the employer group, including formal coursework taught in industry. This coursework is assessed to university and business standards and familiarises students with business needs and requirements. During the industry periods students will be exposed to real problems within an environment quite different from that of the university. The resources of industry will be available to support the education of students.

The central curriculum of the course is information systems; this is supported by studies in management, accounting, finance and marketing as well as the necessary background subjects in computing science and programming. The active participation of industry practitioners in course design and course delivery will further ensure that graduates of the course are well equipped with skills relevant to present and future industry needs.

The two industry semesters will be spent with two different companies. Students are not employees of the company, and will not be obliged to find employment with a given company on completion of their studies. Nevertheless students are encouraged to find employment within the group of sponsoring employers.

The number of students admitted each year will be limited by the number of sponsorship commitments secured from employers, to a maximum of 50 places.

Each student admitted to the course will receive a scholarship for the duration of the course, subject to satisfactory performance and to certain conditions detailed further in this handbook. Each of the industry partners undertakes to sponsor a stated number of students, and contributes the full amount of their scholarship to a fund administered by the university.

Each company also provides the industry semester facilities for the number of students being sponsored.

Selection to the course is based on HSC results and on performance at interview. Interviews are conducted by panels comprising representatives of the university and the industry group. Applicants will be assessed for their suitability to the industrial as well as the academic components of the course.

RECOMMENDED PROGRAM

Semester 1 - UTS	
31611	Information Systems (4cp)
31613	Computer Systems Architecture (4cp)
31614	Programming Principles (5cp)
31615	Discrete Mathematics (4cp)
31617	Accounting Fundamentals (4cp)
31621	Systems Analysis (4cp)
Semester 2 - Industry	
31722	Commercial Programming (5cp)
31770	Industry Project I (5cp)
31771	Business Requirements Analysis (5cp)
31779	Applications of Information Technology I (5cp)
Semester 3 - UTS	
23106	Economics (5cp)
24105	Principles of Marketing (5cp)
31631	Database (4cp)
31632	Communications and Networks (4cp)
31633	Operating Systems (4cp)
31738	Management Principles for IT Professionals (4cp)
Winter	
31780 *	Industry Studies (4cp)
Semester 4 - UTS	
31625	Software Engineering (4cp)
31626	Probability and Statistics (4cp)
31641	Systems Design (4cp)
31642	On-Line Systems (4cp)
31647	Management Control Systems (4cp)
31788	Organisation Theory for IT Professionals (4cp)
Semester 5 - Industry	
31756	Project Management (5cp)
31781	Business Systems Design (5cp)
31789	Applications of Information Technology II (5cp)
31790	Industry Project II (5cp)
Semester 6 - UTS	
25314	Business Finance I (5cp)
31762	Technology Planning (5cp)
31766	Performance Modelling and Management (4cp)
31902	Auditing the Computer (4cp)
31768	Business Planning for IT Professionals (4cp)
31669	Social Implications of Computers (3cp)

* This subject requires commitment of time over the winter period, in order to complete the 42-week requirement of the course.

Special conditions relating to students enrolled in the Bachelor of Information Technology

Leave of absence will not normally be granted to students, except under exceptional circumstances and subject to satisfactory arrangements being possible. Likewise, withdrawal from the course and subsequent re-admission is not normally granted. Students are reminded that withdrawal without penalty from any course at the university is only possible up to the deadlines imposed by the university. After such deadlines, students will be expected to complete all assessment tasks for subjects in which they are enrolled.

Variations to the approved program of study for the Bachelor of Information Technology are restricted. No industry-based subject may be deleted from the program, except under extraordinary circumstances and at the discretion of the Course Steering Committee and the School of Computing Sciences. No industry-based subject can be taken during a university-based semester. The taking of additional subjects during an industry-based semester is seen as unusual and may only be done at the discretion of the Steering Committee and the School.

The School will not recommend probation for unsatisfactory academic performance. Instead, the School will recommend to the Faculty Board that a student be excluded under the following circumstances:

> a student fails any subject for the second time;
> a student gains less than 50% of the credit points for which they are enrolled in that assessment period;
> a student fails any subject that is part of the program of an industry-based semester (there is provision for a supplementary examination to be taken in these subjects following a failure on the first attempt) or a student performs unsatisfactorily during an industry-based semester;
> a student who, immediately prior to the commencement of an industry-based semester, has still to complete more than one subject in the normal program of the course to that stage.

Appeals against exclusion will be dealt with by the Appeals Committee (Academic Board), which will take into account the recommendation of the Course Steering Committee.

Industry Semesters

The dates of the industry-based semesters for 1993 are as follows:–

Autumn semester (3rd year students)
Monday 18 January 1993 - Friday 2 July 1993

Spring semester (1st year students)
Monday 5 July 1993 - Thursday 17 December 1993

Students are expected to attend their assigned sponsoring company on a full-time basis throughout these periods. Students cannot expect any absences to be approved during the industry semesters.

Scholarship

The scholarship will be paid at three different and increasing levels, Levels 1, 2 and 3, where Level 2 is the average of the three levels. All first year students will start at Level 1; at the end of each year all BInfTech students with satisfactory progress will move from their current level to the next level.

The levels for 1993 are as follows:-

Level 1 $9,000 per annum
Level 2 $9,450 per annum
Level 3 $9,900 per annum

The scholarship paid to BInfTech students has been ruled as tax exempt.

EXTENSION COURSES

The School offers courses which run regularly each semester for12 weeks, one evening per week, in UNIX/C, COBOL, Object Oriented Programming with C++ and Auditing Computer Systems

The School also offers other extension courses at various times during the academic year. These include:

Database design: using relational and E-R models
C and UNIX for the professional
Expert systems design
4th generation languages and application building
Introduction to capacity planning
OCCAM and the transputer
Object oriented programming in eiffel
Object Oriented Design.
Software quality assurance

In addition, the School offers weekly "State-of-the-Art" seminars, usually on Wednesday afternoons. Visitors are welcome.

POSTGRADUATE COURSES

Application forms for all postgraduate courses may be obtained from the UTS Student Information Service. General enquiries should be directed to either the Postgraduate Studies and Scholarships Office, telephone 330-1523, or the Faculty Graduate Assistant, telephone 330-1806. All prospective applicants should contact the Faculty Graduate Assistant BEFORE submitting an application. Applicants for research degrees should obtain approval either from the Director, Graduate and External Studies or from their chosen supervisor before submitting applications.

POSTGRADUATE RESEARCH DEGREES

DOCTOR OF PHILOSOPHY

In general terms, the PhD degree entails a more extensive investigation than the MSc (by thesis) degree. In addition, PhD students are expected to demonstrate significant originality in the conduct of their research work. Areas of particular interest for research towards the Doctor of Philosophy (by thesis) degree in the School of Computing Sciences include operating systems; computer performance evaluation; intelligent office automation systems; computer graphics, image processing; artificial intelligence, expert systems, knowledge bases, inference; local networks and network interface technology; neural networks; parallel processing and transputers; information modelling; auditing large databases; microprocessors and their applications; distributed databases; computer systems security; and object-oriented techniques.

The Doctor of Philosophy degree is available on both a full-time and a part-time basis. The normal duration of enrolment for this degree is three years on either attendance pattern; however, candidates who already possess a degree at the Masters level may be permitted to complete in two years. The maximum duration of enrolment is four years for full-time students and five years for part-time students.

Applicants should hold a first class, or second class division one, Bachelor degree with a major computing component, or should hold a Masters degree in an appropriate area, or should have previously undertaken other postgraduate studies in computing. Prospective applicants are expected to have developed interests in a specific area of research, and should have one or more specific proposals for research work in that area. Before submitting a formal application for admission to this degree

course, applicants should first seek the approval of the School for their proposed research work. To gain this approval, applicants should initially:

EITHER send a summary proposal of at least 1,000 words to the Director , Graduate and External Studies, School of Computing Sciences, containing references to seminal works in the area of proposed research. If the proposal is of interest to the School then the Director will refer the applicant to a suitable member of staff for further detailed discussion.

OR approach a suitable member of the School's academic staff directly and discuss the proposed research.

When the applicant's proposed research has been approved by a member of the School's academic staff, and if that member of staff is prepared to supervise the research, then the applicant may formally apply for admission. Formal application for admission should consist of:

a completed *Application For Admission – Doctor of Philosophy* form, and
a completed *Details of Proposed Study* form which should be signed by both the applicant and the proposed supervisor.

There are no tuition fees for this course, and students are not required to pay the Higher Education Contribution Scheme. However, students are required to pay Students' Association and Student Union fees, together with an accommodation levy.

MASTER OF SCIENCE (BY THESIS)

The MSc (by thesis) degree enables graduates to extend and deepen their knowledge of a specialised area in computing by undertaking research under the supervision of a member of the academic staff. Areas of particular interest for research in the School of Computing Sciences include operating systems; computer performance evaluation; intelligent office automation systems; computer graphics, image processing; artificial intelligence, expert systems, knowledge bases, inference; local networks and network interface technology; neural networks; parallel processing and transputers; information modelling; auditing large databases; microprocessors and their applications; distributed database; computer systems security; and object oriented techniques.

This degree is available on a full-time, part-time and external basis. The normal duration of enrolment for this degree is two years on full-time attendance or three years on part-time attendance. The School of Computing Sciences has a strong preference for research work which proceeds at a full-time pace. This preference should not be seen as a deterrent to those students who wish to remain in employment.

External students, who are working in a full-time job, are encouraged to select a topic for their research which is closely aligned with their professional work. Once such a topic has been selected, the School usually requires that the student's employer provide a statement to the effect that at least half of the student's working week will be devoted to work which is directly relevant to the research. The student is then expected to contribute some of his or her own time to the project which brings the total number of hours devoted to research within that expected of full-time attendance.

There are no tuition fees for this course, and students are not required to pay the HECS (i.e. Higher Education Contribution Scheme). However, students are required to pay Students' Association and Student Union fees, together with an accommodation levy.

Applicants should hold a first degree with a major computing component or should have previously undertaken other postgraduate studies in computing. Prospective applicants are expected to have developed interests in a specific area of research, and should have one or more specific proposals for research work in that area. Before submitting a formal application for admission to this degree course, applicants should first seek the approval of the School for their proposed research work. To gain this approval, applicants should initially:

EITHER send a summary proposal of at least 1,000 words to the Director, Graduate and External Studies, School of Computing Sciences, containing references to seminal works in the area of proposed research. If the proposal is of interest to the School then the Director will direct the applicant to a suitable member of staff for further detailed discussion.

OR approach a suitable member of the School's academic staff directly and discuss the proposed research.

When the applicant's proposed research has been approved by a member of the School's academic staff, and if that member of staff is prepared to supervise the research, then the applicant may formally apply for admission. Formal application for admission should consist of:

a completed *Application For Admission – Graduate Courses* form and
a completed *Details of Proposed Study* form which should be signed by both the applicant and the proposed supervisor.

Note that all prospective applicants should obtain approval for their proposed research work either from the Director, Graduate and External Studies or from their chosen supervisor BEFORE submitting an application form for admission to this course.

