

1990

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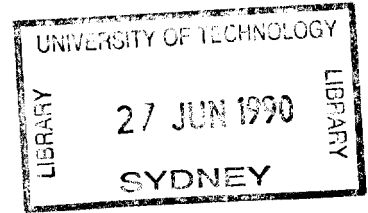
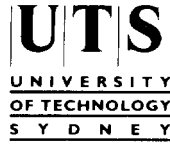
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UTS
UNIVERSITY
OF TECHNOLOGY
SYDNEY

FACULTY OF MATHEMATICAL
& COMPUTING SCIENCES

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Faculty of Mathematical and Computing Sciences

**1990
Handbook**

UNIVERSITY OF TECHNOLOGY, SYDNEY

The University of Technology, Sydney, was established as the New South Wales of Technology in 1965 and became a university in 1988. It amalgamated with Kuring-gai College of Advanced Education and the Institute of Technical, Adult and Teacher Education on 1 January 1990. Over 15,000 students study in over 70 courses at UTS. At postgraduate level the University offers Graduate Diplomas, Masters by coursework, Masters by thesis courses and Doctoral programmes.

All courses are vocationally oriented and the close relationship between a student's academic study and the realities of the work situation is stressed. Particular attention is paid to the needs of part-time students and the structure of their study programmes. In a number of courses, special programmes involving "sandwich" attendance enable the student to alternate between periods of full-time study and full-time professional experience.

The University occupies five campuses close to the business district of Sydney. The main campus is at Broadway, with others at North Shore, Haymarket, Balmain and Kuring-gai.

The Faculty of Mathematical and Computing Sciences is located at Broadway.

Full-time, Part-time and Sandwich Courses

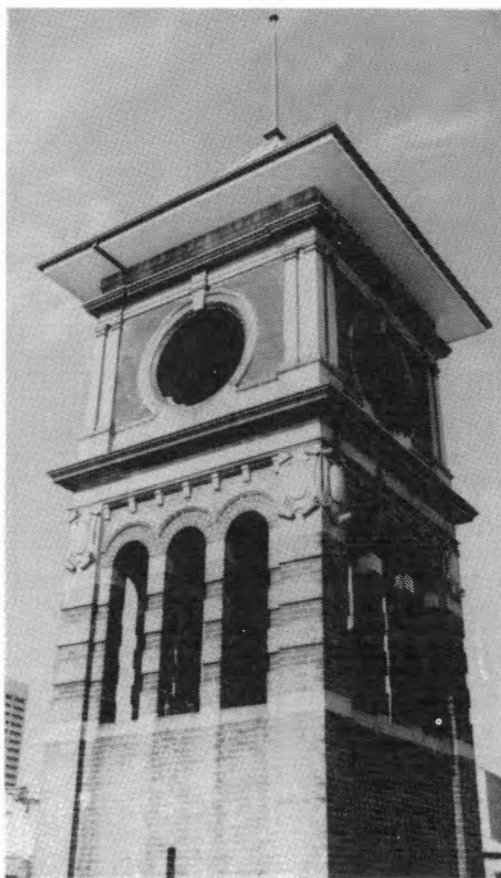
Most courses offered by UTS can be undertaken with part-time attendance. A number of courses are also offered with full-time and sandwich attendance (see table of courses). Students are usually allowed to transfer from one attendance pattern to another at the end of a stage. This is subject to the Head of School's approval and class space availability. The University does not offer external or correspondence courses.

It should be noted that admission to courses on a sandwich attendance pattern basis does not require students to be employed at the time of enrolment.

Further Information

The University publishes a Calendar which may be purchased from the Co-operative Bookshop, or consulted at the University Library or UTS Information Service.

The 1990 Calendar is published in two volumes and should be read in conjunction with this and other UTS Faculty Handbooks. Volume 1 contains other course information, lists of officers and staff, general information and regulations. Volume 2 covers the Kuring-gai campus only.