POSTGRADUATE COURSEWORK PROGRAMS

MASTER OF SCIENCE IN INFORMATION SCIENCE (BY COURSEWORK)

The MSc in Information Science (by coursework) enables graduates to select a program of study which suits individual career goals. For example, a program may be chosen which develops specialised expertise in computer systems, which provides a general update of Information Science technology, or one which equips the student for a position in corporate management as an information scientist.

The course is intended for computing professionals. Applicants should have both

> a Bachelor degree from the University of Technology, Sydney, or equivalent, preferably with a major computing component. Those applicants whose degrees do not have a major computing component will be required to submit evidence to the effect that the extent of their formal knowledge of computing is equivalent to that of a graduate from the UTS Bachelor of Science in Computing Science
> *and*
> an established professional career within the information industry. As a guide, the extent of the applicant's professional experience should be equivalent to that of an Associate Member of the Australian Computer Society of at least two years' standing.

The course is offered on a part-time basis only, over six semesters (3 years), as it is considered important that students remain in professional employment whilst undertaking their graduate studies in Information Science. Attendance is required for at least two evenings each week for lectures, and at the periodical seminar evenings.

Each semester the School publishes the *MSc (by coursework) in Information Science Course Guide*. This *Guide* contains much administrative information as well as a detailed statement of the course regulations. Students and prospective applicants are advised to obtain a copy of this *Guide* and to study it carefully. An "admission package" containing a copy of the *Guide*, the application forms and other relevant information is available from August each year. Prospective applicants may obtain one of these packages by either the UTS Student Information Service, or the Faculty Graduate Assistant, or the University's Postgraduate Studies and Scholarships Office. Please note that completed application forms must be submitted to the University by **31 October** in the year prior to that in which admission is sought.

The minimum total length of the course is 64 credit points, consisting of the following:

> Formal lectures and laboratory requirements will total 50 credit points.
> There is a specific requirement for seminar attendance for one hour each week throughout the time the candidate is enrolled. The seminar is weighted at four credit points.
> The remainder of the course will consist of the equivalent of 10 credit points of project work.

The coursework is structured into four strands. These four strands consist of the fundamental areas of Computer Systems, Information Systems and Computing Methods, as well as a Management strand. Students select subjects to a total of 50 credit points. This selection will contain at least one subject from each of the four strands, and at least one entire strand.

Students enrol in the seminar subject each semester, and are required to attend at least 70% of the research seminars presented in any semester to be eligible to take examinations at the end of that semester.

The project is undertaken during the final year of enrolment.

Project

The project entails a substantial investigation of a topic, in an area of current research interest in Information Science and related to the student's major strand of study. All students are required to pass the project subject. The project is undertaken in the final year of study after the completion of at least two years of coursework.

The topic for the project should be of direct interest to the student, and of value to the student's professional development.

Students may wish to select a topic which is closely related to their current employment. Alternatively, students may wish to choose a topic which should be of value to their future career. The project should be a vehicle for importing the knowledge learned from the coursework to the student's professional life. The topic should be chosen with this professional goal in mind. Students are advised to seek the assistance of the lecturing staff in deciding on the topic for their project.

Before beginning the project work a student should obtain the agreement of a member of the lecturing staff to act as project supervisor, and deliver a 500 word description of the project to the Director, Graduate and External Studies for approval.

Once approved, the project will proceed "in the manner of a Masters thesis", and students are

advised to discuss their work with their project supervisor regularly. The role of the supervisor is to advise on the general direction of the investigation, advise on a work schedule, advise on a framework for writing up the work, and criticise draft sections of work.

It is usual for the project work to extend over more than one semester. Students should enrol in the project for the semester in which they hope to *submit* their completed project. Note the requirement, stated below, for the project to be submitted before the end of the twelfth week of the semester in which the student wishes their project to be examined. The examination of the project *must be completed before* the School's Examination Review Meeting for that semester. This meeting takes place towards the end of each semester. If a student is enrolled in the project subject at the time of the School's Examination Review Meeting, and if the examination of their project has not been completed in time for that meeting, then their enrolment in project for that semester will be cancelled.

Students usually enrol in a 10 credit point project. If, in the opinion of the project supervisor, the topic chosen merits a more substantial investigation then the supervisor should make a case to the Director, Graduate and External Studies for the project to be extended to 15 or 20 credit points; students should not enrol in the 15 or 20 credit point project unless they have written permission to do so from the Director, Graduate and External Studies.

The project will result in the preparation of an extensive written report and an oral presentation. Three copies of the report should be lodged with the Director, Graduate and External Studies before the end of the tenth week of the semester in which the student wishes to be examined. All three copies will be retained by the School, and one of them will be placed in the University Library. The final version of the report should be typed and bound in accordance with the university's specification for theses (available from the Postgraduate Studies and Scholarships Office, Academic Office). Students may have their written report bound before submitting it for examination; alternatively, to avoid the possible expense of rebinding, three copies of a typed but unbound report may be submitted for examination. When submitted, the written report should be accompanied by a *Certificate of Originality* and a *Retention of Report* form: these forms are available from the Director, Graduate and External Studies.

The oral presentation is of 40 minutes duration, followed by 20 minutes of discussion with the examiners. Students should arrange a time for their oral presentation with the Director, Graduate and External Studies when they submit their written report. The oral presentation should be delivered before the end of the fifteenth week of the semester in which the student wishes to be examined. The oral presentation should consist of a discussion of the more highly controversial or technical issues within the written report. When delivering the oral presentation, students should assume that their audience is familiar with the contents of their written report.

The project will be examined on the contents and standard of presentation of the written report and the oral presentation. The examiners of the project will include the project supervisor, or nominee, and one lecturer who shall not be from the same unit or department as the project supervisor (or nominee). The result of the examination of the project shall be one of the following:

> outright pass
> pass subject to minor corrections being made (without general re-typing) to the satisfaction of the project supervisor (or nominee) and without a formal re-examination
> pass subject to major revisions being made (probably involving substantial re-typing). The student is responsible for making arrangements for these major revisions to be re-examined before the end of the twelfth week of the semester following the semester of the initial examination. The result of such a re-examination shall be "outright pass" or "outright failure".
> outright failure.

In addition, the examiners will allocate marks to the project.

For a project to be judged as being of a satisfactory standard:

> The project should be a substantial, well presented, original, analytic investigation.
> Prominent within the project should be the clear statement of a specific thesis (or proposition).
> The project should be substantially concerned with establishing the truth of this central thesis.
> In addition to this specific thesis, the project may have some general aims: these should also be clearly stated.
> If the work of others is quoted or paraphrased that work must be clearly acknowledged and referenced.
> It should be clear that the intellectual effort expended on the project is no less than that normally required to pass coursework of the same number of credit points.
> The project should refer to a comprehensive set of references to the major directions of research in the area of the project.

The principal ideas within the project should be compared to, and contrasted with, these major, current directions of research, so as to place the work of the project in perspective in Information Science.

Specific factors considered by the examiners whilst assessing the project will include:

The extent to which the thesis and general aims (if any) are explicitly stated.
The significance that the thesis and general aims have within Information Science.
The extent to which the scope of the investigation is clearly defined.
The extent to which the methods used are appropriate to establish the thesis and to achieve the general aims.
The extent to which the shortcomings of the method of approach are discussed; in particular, the discussion of the validity of any assumptions that have been made either explicitly or implicitly.
The extent to which the effect of these shortcomings on the conclusions of the investigation has been discussed.
The care with which data and other evidence has been presented, interpreted and analysed.
The extent to which the reasoning within the project is presented clearly and coherently.
The extent to which the whole investigation has been placed in context within Information Science.
The extent to which the whole investigation has been supported by, and contrasted with, a comprehensive and appropriate set of references to recent research papers and review papers in the general area of the project.
The extent to which terminology is clearly defined and consistently used.
The amount of work involved in the investigation. As a rough rule, examiners will expect a written report of at least 50 double spaced, typed pages for a 10 credit point project; in addition, computer printout and other material may be bound with the written report or presented in separate appendices.
The general quality, neatness and clarity of the presentation.

Unsatisfactory Student Progress

Any Masters degree candidate enrolled in the MSc in Information Science (by coursework) who records any three failures will be excluded from the course, in accordance with Resolution FBMC/92/70 of the Faculty Board in Mathematics and Computing Sciences.

General Course Description

Students select a program from the following subjects, all of which have a credit point value of 5, except for Seminar and Project.

COMPUTING METHODS

32100 Advanced Programming Techniques
32101 Intelligent Systems
32104 Decision Making and Modelling
32105 Specialist Topics in Artificial Intelligence

INFORMATION SYSTEMS

32200 Information Processing Strategy
32201 Database
32202 Communication Systems
32203 Information Management

COMPUTING SYSTEMS

32301 Performance Evaluation
32302 Computer Architecture
32304 Computer Languages
32305 Operating Systems

MANAGEMENT

21718 Organisation Analysis and Design
32400 Accounting for Management
32401 Management Policy and Strategy
79729 The Legal Environment of Business
32999 Seminar (4cp)
32908 Project (10cp)

Fees

Tuition fees are charged to students in the MSc (by coursework). These fees have been set at $1,000 per semester for a normal attendance pattern. Students paying tuition fees will not be liable for the Higher Education Contribution Scheme. In addition, students are required to pay the standard administration fee each year.

GRADUATE DIPLOMA IN DATA PROCESSING

This course aims to provide students with the basic knowledge and skills required for a professional career in programming and/or systems work. It is designed for people who have already taken a first degree in which computing has not been included or only covered lightly.

The course is not open to students who have already completed the Bachelor of Science in Computing Science, Diploma of Technology (Information Processing), or a similar course at an equivalent level.

Satisfactory completion of this course leads to the award of Graduate Diploma in Data Processing.

Holders of Graduate Diploma in Data Processing are granted exemption from the Associate examinations of the Australian Computer Society.

It is anticipated that students entering the course will have previously studied courses from a wide range of disciplines. Some will have graduated with little or no previous contact with computing and data processing, while others will be familiar with computing concepts in areas such as programming, and will be seeking to consolidate their present knowledge by attaining a formal qualification.

Admission Requirements

The prerequisites for entry to the Graduate Diploma in Data Processing are a first degree, equivalent to an undergraduate three-year degree from the University of Technology, Sydney, plus a working knowledge of the programming languages COBOL, and either C or PASCAL.

Applicants who are in doubt about the ranking of their academic qualifications should contact the Postgraduate Studies and Scholarships Officer or the Admissions Branch at the University, or write to the National Office of Overseas Skills Recognition, PO Box 25, Belconnen, ACT, 2616.

Intending applicants who do not have the required knowledge of COBOL and PASCAL or C, will need to acquire such knowledge before the close of applications. Extension courses on these languages are offered by the university; for details, contact the School of Computing Sciences on 330-1803. However, applicants are at liberty to present for consideration evidence of successful completion of any COBOL and PASCAL or C courses, or of substantial work experience using these languages. The Selection Committee will assess whether what is presented satisfies the prerequisites for the course. Candidates presenting evidence of fulfilling the requirements will be offered an interview. It must be realised, though, that the number of applicants for the course is always in excess of the number of places, and therefore no guarantee can be given that every candidate meeting the requirements will be successful in gaining admission.

For further information, candidates should telephone the Faculty's Graduate Assistant, Mr B Irvine on 330 1806, or the School Office on 330 1803, or write to:

The Coordinator
Graduate Diploma in Data Processing
School of Computing Sciences
University of Technology, Sydney
PO Box 123
BROADWAY NSW 2007

All applications should be well documented, including proof of graduate status, the applicant's academic record, and such other documentation as the applicant wishes to provide in support of their application.

Course Fees

Australian citizens and permanent residents will contribute to the cost of the course through HECS (i.e. the Higher Education Contribution Scheme).

It is the responsibility of each student to ensure that he/she is correctly enrolled for each subject attempted. A student will not be credited for any work done in a subject for which he/she is not formally enrolled. No refund of HECS will be given for subjects deleted after the published deadlines.

In addition to course charges students are required to pay the standard administration fee.

Mode and length of study

The course is normally taken on a part-time attendance pattern over two years (two evenings and one afternoon each week). However, some students may take longer to complete the course. This is possible, subject to approval, but it must be noted that the attendance pattern in this latter case will require students to attend the university for at least six hours a week, depending upon the times at which subjects are scheduled for a particular semester. In exceptional circumstances, the course may be undertaken on a full-time attendance pattern over one year.

Students may be permitted to enter the course with advanced standing but, in order to qualify for an award, a student must complete at least 32 credit points of the prescribed 48 credit points for the course. Exemptions from some compulsory subjects will normally only be granted where a student has partially completed a similar Graduate Diploma elsewhere. A maximum of 16 credit points ONLY may be exempted.

Where a student can demonstrate proficiency in a subject area, approval for substitution of Semester 1 and 2 subjects by other approved subjects from the undergraduate course may be granted.

Progression Rules

All students in the Graduate Diploma in Data Processing course should be aware of the following rules under which a student's registration will be discontinued:

Maximum time

Failure to complete the course within four semesters from initial registration in the case of a full-time student, or within eight semesters from initial registration in the case of a part-

time student. This is not inclusive of periods of approved leave of absence.

Unsatisfactory progress

The definition of unsatisfactory progress, as defined by the Faculty Board in Mathematical and Computing Sciences, is failure in any subject three times.

Course Rules

To complete the Graduate Diploma students must gain 48 credit points. Since all subjects for this course are four credit point subjects, this means students must complete 12 subjects.

Of these students must take SIX core subjects:

31071 Introduction to Information Systems (4cp)
31073 Introduction to Computer Systems (4cp)
31621 Systems Analysis (4cp)
31022 Commercial Programming Development (4cp)
31631 Database (4cp)
and one of
31617 Accounting Fundamentals (4cp)
or
31632 Communications and Networks (4cp)

In addition students must take SIX electives. These are usually chosen from the list given below or from elective subjects in the BSc in Computing Science. Students must have completed the appropriate prerequisites for the electives which they choose and their choice must be approved by the Graduate Diploma Coordinator.

Graduate Diploma Electives – **usually offered in Autumn**

31632* Communications and Networks (4cp)
31617* Accounting Fundamentals (4cp)
31615 Discrete Mathematics (4cp)
31641 Systems Design (4cp)
31642 On-line Systems (4cp)
31658 Project Management (4cp)
31623 Computer Systems Architecture II (4cp)

* If not taken as a core subject.

Other electives may be available during the day.

Graduate Diploma Electives – **usually offered in Spring**

31624 Data Structures and Algorithms (4cp)
31025 Introduction to Software Engineering (4cp)
31626 Probability and Statistics (4cp)
31633 Operating Systems (4cp)
31641 Systems Design (4cp)
31642 On-Line Systems (4cp)
31647 Management Control Systems (4cp)
31648 Business Tools and Applications (4cp)
31653 Communications Software (4cp)

Other electives may be available during the day.

RECOMMENDED PART-TIME PROGRAM

Semester 1 (Autumn)	
31621	Systems Analysis
31071	Introduction to Information Systems
31073	Introduction to Computer Systems
Semester 2 (Spring)	
31022	Commercial Program Development
31631	Database
	Elective
Semester 3 (Autumn)	
31632	Communications and Networks
	and/or
31617	Accounting Fundamentals
	One or two electives
Semester 4 (Spring)	
	Three electives

NOTE that the hours per week listed in the subject descriptions are lecture and tutorial hours. Students should plan to spend at least the same amount of time again on private study.

Students who commenced before 1990 will follow the part-time program as set out in the School of Computing Sciences Handbook for the year in which they entered the Graduate Diploma course.

GRADUATE CERTIFICATES

GRADUATE CERTIFICATE IN APPLIED COMPUTING

Coordinator: Ms E Lawrence

Course Description

The course will provide students with the practical skills and knowledge that are necessary to operate effectively at entry level in a computing environment.

On completion of the three subjects, graduates will have acquired sound knowledge of, and experience and skills in Foundations of Computing and Programming; Systems Analysis and Design; and Database. Each of these subjects has a weighting of six credit points.

It is anticipated that graduates may wish to further their knowledge by attending follow-on graduate certificates at UTS.

Length

The course is one year part-time, that is, four hours per week per six credit point subject, or the equivalent part-time attendance.

Attendance Pattern

Depending on demand, students may undertake formal studies involving attendance of full-time blocks of lectures in January and July with additional weekend attendance blocks, or as part of the normal program, provided class space is available.

Projected Enrolment

Enrolment will be limited to 20 students for each offering.

Course Structure and Curriculum

The course may be offered as a special course or as part of the School's normal program. For example, the special course may be offered for 72 hours for two semesters, for example:

4 days in January	9-12, 1-4
4 x 2 days	Semester 1
4 days in July	9-12, 1-4
4 x 2 days	Semester 2

The subjects to be taken are as follows

31521 CIT 2 - Foundations of Computing and Programming
31531 CIT 3 - Systems Analysis and Design
31551 CIT 5 - Database

Admission Requirements

The course is intended for non-computing professionals. Applicants should have, from a recognised university, a bachelor degree (or equivalent), with no major computing content. Consideration will be given to applicants whose background does not fit the above requirements, provided that a case can be made to establish that their knowledge and practical experience is equivalent to that which is implied by these requirements.

Fees

The fee for this course is $1500.

GRADUATE CERTIFICATE IN INFORMATION SYSTEMS

Coordinator: Mr C Richardson

Course Description

The course is intended for staff within companies who are specialising in a new direction. The course will provide students with a foundation in Information Systems. This foundation can be later consolidated via the Graduate Certificate in Advanced Information Technology. The course will consist of a coherent set of four subjects from the Information Systems field, and will be the equivalent of one year part-time study. The course will be offered on a full fee paying basis which, it is expected, will typically be met by companies for selected employees. However, the course will be a general qualification, which is not intended to be restricted to the employees of any particular companies.

Length

The course will typically be completed over a period of one year, part time. Nonetheless, depending on demand, the course or individual subjects may be offered in flexible attendance modes.

Attendance Pattern

The course may be offered as part of normal program, provided class space is available. Depending on demand, students may undertake formal studies involving attendance at intensive blocks of lectures with possible additional weekend attendance. The precise attendance pattern will be developed as part of the business plan for any given course offering.

Course Structure and Curriculum

The course will consist of a coherent set of four subjects from the field of Information Systems, approved by the School of Computing Sciences. Existing subjects from the Graduate Diploma in Data Processing will be used. A typical selection would be:

31071	Introduction to Information Systems
31621	Systems Analysis
31022	Commercial Program Development
31631	Database

Every graduate diploma subject attracts four credit points; thus the total for the Graduate Certificate will be 16 credit points.

Admission Requirements

Applicants with a recognised Bachelor degree (or equivalent) will normally be deemed eligible for the course. Consideration will be given to applicants whose background does not fit the above requirement provided that a case can be made to establish that their aptitude, knowledge and practical experience is sufficient. Experience in the Information Technology industry will be especially important in this regard. Nonetheless, to achieve non-graduate entry, applicants may be asked to undertake an aptitude test or approved bridging program.

Fees

The fee for this course is $3600.

GRADUATE CERTIFICATE IN COMPUTER SCIENCE

Coordinator: Dr J Edwards

Course Description

The course is intended for staff within companies who are specialising in a new direction. The course will provide students with a foundation in Computer Science. This foundation can later be consolidated via the Graduate Certificate in Advanced Information Technology, and/or complemented by the Graduate Certificate in Information Systems. The course will consist of a coherent set of four subjects from the Computer Science field, and will be the equivalent of one year part-time study. The course will be offered on a full fee paying basis which, it is expected, will typically be met by companies for selected employees. However, the course will be a general qualification, which is not intended to be restricted to the employees of any particular companies.

Length

The course will typically be completed over a period of one year, part time. Nonetheless, depending on demand, the course or individual subjects may be offered in flexible attendance modes.

Attendance Pattern

The course may be offered as part of normal program, provided class space is available. Depending on demand, students may undertake formal studies involving attendance at intensive blocks of lectures with possible additional weekend attendance. The precise attendance pattern will be developed as part of the business plan for any given course offering.

Course Structure and Curriculum

The course will consist of a coherent set of four subjects from the field of Computer Science, approved by the School of Computing Sciences. Existing subjects from the Graduate Diploma in Data Processing will be used. A typical selection would be:

31073	Introduction to Computer Systems
31615	Discrete Mathematics
31623	Computer Systems Architecture II
31624	Data Structures and Algorithms

Every Graduate Diploma subject attracts four credit points; thus the total for the Graduate Certificate will be 16 credit points.

Admission Requirements

Applicants with a recognised bachelor's degree (or equivalent) will normally be deemed eligible for the course. Consideration will be given to applicants whose background does not fit the above requirement provided that a case can be made to establish that their aptitude, knowledge and practical experience is sufficient. Experience in the Information Technology industry will be especially important in this regard. Nonetheless, to achieve non-graduate entry, applicants may be asked to undertake an aptitude test or approved bridging program.

GRADUATE CERTIFICATE IN ADVANCED INFORMATION TECHNOLOGY

Coordinator: Mr J Colville

Course Description

The course is intended for staff within companies who are specialising in a new direction. The course will allow students to build upon foundations in information systems and/or computer science. The prerequisite for the course will be the Graduate Certificate in Information Systems and/or the Graduate Certificate in Computer Science, or their equivalent. The course will enable students to develop advanced skills in more specialised areas of information technology, and will be the equivalent of one year part-time study. The course will be offered on a full fee paying basis which, it is expected, will typically be met by companies for selected employees. However, the course will be a general qualification, which is not intended to be restricted to the employees of any particular companies.

Length

The course will typically be completed over a period of one year, part-time. Nonetheless, depending on demand, the course or individual subjects may be offered in flexible attendance modes.

Attendance Pattern

The course may be offered as part of normal program, provided class space is available. Depending on demand, students may undertake formal studies involving attendance at intensive blocks of lectures with possible additional weekend attendance.