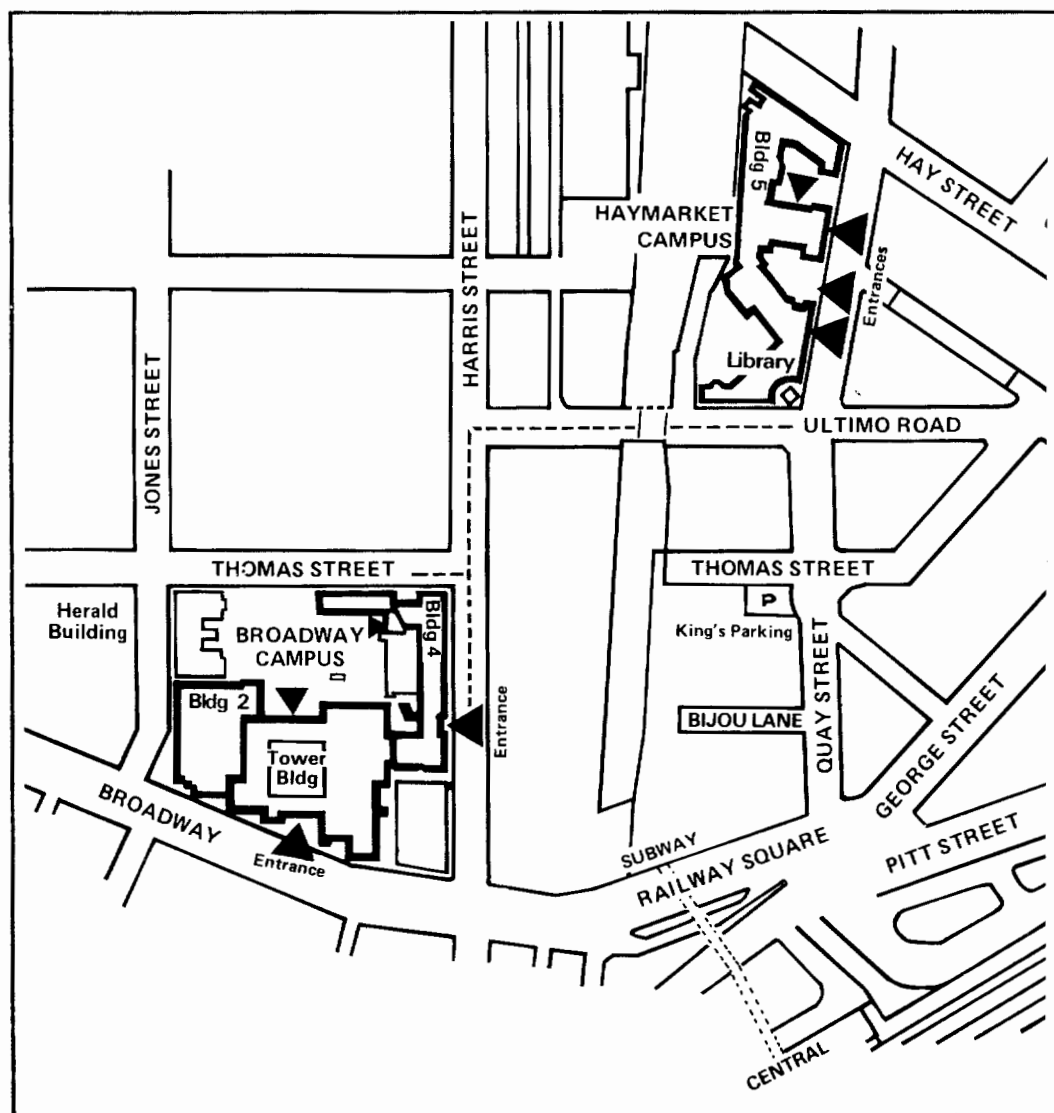
MISSION

The special mission of the University of Technology, Sydney is to provide higher education to equip graduates for professional practice. The UTS approach has been to relate academic study to practical needs and to offer courses through a variety of attendance patterns to encourage the combination of work and study. This style of cooperative education is appealing to students and highly regarded by professional associations.

UTS offers not only a degree but a profession, the option to combine work and study, the opportunity for working men and women to improve their qualifications, and a university education with a difference.

EQUAL OPPORTUNITY

It is the policy of the University of Technology, Sydney to provide equal opportunity for all persons regardless of race, sex, marital status, physical disability, racial vilification or homosexuality.