Course Structure and Curriculum

The course will consist of a coherent set of four subjects approved by the School of Computing Sciences. Existing subjects from the Graduate Diploma in Data Processing will be used. A typical selection, permitting a particular specialisation, would be:

31032 Communications and Networks
31033 Operating Systems
31053 Communications Software
31048 Business Tools and Applications

Every Graduate Diploma subject attracts four credit points; thus the total for the Graduate Certificate will be 16 credit points.

Admission Requirements

Applicants will normally be expected to have completed the Graduate Certificate in Information Systems and/or the Graduate Certificate in Computer Science. Applicants with demonstrable, equivalent backgrounds will be considered on a case-by-case basis.

Fees

The fee for this course is $3600.

GRADUATE CERTIFICATE IN SOFTWARE QUALITY ASSURANCE

Coordinator: Mr B Wong

Course Description

This is a full fee-paying course designed for professional upgrade and leads to the award of a Graduate Certificate. The course will provide the students with the practical knowledge and skills that are necessary to effectively measure and control the quality of software products. The course focuses on the procedures and disciplines of a software quality system and the operational issues associated with implementing such a system in an organisation.

Length

The course will be 12 credit points, one year part-time.

Attendance Pattern

Students will undertake formal studies for two evenings each week in the first semester and one evening each week in the second.

Projected Enrolment

Enrolment will be limited to 20 students for each offering.

Rationale and Aims

A primary objective is to assist computing professionals to implement a software quality system that complies with Australian Standard AS3563.

On successful completion of this subject, students will be able to understand the need for quality assurance of software products; specify the role of the quality assurance function in software development and maintenance; understand the nature of software quality and the problems of assessing the level and presence of software quality; ensure adequate quality control of software development is achieved; and produce and implement a quality assurance plan for software.

Course Structure and Curriculum

The course will consist of formal studies for two evenings each week in the first semester and one evening each week in the second. The three subjects that comprise the formal studies are as follows:

31855 Software Quality Techniques
31856 Quality and Software Engineering
31857 Software Quality Assurance Principles

Each subject carries four credit points, with three hours attendance per week.

Admission Requirements

The course is intended for information technology professionals and applicants should meet **both** the following admission requirements:

> A Bachelor degree from UTS, or equivalent, preferably with a major computing component. Applicants whose degrees do not have a major computing component will be required to submit evidence to the effect that the extent of their formal knowledge of computing is equivalent to that of a graduate from the UTS Bachelor of Applied Science in Computing Science.
>
> An established professional career within the information technology industry. As a guide, the extent of the applicant's professional experience should be equivalent to that of an Associate Member of the Australian Computer Society of at least two years' standing.

Consideration will be given to applicants whose background does not fit these requirements, provided that a case can be made to establish that their computing knowledge and practical experience is equivalent to that which is implied by these requirements.

Fees

The fee for this course is $2000.

SUBJECT DESCRIPTIONS

Guide to subject descriptions

The subject descriptions shown below indicate the subject code and name, the number of credit points for the subject (i.e. *3cp*), the duration of the subject, indicated as semester weeks, if applicable, and the number of formal contact hours each week (i.e. *four hpw*); for some subjects, there may also be practical components off-campus, and this is indicated in the text. Also shown are the prerequisites or corequisites if any, the method of assessment and name of the subject coordinator, if known, and a brief outline of the content.

Prerequisites are subjects which must be completed before taking the subject to which they refer. Corequisites may be completed before or be taken concurrently with the subject to which they refer.

21718 ORGANISATION ANALYSIS AND DESIGN *(5cp); three hpw; subject coordinator Assoc Professor R Dunford*

Historical perspective; components of organisational structure; consequences of structural deficiencies; structural contingencies; limitations of organisation design. Aspects of organisation design – job design; communication; differentiation; integration; control and organisation performance. Factors affecting organisation design – ideology of management; technology of organisation; personal skills of employees; environment of organisation; size of organisation; goals of organisation; politics of organisations. Organisational Futures – the development of large-scale organisation and bureaucracies; organisations of the future and "beyond the work ethic".

31022 COMMERCIAL PROGRAM DEVELOPMENT *(4cp); three hpw; prerequisite 31071 Introduction to Information Systems, COBOL; subject coordinator Mr R Raban*

Structured design techniques and their application to COBOL programming in an off line commercial environment. Advanced features of COBOL are presented to give the student a complete knowledge of the language.

31025 INTRODUCTION TO SOFTWARE ENGINEERING *(4cp); three hpw; prerequisite 31615 Discrete Mathematics; subject coordinator Dr J Potter*

An introduction to the formal aspects of modern software engineering. Topics: an overview of the software engineering environment, the practice of formal mathematical specification, program development via refinement of specifications, programs correctness, machine executable specifications, an overview of software testing and reliability.

31071 INTRODUCTION TO INFORMATION SYSTEMS *(4cp); three hpw; subject coordinator Mrs J Hammond*

A fundamental foundation for the understanding of information systems and their applications to common computer-based practices and procedures used in organisations today. Elementary system models, typical business systems development life cycle and applications, and a range of techniques and resources used in developing and designing information systems are examined.

31073 INTRODUCTION TO COMPUTER SYSTEMS *(4cp); three hpw; subject coordinator Dr B Howarth*

An introduction to computer hardware and software systems. The relationship between hardware and software is discussed by considering the structure of the computer, the inter-relationship of the various components and the processing by the computer of data and programs. Students will be introduced to machine-language and to assembly-language programming.

31140 INTRODUCTION TO COMPUTER GRAPHICS *(4cp); three hpw; prerequisite 31624 Data Structures and Algorithms; subject coordinator Dr K Suffern*

Provides a thorough introduction to the computer representation, manipulation and display of pictorial information. Topics covered include passive and interactive graphics hardware devices and programming; mathematical tools for two and three dimensional graphics; two and three dimensional graphics algorithms; graphics standards; human-computer interaction, graphical design; application areas of computer graphics.

31163 KNOWLEDGE-BASED SYSTEMS *(4cp); three hpw; prerequisites 31624 Data Structures and Algorithms, 31625 Software Engineering; subject coordinator Dr S Prabhakar*

An introduction to recent developments in artificial intelligence, based on the representation and manipulation of knowledge. The student will obtain an understanding of the principles of expert systems together with some experience constructing small knowledge-based systems with the aid of current development tools. Topics: representation of knowledge; plausible reasoning; knowledge acquisition; development methodologies; evaluation of current tools.

31240 TOPICS IN COMPUTER GRAPHICS *(4cp); three hpw; prerequisite 31140 Introduction to Computer Graphics; subject coordinator Dr K Suffern*

For students who have passed 31140, this subject provides a study of several additional computer graphics topics, with an emphasis on image synthesis techniques. Topics covered include fractals, illumination models, ray tracing, textures, antialiasing, halftoning and ordered dither, hidden line and surface removal algorithms, computer animation and radiosity.

31350 PROJECT (2 sem) *(8cp); six hpw; prerequisite 31641 Systems Design; subject coordinator Mr P Bebbington*

31351 PROJECT (1 sem) *(8cp); six hpw; prerequisite 31641 Systems Design; subject coordinator Mr P Bebbington*

31352 PROJECT *(4cp); three hpw; prerequisite 31641 Systems Design; subject coordinator Mr P Bebbington*

31894 PROJECT *(4cp); three hpw; prerequisite 31641 Systems Design; subject coordinator Mr P Bebbington*

A project is intended to give a student experience in working independently and responsibility for scientific research or the development of a small system from initial analysis to user documentation. Projects may be drawn from any area of computer science or information systems. Each project is supervised by a member of academic staff.

31611 INFORMATION SYSTEMS *(5cp); seven hpw; subject coordinator Mr J Underwood*

An introduction to the idea of an information system and its importance in modern organisations. An information system is defined as a system which processes data to produce information for people. We introduce techniques for analysing user requirements and for structuring data so that they may be used more effectively and efficiently. Systems development life cycles and prototyping are discussed and the later stages of system design are outlined. Examples from typical information systems are used to illustrate the concepts.

31613 COMPUTER SYSTEMS ARCHITECTURE I *(4cp); three hpw; subject coordinator Dr B Howarth*

An introduction to computer hardware and software systems. The relationship between hardware and software is discussed by considering the structure of the computer, the inter-relationship of the various components and the processing by the computer of data and program. Students will be introduced to machine-language and to assembly-language programming.

31614 PROGRAMMING PRINCIPLES *(5cp); seven hpw; subject coordinator Dr K Suffern*

An introduction to problem analysis and solution on the computer. Students gain experience at using the UNIX operating system and developing programs with the two major software development methodologies. The principles of object oriented design and programming are introduced using the language EIFFEL; the principles of top-down structured design and programming are introduced using the language PASCAL. Methods of pseudo-coding, coding, debugging, testing, and documentation are discussed.

31615 DISCRETE MATHEMATICS *(4cp); five hpw; subject coordinator Dr T Osborn*

Develops the mathematics of discrete objects and models. Logic: propositions, truth tables, predicate logic, proof techniques. Set theory: sets, relations, relational algebra, functions, iteration, recursive definitions and inductive proof, partial orders and equivalence relations. Discrete structures: natural numbers, lists, trees. Functional programming (Miranda) is used to illustrate the mathematical concepts introduced.

31617 ACCOUNTING FUNDAMENTALS *(4cp); three hpw; subject coordinator Mr B Wong*

A general introduction to financial accounting and business law. Accounting related applications are the backbone of many commercial computing systems, and an understanding of business law facilitates the study of business methods. Students will also develop an awareness of computers in the accounting discipline – looking at how computers are used, how systems have been designed, and examples of accounting systems.

31621 SYSTEMS ANALYSIS *(4cp); three hpw; prerequisite 31611 Information Systems; subject coordinator Mr J El-Den*

Introduces systems concepts and a range of techniques used in systems analysis. Covers the techniques used to analyse all discrete systems data functions and flows inclusive of data flow diagrams, relational analysis and normalisation and E-R modelling. Describes systems life cycles and the role of these techniques within life cycles in evaluating requirements and proposals and setting objectives for new systems.

31622 COMMERCIAL PROGRAMMING DEVELOPMENT *(4cp); three hpw; prerequisites 31614 Programming Principles, 31611 Information Systems; subject coordinator Miss J Robb*

Structured design techniques and their application to COBOL programming in an off-line commercial environment.

31623 COMPUTER SYSTEMS ARCHITECTURE II *(4cp); five hpw; prerequisites 31613 Computer Systems Architecture I, 31614 Programming Principles; subject coordinator Mr C W Johnson*

A continuation of Computer Systems Architecture I. The concepts introduced there are elaborated upon, and study of CPU internals is facilitated by use of assembler language on a real machine. Additional requirements of architectures for performance enhancement and support of high-level languages and operating systems are discussed.

31624 DATA STRUCTURES AND ALGORITHMS *(4cp); five hpw; prerequisites 31614 Programming Principles, 31615 Discrete Mathematics; corequisites 31625 Software Engineering; subject coordinator Dr R Rist*

Structured approach to software development: modular design, step-wise refinement, top down design, documentation and layout, complexity analysis, program correctness and program testing strategies. The data structures covered include sets, files and dynamic data structures: stacks, queues, lists and binary trees. Each data structure is presented as an abstract data type, and then discussed at the implementation and application levels. Hashing and common searching and sorting algorithms are also discussed.

31625 SOFTWARE ENGINEERING *(4cp); three hpw; prerequisites 31614 Programming Principles, 31615 Discrete Mathematics; subject coordinator Dr J Potter*

Introduces the formal aspects of modern software engineering. Topics: an overview of the software engineering environment, the practice of formal mathematical specification, program development via refinement of specifications, program correctness, machine executable specifications, an overview of software testing and reliability.

31626 PROBABILITY AND STATISTICS *(4cp); three hpw; subject coordinator Dr T Osborn*

Descriptive statistics. Probability theory, random variables, conditional probabilities, independence and Bayes' theorem, and modelling of uncertainty, measures of central tendency and dispersion, moments. Processes and distributions: binomial, Poisson, normal and sampling. Theorems: Chebychev, central limit. Applied statistics: estimation, confidence intervals, hypothesis testing and types of errors; problem solving by theory, statistical tables and machine packages.

31631 DATABASE *(4cp); three hpw; prerequisite 31621 Systems Analysis; subject coordinator Mr R Raban*

Database design and implementation methodologies. Both entity-relationship and relational models are described and used to facilitate database design. The SQL language is described in detail illustrating database query and update techniques. Traditional database approaches including codasyl and hierarchical databases are described.

31632 COMMUNICATIONS AND NETWORKS *(4cp); three hpw; prerequisites 31611 Information Systems, 31613 Computer Systems Architecture I; subject coordinator Mr J Colville*

Introduces communication concepts and terminology, and describes the problems involved in the Physical and Data Link Layers of communication and their solutions. The subject discusses network architectures, topologies and carrier services.

31633 OPERATING SYSTEMS *(4cp); five hpw; prerequisites 31613 Computer Systems Architecture I, subject coordinator Mr U Szewcow*

An introduction to the concepts and facilities available in computer operating systems. The subject includes scheduling, multiprogramming, protection and resource control.

31636 SIMULATION AND MODELLING *(4cp); four hpw; prerequisites 31626 Probability and Statistics, 31624 Data Structures and Algorithms; subject coordinator Dr J Edwards*

Principles and practice of modelling: analysis, data gathering, solution, validation, implementation. Modelling in and of computer systems, queueing theory, continuous simulation, languages, corporate modelling, and inventory.

31641 SYSTEMS DESIGN *(4cp); four hpw; prerequisite 31631 Database; subject coordinator Mr R Raban*

Focuses on the user and business aspects of systems design. User interface issues cover dialogue, screen, report and forms design as well as designing and writing user documentation. Integration with

business environment includes business procedures, security, control and implementation. A variety of design and implementation strategies are introduced, such as prototyping, CASE tools and 4GL's.

31642 ON-LINE SYSTEMS *(4cp); four hpw; prerequisites 31622 Commercial Programming Development, 31632 Communications and Networks; corequisite 31641 Systems Design; subject coordinator Mr C Richardson*

Aspects of systems development that are specific to on-line application systems. Real time and distributed systems are also covered with respect to their impact on the development of application systems. Practical work involves developing a series of programs in an on-line transaction processing environment. A research report is also included in the assessment for the subject.

31647 MANAGEMENT CONTROL SYSTEMS *(4cp); four hpw; prerequisite 31617 Accounting Fundamentals; subject coordinator Mr P Bebbington*

The principles and techniques of cost accounting, budgeting and financial planning and their use in computer-based accounting and business decision-making systems.

31648 BUSINESS TOOLS AND APPLICATIONS *(4cp); four hpw; prerequisite 31631 Database; subject coordinator Mr B Wong*

Gives students familiarity with microcomputers in the office and business environment and as stand alone machines or workstations. The use of database and file management programs and the physical operation of microcomputers are discussed. Students will become familiar with specific packages such as business databases, spreadsheets and program development aids.

31653 COMMUNICATIONS SOFTWARE *(4cp); six hpw; prerequisites 31633 Operating Systems, 31632 Communications and Networks; subject coordinator Mr J Colville*

An examination of the mechanics of operation of communication systems using as a reference model the ISO definitions of OSI (Open Systems Interconnection) seven-layer protocols. A rudimentary protocol verification and protocol efficiency calculation methods are introduced.

Each of the OSI seven layers is examined in detail. Some well-known communications protocols as well as international standard protocols are analysed. They are: Aloha (Pure and Slotted) Systems; Arpanet; IEEE 802.3 CSMA/CD (Ethernet); IEEE 802.4 Token Bus; IEEE 802.5 Token Ring; Fastnet and Expressnet Systems.

In addition, the following networks are introduced and discussed briefly to provide up-to-date knowledge of the communications industry: ISDN (Integrated Services Digital Network); BISDN (Broadband ISDN); IN (Intelligent Network); MAN (Metropolitan Area Network).

31654 LANGUAGES AND TRANSLATORS *(4cp); three hpw; prerequisites 31613 Computer Systems Architecture I, 31624 Data Structures and Algorithms; subject coordinator Mr J Colville*

Translation and execution of expressions and statements. Syntactic analysis and parsing. Attribute grammars. Compile-time type checking. Syntax and table-driven compilers. Compiler-compilers. Code generation, error diagnostics and error correction of code. Code optimisation. Memory allocation during compilation and execution.

31655 THEORY OF COMPUTER SCIENCE *(4cp); three hpw; prerequisites 31624 Data Structures and Algorithms, 31625 Software Engineering; subject coordinator Professor J Debenham*

Topics from the theory of machines, the theory of languages – syntax and semantics, the theory of processes, the theory of data, the complexity of problems. Applications of the theory particularly in the area of language translation and compiler writing.

31658 PROJECT MANAGEMENT *(4cp); three hpw; prerequisite 31696-7 or 31698 Industrial Training, subject coordinator Mr D Wilson*

Provides students with the practical knowledge and skills that are necessary to effectively manage project teams and software development projects. The major topics are: leadership, people management, communication and control; planning a software project, project life cycles, project/milestones and development plans; software time and cost estimation; controlling software projects; development aids and alternatives.

31662 INFORMATION SYSTEM CASE STUDY *(5cp); six hpw; prerequisites 31641 Systems Design, 31642 On-Line Systems; corequisites 31658 Project Management, 31666 Performance Evaluation; subject coordinator Mr J Underwood*

This case study deals with the issues involved in strategic level analysis and design in a corporate wide information systems environment. It reinforces material previously studied while giving groups of students scope to use their own judgment in applying their knowledge. It stresses the development and assessment of alternative approaches to a system strategy and senior management communication skills.

31666 PERFORMANCE EVALUATION *(4cp); six hpw; prerequisite 31636 Simulation and Modelling; subject coordinator Mr J Cady*

Reviews considerations involved in configuring, selecting or upgrading a computer system in the most cost-effective way. Operating systems and other software factors affecting computer performance are also studied. Measurement and modelling techniques are emphasised.

31669 SOCIAL IMPLICATIONS OF COMPUTERS *(3cp); three hpw; prerequisite 31696-7 or 31698 Industrial Training; subject coordinator Dr J Edwards*

Aims at identifying areas of society where the use of computer technology is of concern, and to apply an understanding of the social issues to the actual work situation. Topics include: history of computing (social and economic factors), effects on workforce, professionalism and ethics, social responsibility of computer practitioners, privacy, the DP workforce. These areas are discussed in the context of contemporary issues.

31696 INDUSTRIAL TRAINING *(full-time – first semester) (0cp); six hpw; prerequisites 31621 Systems Analysis, 31622 Commercial Programming Development, 31624 Data Structures and Algorithms, 31633 Operating Systems, 51370 Human Communication plus at least eight other core subjects from the BAppSc program; subject coordinator Associate Professor M Fry*

31697 INDUSTRIAL TRAINING *(full-time – second semester) (0cp); six hpw; prerequisites 31696 Industrial Training (F/T first semester); subject coordinator Associate Professor M Fry*

The first and second semesters of the compulsory industrial requirement for the course. All full-time students must enrol in these subjects and obtain a minimum of nine months' of full-time employment. Students must normally have completed the equivalent of at least four full-time semesters before obtaining employment.

31698 INDUSTRIAL TRAINING *(part-time – first semester – Stage 5) (0cp); three hpw; prerequisites 31621 Systems Analysis, 31622 Commercial Programming Development, 31624 Data Structures and Algorithms, 31633 Operating Systems, 51370 Human Communication plus at least eight other core subjects from the BSc program; subject coordinator Associate Professor M Fry*

31699 INDUSTRIAL TRAINING *(part-time – second semester – Stage 6) (0cp); three hpw; prerequisites 31698 Industrial Training (P/T first semester)*

The first and second years of the compulsory industrial requirement for the course, normally taken for a total of four semesters in Stages 5 and 6. All part-time students must enrol in these subjects and obtain a minimum of 18 months' of full-time employment.

31722 COMMERCIAL PROGRAMMING *(5cp); five hpw; prerequisites 31611 Information Systems, 31614 Programming Principles; subject coordinator Mr C Richardson*

Commercial structured design techniques and commercial programming in either a batch or on-line environment. Students will be taught the design technique and language of the particular industry organisation using approved assignment work.

31738 MANAGEMENT PRINCIPLES FOR IT PROFESSIONALS *(4cp); three hpw; prerequisite 51370 Human Communication or equivalent; subject coordinator Mr J Clark*

The environment of business organisations and the challenges facing large and small business. Management theory, evolution and schools of thought. Management principles, style, decision making, mechanistic and organic systems. Personnel management, planning, job analysis and design, selection and training, career planning, appraisal and counselling, compensation and incentives. Operations management.

31756 PROJECT MANAGEMENT *(5cp); three hpw; prerequisite 31788 Organisation Theory for IT Professionals; subject coordinator Mr D Wilson*

Provides students with the practical knowledge and skills that are necessary to effectively manage project teams and software development projects. The major topics are: leadership, people management, communication and control; planning a software project, project life cycles, project phases/

milestones and development plans; software time and cost estimation; controlling software projects; development aids and alternatives.

31762 TECHNOLOGY PLANNING *(5cp); three hpw; prerequisites 31642 On-Line Systems, 31781 Business Systems Design; corequisites 31766 Performance Modelling and Management; subject coordinator Mr J Underwood*

This case study deals with the issues involved in strategic level analysis and design in a corporate wide information systems environment. It reinforces material previously studied while giving groups of students scope to use their own judgment in applying their knowledge. It stresses the development and assessment of alternative approaches to a system strategy and senior management communication skills.