SCHOOL OF MATHEMATICAL SCIENCES

Office: Room 1523, Level 15, Building 1

SCHOOL OF COMPUTING SCIENCES

Office: Room G30, Building 4

BROADWAY CAMPUS

15-73 Broadway

Broadway

Telephone: (02) 20930

PO Box 123

Broadway NSW 2007

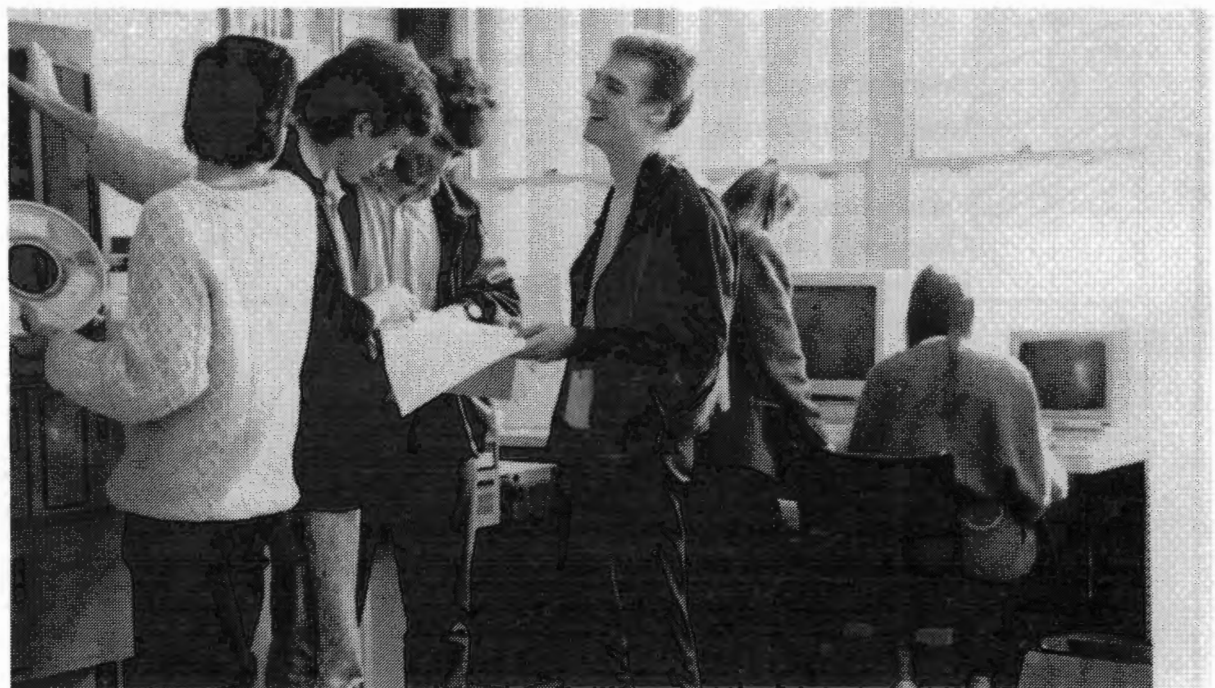


Faculty of Mathematical and Computing Sciences

1990 Handbook

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INFORMATION DAY

Visit UTS on Monday 28 May, 1990
from 2.00pm - 7.00pm at the
Broadway Campus 15-73 Broadway.
Phone (02) 20930.

Select from an exciting new range of degree courses in

- Adult Education
- Architecture
- Biological and Biomedical Sciences
- Building
- Business
- Communication
- Computing
- Design
- Education
- Engineering
- Law
- Leisure Studies
- Library and Information Science
- Mathematics
- Nursing
- Physical Sciences
- and Accredited Short Courses

PRINCIPAL DATES FOR 1990

All courses at the University follow the semester pattern of attendance. The academic year is divided into two semesters, each containing twenty weeks.

January

- 3 Teaching commences for College of Law co-operative course C190
- 15 Teaching commences for College of Law full-time course C901
- 29 Academic year commences
- 29-30 Enrolment of continuing students (not Kuring-gai)
- 31 Enrolment of new students (not Kuring-gai)

February

- 1-2 Enrolment of new students (not Kuring-gai)
- 5-9 Enrolment of continuing students (not Kuring-gai)
- 10 Orientation Open Day
- 12 Classes commence for continuing students (not Kuring-gai), new Faculty of Business (Broadway) students and new School of Nursing (Gore Hill) students
- 12 Classes for all Faculty of Adult Education students commence
- 12-15 Enrolment of new and continuing students (Kuring-gai)
- 12-16 Orientation Week
- 13 Teaching ceases for College of Law co-operative course C190
- 13-15 Special Examinations (Kuring-gai)
- 19 Classes commence for other new students (all campuses) and for continuing Kuring-gai students
- 19 Teaching commences for College of Law co-operative course C289

March

- 2 Last day to add subjects (Kuring-gai)
- 9 Last day to add subjects (except Kuring-gai)
- 9 Last day to apply for advanced standing (ie subject exemption)
- 9 Last day to apply for transfer of course
- 9 Last day to pay HECS Up front charges
- 16 Last day for continuing students to withdraw without penalty from a course or a semester-unit (Kuring-gai)
- 16 Teaching ceases for College of Law co-operative course C289
- 19 Tutorial week commences (except Kuring-gai)
- 19 Classes suspended week (Kuring-gai except I.T.CS)
- 19 Field Experience week (School of Leisure, Tourism and Community Studies)
- 19 Project and Directed Activity week commences (Faculty of Adult Education)
- 30 Last day to change HECS Payments Option
- 31 Autumn HECS census date