31766 PERFORMANCE MODELLING AND MANAGEMENT *(5cp); three hpw; prerequisites 31633 Operating Systems, 31626 Probability and Statistics; subject coordinator Mr J Cady*

Understanding the basic techniques of system performance modelling and the application of systems modelling techniques to the assessment of present and future required system capacity; basic principles of capacity management and its importance to IS management and senior management. Simple queueing theory and operational analysis modelling techniques; systems performance analysis – measurement and models; modelling and analysis of on-line systems; workload characterisation; workload forecasting; relations between capacity planning, IS management, corporate planning and corporate management.

31768 BUSINESS PLANNING FOR IT PROFESSIONALS *(4cp); three hpw; prerequisite 51370 Human Communication or equivalent; subject coordinator Mr J Underwood*

Provides students with an awareness of the problems in developing corporate strategies, in general, and information technology strategies, in particular; also, develops skills in the selection and use of appropriate techniques. Major topics are: business planning/strategic planning, analysing business priorities and objectives, long term planning, models, tools and techniques; information technology planning, major tools and techniques and the changing role of the information systems manager; corporate needs for information technology.

31770 INDUSTRY PROJECT I *(5cp); fourteen hpw; subject coordinator Mr B Wong*

Understanding the function of the Information Systems Department in an organisation and also of at least one user business function serviced by IS. Understanding is via a number of strategies such as interviewing, observation and work experience. Students will be taught human communication skills in conjunction with the project work, with special emphasis on oral and written communication. Training will also be provided in a variety of development tools used in the information systems development process in order to build up a defined skills profile in conjunction with the subject Industry Project II.

31771 BUSINESS REQUIREMENTS ANALYSIS *(4cp); three hpw; prerequisite 31621 Systems Analysis; subject coordinator Mr J Clark*

Applications of systems analysis (data flow diagrams, relational modelling, etc) in a business setting; the roles of the business analyst and the systems analyst; systems research and requirements analysis (interviewing, document analysis, etc) for data processing, management information systems, etc; top-down enterprise-wide perspective; evolution of the business environment; business, product and other life cycles. Industry case studies.

31777 HUMAN-COMPUTER INTERACTION *(4cp); three hpw; prerequisite 31641 Systems Design; subject coordinator Mrs J Hammond*

Focuses on human factors and management aspects of "user-centred" systems development and design. It provides students with HCI principles, concepts, tools and techniques needed to build user-centred systems, particularly in terms of the design of interfaces that satisfy user needs and create usable products that support user tasks and goals. Major topics include: role and scope of HCI, methodologies such as requirements analysis, task analysis and usability testing, usability evaluation, user-centred design support and user interface management systems.

31778 RESOURCES MANAGEMENT FOR IT PROFESSIONALS *(4cp); three hpw; prerequisite 51370 Human Communication; subject coordinator Mr P Bebbington*

Developed to instil the knowledge and skills required for effective management of hardware and software resources within an Information System organisation. The major topics: resource acquisition, developing software, workplace environment, hardware and software security, operations management, EDP accounting.

31779 APPLICATIONS OF INFORMATION TECHNOLOGY I *(5cp); three hpw; prerequisite 31711 Information Systems; subject coordinator Mr C S Johnson*

Formal and practical exposure to, and understanding of a variety of specific applications of information technology, such as management information systems, database, decision support systems, process control, graphics, etc. Subject material will complement that of 31789 to ensure a common level of experience for all students.

31780 INDUSTRY STUDIES *(5cp); four hpw; prerequisite 31770 Industry Project 1; subject coordinator Mr P Bebbington*

Students undertake surveys of industry sponsors of the BInfTech program investigating contemporary topics in the field of information systems. Students may also be required to undertake other formal activities to complement the industry objectives of the BInfTech program.

31781 BUSINESS SYSTEMS DESIGN *(5cp); four hpw; prerequisites 31771 Business Requirements Analysis, 31641 Systems Design; subject coordinator Mr J Underwood*

Understanding systems design in a business setting; performance and quality criteria; alternative implementation strategies; approaches to systems construction and estimation (including package evaluation and prototyping); implementation issues; productivity issues; methods engineering; information technology in business; industry and product differences. Case studies.

31788 ORGANISATION THEORY FOR IT PROFESSIONALS *(4cp); three hpw; prerequisite 51370 Human Communication or equivalent; subject coordinator Mr J Underwood*

This subject examines the structural and sociological aspects of organisations. Topics include: the nature of organisation theory; organisation effectiveness; structure and technology; structure and environment; typical organisation structures; organisations as social systems; work groups and job design; organisational learning; cultures and organisations; information technology in organisations.

31789 APPLICATIONS OF INFORMATION TECHNOLOGY II *(5cp); three hpw; prerequisite 31779 Applications of Information Technology I; subject coordinator Mr C S Johnson*

Formal and practical exposure to and understanding of a variety of specific applications of information technology, such as management information systems, database, decision support systems, process control graphics, etc. Subject material will complement that of Applications of IT I to ensure a common level of experience for all students.

31790 INDUSTRY PROJECT II *(5cp); fourteen hpw; prerequisite 31770 Industry Project I; subject coordinator Mr B Wong*

Students gain practical "hands on" experience of the role of members of an information systems development team in relation to business organisational goals and objectives; students are incorporated as members of a project team in a sponsoring company. Training will also be provided in a variety of development tools in order to build up a defined skills profile in conjunction with the subject Industry Project 1.

31853 OFFICE AUTOMATION *(4cp); three hpw; prerequisite 31621 Systems Analysis; subject coordinator Mr C S Johnson*

Covers the advanced concepts of office automation and the impact on the organisational structure. Analysis of the social issues of the implementation of office automation systems into the corporate structure and the current information systems. The management of office automation systems is discussed. Current research issues in office automation are presented by the researchers. Practical exposure is given in the requirements stage of office automation.

31854 DISTRIBUTED DATABASES *(4cp); three hpw; prerequisites 31631 Database, 31632 Communications and Networks; subject coordinator Dr G Feuerlicht*

This elective subject addresses both the theoretical and practical issues associated with design and implementation of distributed database. Relational database concepts will form the basis for the theoretical material presented in this course. The material presented in lectures will be supported by practical assignment work using a commercially available distributed database management system.

31859 COMPUTER AIDED SYSTEM DEVELOPMENT ENVIRONMENT *(4cp); three hpw; prerequisites 31631 Database, 31641 Systems Design; coordinator Dr G Feuerlicht*

The subject will enable the student to understand the role and interaction of various system development tools through the system development life cycle; gain in-depth understanding of methodologies which are used in conjunction with modern system development tools; understand repositories and the role of international repository standards; gain working knowledge of application generating tools

and CASE tools; gain practical experience with computer assisted tools during the development of a realistic commercial application system; appreciate the differences between the various commercially available tools.

31860 OBJECT ORIENTED PROGRAMMING AND C++ *(4cp); three hpw; prerequistite 31904 Systems Programming; subject coordinator Dr K Suffern*

Review of object oriented design principles and practices. Objects, classes, run time instantiation, inheritance, information hiding polymorphism and libraries and their implementation in C++. Comparison with the approach in Eiffel. Contrast with the procedural style of C.

31875 PARALLEL PROGRAMMING *(4cp); three hpw; prerequisites 31624 Data Structures and Algorithms, 31633 Operating Systems; subject coordinator Mr J Cady*

An introduction to parallel programming covering the following topics: a parallel programming language and program development system; modularising a problem into a set of cooperating sequential processes running in parallel; the prevention of deadlock; orderly termination of a set of parallel processes; use of multiple intercommunication processors; comparison of performance under different physical configurations.

31876 OPERATING SYSTEMS FACILITIES *(4cp); three hpw; prerequisites 31624 Data Structures and Algorithms, 31633 Operating Systems; subject coordinator Mr J Cady*

The development of applications to make use of the facilities offered by an operating system offering support for a graphical user interface, such as Microsoft Windows will be covered. Included is the methodology involved in building applications that are driven by user actions such as the mouse as well as input from a keyboard. Issues related to inter-application communication will also be explored.

31882 ADVANCED THEORETICAL COMPUTER SCIENCE *(4cp); prerequisite 31655 Theory of Computer Science*

Reviews advanced work in the theory of machines, theory of languages, theory of programs and theory of data.

Not offered in 1993.

31885 ADVANCED MATHEMATICS *(4cp); three hpw; prerequisites 31615 Discrete Mathematics, 31626 Probability and Statistics; subject coordinator Dr J Edwards*

A compulsory prerequisite for a mathematics sub-major or any subjects in the School of Mathematics.

Linear Mathematics: matrices, determinants, eigenvalues and eigenvectors, inversion, pivoting and conditioning, complex numbers and functions. Calculus: Calculus methods and theory, ordinary and partial differential equations. Analysis: real numbers, real functions, continuity, formal calculus.

31888 LOGIC DESIGN *(4cp); three hpw; prerequisite 31613 Computer Systems Architecture I; subject coordinator Mr J Tu*

Provides an introduction to the concepts of logic design, gates, combinational and sequential circuits. The subject is supported by some practical work.

31889 ADVANCED LOGIC DESIGN *(4cp); three hpw; prerequisite 31888 Logic Design; subject coordinator Mr J Tu*

A continuation of Logic Design to include the concepts of machine structure as a controlled combination of registers and gates.

31892 LOGIC PROGRAMMING *(4cp); three hpw; prerequisites 31624 Data Structures and Algorithms; subject coordinator Dr S Prabhakar*

Intended to give the student an understanding of the principles and techniques underlying logic programming. A student should become proficient in PROLOG and its applications to AI problems.

31893 COMPARATIVE PROGRAMMING LANGUAGES *(4cp); three hpw; prerequisite 31624 Data Structures and Algorithms; subject coordinator Dr J Potter*

Programming language constructs, their syntax and semantics. A comparative study of different language styles through particular languages, for example PROLOG, LISP, C, MODULA-2, SMALLTALK, OCCAM.

31895 NUMERICAL ANALYSIS *(4cp); prerequisite 31885 Advanced Mathematics*

Errors, numerical linear algebra, interpolation and approximation, solution of non-linear equations in one and many unknowns, numerical differentiation and integration, numerical solution of ordinary and

partial differential equations. Computer implementation of numerical algorithms and use of packages.

Not offered in 1993.

31896 LISP PROGRAMMING *(4cp); three hpw; prerequisites 31624 Data Structures and Algorithms, 31625 Software Engineering; subject coordinator Dr R Rist*

This subject introduces the student to (i) various aspects of common LISP, (ii) their application to AI problems and methodologies, and (iii) important programming concepts in LISP. Different aspects of LISP include various data types of LISP, recursion, iteration, functions and macros. AI applications include expert systems, model based reasoning and diagnosis. Programming concepts include variable binding, lexical and dynamic scoping, data and procedure abstractions, and building large programs.

31897 COMPUTER SYSTEMS ARCHITECTURE III *(4cp); three hpw; prerequisite 31633 Operating Systems, subject coordinator Associate Professor T Hintz*

A systematic treatment of more advanced topics in machine organisation and systems architecture. Particular emphasis is placed on parallelism in general and its exploitation in a number of special purpose machines. Some practical work with a distributed parallel system will be included.

31898 MICROPROCESSORS AND APPLICATIONS *(4cp); three hpw; prerequisites 31888 Logic Design, 31623 Computer Systems Architecture II; subject coordinator Mr J Tu*

An examination of the current range of microprocessors and their applications in embedded systems. Emphasis is on interfacing peripheral devices to microcomputers

31899 SYSTEMS ARCHITECTURE *(4cp); prerequisite 31897 Computer Systems Architecture III; subject coordinator Associate Professor T Hintz*

In-depth study at the architectural level of one or more state-of-the-art or experimental computer systems. Some practical work on a state-of-the- art parallel computer will be included.

Not offered in 1993.

31901 ARTIFICIAL INTELLIGENCE THEORY *(4cp); three hpw; prerequisites 31625 Software Engineering, 31624 Data Structures and Algorithms; subject coordinator Dr R Rist*

This subject covers Artificial Intelligence to give a professional basis in the basic methods and algorithms of the subject. It includes knowledge representation, machine reasoning, planning, problem solving and research, constraint based systems, learning robotics and computer vision.

31902 AUDITING THE COMPUTER *(4cp); three hpw; prerequisite 31617 Accounting Fundamentals; subject coordinator Mr J Clark*

Audit concepts and techniques in the EDP audit field. Control measures that must be embedded in computer accounting and information systems. Different systems of control, administrative, operational and security. Audit techniques and the DP audit function. Risk analysis, quality assurance.

The emphasis is oriented to control measures possible and desirable in various computer systems e.g. billing, creditors, payroll, etc. and non-monetary information systems.

31904 SYSTEMS PROGRAMMING *(4cp); three hpw; prerequisite 31633 Operating Systems; subject coordinator Mr U Szewcow*

The role of the systems programmer. Comparison of programming languages for systems programming. UNIX operating system. C programming language. Comparison of using tools vs writing a new program.

31931 SOFTWARE QUALITY ASSURANCE *(4cp); three hpw; prerequisite 31621 Systems Analysis; subject coordinator Mr C S Johnson*

Aims to provide students with the practical knowledge and skills that are necessary to effectively measure and control the quality of software products. Major topics are quality assurance principles, quality metrics, verification, validation and test, implementing quality assurance, software engineering methods and tools.

32100 ADVANCED PROGRAMMING TECHNIQUES *(5cp); four hpw; subject coordinator Dr J Potter*

This subject deals with the logical foundation of programming, the structure of programs, their verification using a logical formalism, correct construction of programs from first principles, and program efficiency. A formal specification and development language will be introduced. The process of program development and transformation will also be studied within the area of logic programming.

32101 INTELLIGENT SYSTEMS *(5cp); four hpw; subject coordinator Dr S Prabhakar*

Concentrates on the transfer of research and development in Artificial Intelligence into functional

systems. Topics treated include expert systems, learning systems, natural language understanding, cognitive modelling, intelligent computer assisted instruction, logic programming, problem-solving and planning.

32104 DECISION MAKING AND MODELLING *(5cp); four hpw; subject coordinator Dr J Edwards*

The theory and practice of both managerial decision making and modelling processes. Application areas for modelling will include networks, queueing models, and corporate and financial models. Mathematical programming and simulation tools will be discussed, as will the role of problem formulation, data collection, sampling and sensitivity analysis. An analysis of decision processes will include a study of probabilistic modelling techniques, decision making under uncertainty, decision trees, influence diagrams, utility theory and risk analysis.

32105 SPECIALIST TOPICS IN ARTIFICIAL INTELLIGENCE *(5cp); four hpw; subject coordinator Dr S Prabhakar*

The purpose of this subject is to familiarise the students, in detail, with some areas of Artificial Intelligence and their applications. These areas include: knowledge representation, problem-solving planning, task-structures, model-based reasoning, case-based reasoning, expert systems, diagnosis, explanation, design and machine learning. Some of the AI techniques are familiarised through a task area like design or diagnosis. In future, this subject may focus more upon design, case-based reasoning, model-based reasoning and learning.

32200 INFORMATION PROCESSING STRATEGY *(5cp); four hpw; prerequisite 32203 Information Management; subject coordinator to be announced*

Designed to develop knowledge and skills required to carry out strategic planning for corporate information systems and services. An introduction to corporate and MIS planning is followed by an examination of the applications spectrum and the technology spectrum supported by examinations of appropriate management tools for strategic planning, modelling and control of information processing.

32201 DATABASE *(5cp); four hpw; subject coordinator Dr G Feuerlicht*

The subject covers advanced database topics including several data analysis and design approaches (entity modelling, object-oriented modelling and others). Other topics include a discussion of database languages and their role in application development, and distributed database environments. Emerging database technology such as object database management systems and extended database management systems will also be discussed.

32202 COMMUNICATION SYSTEMS *(5cp); four hpw; subject coordinator Ms D Jinks*

Corporate communications, requirements and solutions, is the major focus of this subject. Students will demonstrate proficiency in the strategic requirements analysis and design of corporate communications facilities by completing a detailed case study. Topics include: historical development of computer communications, followed by an examination of the traditional mainframe based wide area network and a brief examination of proprietary networking architectures; existing and evolving standards, in particular the ISO-OSI reference model, and moves toward data integration; the local telecommunications regulatory environment and the potential changes in this area; local and metropolitan networks; broadband networks; network management; review of networks within industry, commerce, government and education.

32203 INFORMATION MANAGEMENT *(5cp); four hpw; subject coordinator to be announced*

Information as a resource. Cost of collection, storage, manipulation, validity, and timeliness, security and availability, consistency and flows of information sets within an organisation, integration of functional systems through common flows, access, authorisation and encryption. Planning and implementation of enhanced information systems. Project control and estimation techniques, overall systems design, implementation, testing and maintenance tools. Post implementation reviews and audits.

32301 PERFORMANCE EVALUATION *(5cp); four hpw; subject coordinator Dr B Howarth*

Revision and extension of queueing theory. Analytic models of computer systems and their application to performance evaluation. Brief revision of EDP planning principles. Application of performance evaluation principles to capacity management – modelling the growing system.

32302 COMPUTER ARCHITECTURE *(5cp); four hpw; subject coordinator Dr B Howarth*

An examination of the more advanced architectural features available in contemporary computer systems as well as of the likely future implications of current research. The subject will cover such topics as parallelism in processor design, the

distribution of intelligence storage technology and the incorporation of high-level language capabilities as well as operating systems features in hardware.

32304 COMPUTER LANGUAGES *(5cp); four hpw; subject coordinator Mr J Colville*

Revision of basic structures of procedural programming languages. Concurrency facilities. Approaches to modularisation. List-structured, non-procedural and functional languages. Object-oriented systems. Translation techniques for advanced high-level languages.

32305 OPERATING SYSTEMS *(5cp); four hpw; subject coordinator Dr B Howarth*

Topics in modern operating systems. The role of standards in commercial operating systems. Concurrency in closely coupled and loosely coupled systems. Programming support environments. "User friendly" system interfaces. Object-based systems. Fault-tolerant systems. Secure systems.

32400 ACCOUNTING FOR MANAGEMENT *(5cp); four hpw; subject coordinator to be announced*

The managerial aspects of accounting will be the main area of interest. This will involve consideration of the nature of accounting both in its traditional role and as an aid to management. The nature of costs and the various aspects of cost accounting will be covered in some detail. The effect of inflation on costs, profits and capital replacement decisions will be covered in depth. The use of funds analysis and balance sheet ratios to assess operational efficiency will also be covered.

32401 MANAGEMENT POLICY AND STRATEGY *(5cp); four hpw; subject coordinator to be announced*

Considers the essential tasks of management in formulating, organising and implementing strategy; topics covered include the concepts of strategic management; assessing situations; formulating policies; technology forecasting; environmental analysis; influence of stakeholders on strategy; strategies for organisational learning; case studies in strategic management.

PROJECT *coordinator Professor J Debenham*

32908	Eight hours per week	10 credit points
32912	Twelve hours per week	15 credit points
32916	Sixteen hours per week	20 credit points

All students in the MSc (by coursework) in Information Science are required to enrol in and pass the project subject. The project is normally undertaken in the final year of study. The project entails a substantial investigation, under the supervision of a member of the academic staff, and is examined on the quality of both a written report and an oral presentation of the project work. Students normally enrol in the 10 credit point project. In exceptional circumstances, and with the support of the project supervisor, permission may be granted for a student to enrol in the 15 or 20 credit point project.

32999 SEMINAR *(4cp); one hpw; subject coordinator Professor J Debenham*

All students enrolled in the Masters course should enrol in the seminar subject each semester. To pass the seminar subject, students are required to attend the masters research seminars and to make three presentations at a satisfactory standard during their enrolment in the Masters course. Students who have failed to attend at least 70% of the scheduled seminars which were presented during their enrolment will not normally be permitted to graduate. The three presentations which students are required to make are a literature review, a research seminar and an oral presentation of their project work.

31855 QUALITY ASSURANCE PRINCIPLES *(4cp); three hpw; subject coordinator Mr B Wong*

Definition of quality for software products, quality characteristics and their relationships, setting measurable and testable quality attributes, the importance of being able to measure quality, different approaches to quality metrics, methods of defining suitable metrics, examples of typical metrics and the relationship between the QA Function, Software Developers and Management.

31856 QUALITY AND SOFTWARE ENGINEERING *(4cp); three hpw; subject coordinator Mr B Wong*

The role of engineering methods and tools in the software development process, advantages and disadvantages of different approaches, contribution of engineering disciplines to the achievement of quality.

31857 SOFTWARE QUALITY TECHNIQUES *(4cp); three hpw; subject coordinator Mr B Wong*

Verification, Validation and Test (VV &T) methods and techniques, VV & T tools, relation of VV & T to all phases of the software development life cycle, the processes of VV & T appropriate to each of the life cycle phases, characteristics and documentation of SQA plans, quality standards, configuration management, quality audit and the effectiveness and cost of SQA.

SUBJECTS OFFERED BY OTHER FACULTIES

51370 HUMAN COMMUNICATION *(3cp); two hpw; subject coordinator Ms K Fry*

Outlines the principles and practice of written and oral reporting. It is designed to help students in researching, organising, writing and presenting material appropriate to technical and commercial contexts. Topics covered include adaptation of content and style to suit the medium of communication, e.g., letters, memoranda, reports, articles and graphs, tables and diagrams; short talks on technical subjects: visual aids.

Students will investigate various theories of communication and apply these principles to their practical work. Research, organisation, composition and presentation will be developed in the areas of written, spoken and non-verbal communication.

79729 THE LEGAL ENVIRONMENT OF BUSINESS *(5cp); three hpw; subject coordinator to be announced*

This subject will examine the following topics: Law, Society and other values; Parliament and government; the Constitution; contracts; torts; industrial property; principal and agent; partnership; companies; restrictive trade practices; taxation; foreign investment regulation; the law of international business in Australia. Students have a choice of specialisation in trade practices or computer law.

EXTENSION COURSES

Offered each semester, and currently run through the Centre for Continuing Professional Education

COBOL EXTENSION COURSE *(three hpw)*

Students gain the computing knowledge necessary to deal with problems which confront them in a commercial environment. The COBOL language is an internationally standardised commercial language. In all practical work, the emphasis will be on good programming technique, adequate testing, appropriate documentation and correct syntax.

OBJECT ORIENTED PROGRAMMING WITH C++ *(three hpw); subject coordinator Dr K Suffern*

An introduction to object oriented design and programming with the C++ language. Students enrolling in this course are expected to have some C programming experience, preferably in a UNIX* environment, but no experience with object oriented techniques is assumed.

This course will be offered subject to approval.

UNIX/C EXTENSION COURSE *(three hpw)*

An introduction to the C programming language and the UNIX* operating system. Students enrolling in this course are expected to have programming experience.

[C] UNIX is a trademark of AT&T and Bell Laboratories.

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V Tu, BSc, BE (Mont), ME (Hons), MCSEE, MACS

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D Wilson, BSc (Hons), MBCS, MACS, MACM

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Lecturers
E Lidums, BSc (Hons), MSc (Syd)
P A Wright, BA (Macq), MStats, MEngSc (NSW)

PRINCIPAL DATES FOR 1993

AUTUMN SEMESTER

JANUARY

11	Release of HSC results
11	School of Legal Practice enrolment day at St Leonards
18	Closing date for changes of preference to the Universities Admissions Centre (UAC) from 1992 NSW HSC applicants (by 4.30 pm)
21-29	Enrolment of students at City campus
26	Australia Day
29	Public School Holidays end

FEBRUARY

1 - 26	Enrolment of students at City campus
3 - 5	Enrolment of new undergraduate students at City campus - includes UAC and direct applicants
4 - 5	Enrolment of all Faculty of Nursing students at Kuring-gai campus
10 - 11	Enrolment of all School of Teacher Education students at Kuring-gai campus
22	Enrolment of School of Biological and Biomedical Science students at St Leonards campus

MARCH

1	Classes begin
12	Last day to enrol in a course or add subjects
12	Last day to change to upfront HECS payment
26	Last day to apply for leave of absence without incurring financial penalty
31	HECS Census Date

APRIL

8	Last day to drop a subject without academic penalty*
8	Last day to withdraw from a course without academic penalty*
9	Public School Holidays begin
9	Good Friday
12	Easter Monday
13	Graduation period begins
13 - 16	Vice-Chancellors' Week (non-teaching)
16	Public School Holidays end
25	Anzac Day
30	Graduation period ends
30	Last day to apply to graduate in Spring 1993

MAY

28	Closing date for undergraduate applications for Spring semester

JUNE

14	Formal examination period begins
28	Public School Holidays begin

SPRING SEMESTER

JULY

2	Formal examination period ends
5	School of Legal Practice enrolment day at St Leonards campus
5 - 9	Vice-Chancellors' Week (non-teaching)
9	Public School Holidays end
21	Release of Autumn Semester examination results
26 - 30	Confirmation of Spring programs
27 - 28	Enrolment of new students

AUGUST

2	Classes begin
5	Last day to withdraw form full year subjects without failure*
13	Last day to enrol in a course or add subjects
13	Last day to change to upfront HECS payment
27	Last day to apply for leave of absence
31	HECS Census Date
31	Last day to apply to graduate in Autumn 1994

SEPTEMBER

10	Last day to drop a subject without academic penalty*
10	Last day to withdraw from a course without academic penalty*
27	Public School Holidays begin
27	Vice-Chancellors' Week (non-teaching) begins
27	Graduation period begins
27-29	Conference on Cultural Diversity
30	Closing date for undergraduate applications via UAC (without late fee)
30	Closing date for inpUTS Special Admission Scheme applications
30	Closing date for postgraduate applications - to be confirmed

OCTOBER

1	Vice-Chancellors' Week (non-teaching) ends
1	Graduation period ends
8	Public School Holidays end
29	Closing date for postgraduate research and course award applications
29	Closing date for undergraduate applications via UAC (with late fee)
29	Closing date for undergraduate applications direct to UTS (without late fee)

NOVEMBER

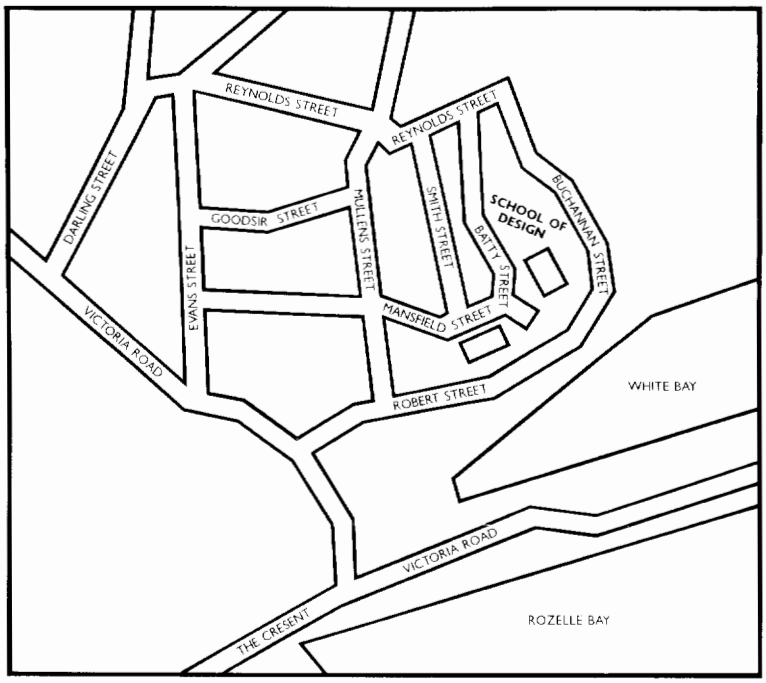
15	Formal examinations begin

DECEMBER

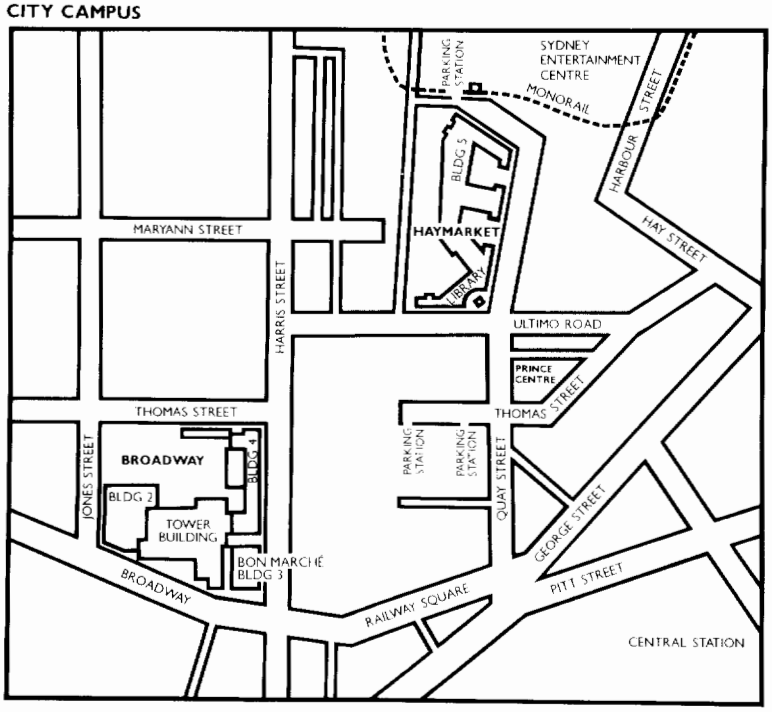
3	Formal examinations end
20	Public School Holidays begin
24	Release of Spring Semester examination results

** HECS or Postgraduate Course Fees still apply after the HECS Census date.*

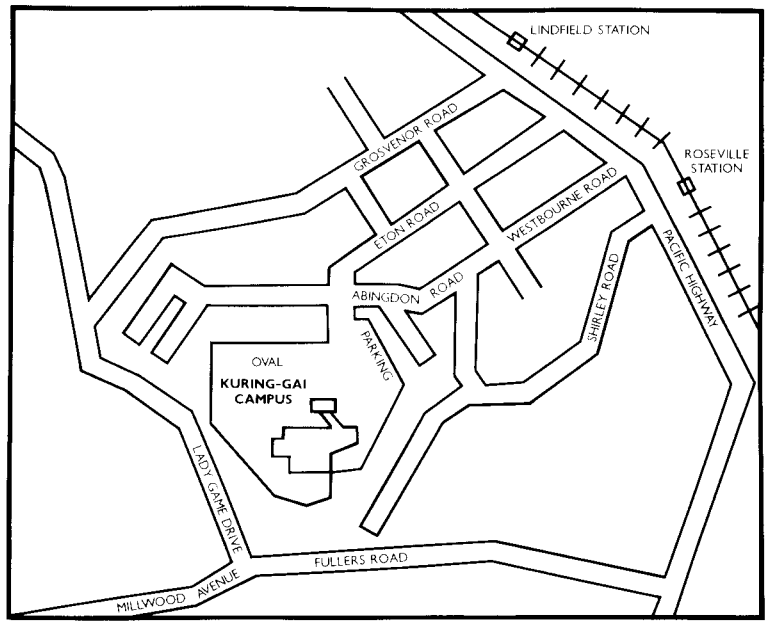
BALMAIN CAMPUS



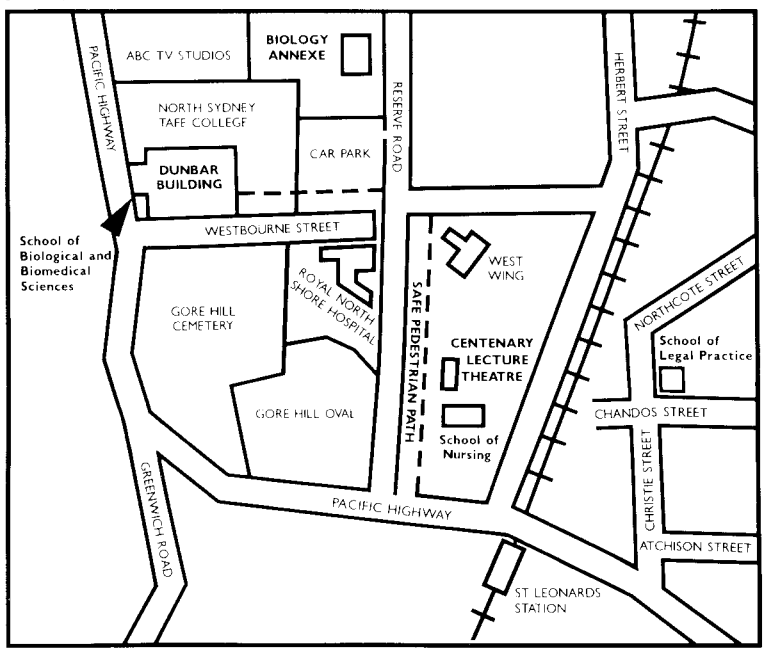
CITY CAMPUS



KURING-GAI CAMPUS



ST LEONARDS CAMPUS



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