April

- 2 Teaching commences for College of Law co-operative course C189
- 6 Last day for withdraw without academic penalty from a course or subject (except Kuring-gai)
- 6 Last day to approve leave of absence
- 9 Recess week for College of Law full-time course C901
- 13 Good Friday
- 13-20 Easter break (Faculty of Adult Education)
- 16 Easter Monday
- 17 Practicum (School of Teacher Education)
- 23 Practicum (School of Teacher Education, School of Library and Information Studies)
- 23 Field Experience week (School of Leisure, Tourism and Community Studies)
- 23 Classes suspended week (Other Kuring-gai Schools)
- 25 Anzac Day
- 26 Graduation Ceremonies commence
- 27 Last day for first-year Kuring-gai students to withdraw without academic penalty from a course or semester-unit

- 30 Tutorial week commences (not Kuring-gai)
- 30 Practicum (School of Teacher Education, School of Library and Information Studies)
- 30 Field Experience week (School of Leisure, Tourism and Community Studies)
- 30 Classes suspended week (other Kuring-gai Schools)

May

- 1 Teaching ceases for College of Law co-operative course C189
- 7 Practicum (School of Teacher Education)
- 7 Project and Directed Activity week commences (Faculty of Adult Education)
- 25 Closing date for applications for Spring semester
- 28 Information Evening

June

- 4 Formal examinations commence for School of Nursing (Gore Hill)
- 4 Project and Directed Activity week commences (Faculty of Adult Education)
- 11 Queen's Birthday holiday
- 12 Formal examination period commences
- 18 Formal examinations commence for Architecture and Building, Engineering, and Kuring-gai
- 22 Teaching ceases for College of Law full-time course C901
- 22 Last day of teaching semester (Faculty of Adult Education)
- 25 Semester recess commences (Faculty of Adult Education)
- 29 End of formal examination period
- 29 End of Autumn Semester

July

- 2 Semester recess commences
- 2 Teaching commences for College of Law co-operative course C290
- 9 Teaching commences for College of Law full-time course C902
- 17-18 Special Examinations (Kuring-gai)
- 18 Project and Directed Activity week (Faculty of Adult Education)
- 18-20 Mid-year enrolment of students
- 23 Spring Semester commences
- 23 Classes commence for all Kuring-gai students and for continuing students on other campuses
- 25 Classes for all Faculty of Adult Education students commence
- 30 Classes commence for new students (except Kuring-gai)

August

- 3 Last day to add semester-units (Kuring-gai only)
- 9 Last day to apply for advanced standing (ie subject exemption)
- 9 Last day to apply for transfer of course
- 9 Last day to pay HECS Up front charges
- 9 Last day to add subjects (except Kuring-gai)
- 10 Teaching ceases for College of Law co-operative course C290
- 17 Last day to add subjects (except Kuring-gai)
- 17 Last day to withdraw from a course or semester-unit without penalty (Kuring-gai, except first-year students)
- 20 Teaching commences for College of Law co-operative course C190
- 27 Tutorial week commences (except Kuring-gai)
- 27 Practicum (School of Teacher Education, School of Library and Information Studies)
- 27 Field Experience week (School of Leisure, Tourism and Community Studies)
- 27 Project and Directed Activity week commences (Faculty of Adult Education)
- 27 Classes suspended week (other Kuring-gai Schools)
- 30 Last day to change HECS Payment Option
- 31 Spring HECS census date

September

- 3 Practicum (School of Teacher Education, School of Library and Information Studies)
- 3 Field Experience week (School of Leisure, Tourism and Community Studies)
- 3 Classes suspended week (other Kuring-gai Schools)
- 10 Practicum (School of Teacher Education)
- 14 Last day to approve leave of absence
- 14 Last day for withdrawal without academic penalty from a course or subject (except Kuring-gai)
- 14 Teaching ceases for College of Law co-operative course C190
- 17 Practicum (School of Teacher Education)
- 24 Non-teaching fortnight commences (Faculty of Adult Education)
- 26 Teaching commences for College of Law co-operative course C289
- 28 Applications close for admission in 1991

October

- 1 Labour Day holiday
- 1 Field Experience week (School of Leisure, Tourism and Community Studies)
- 1 Classes suspended week (other Kuring-gai Schools)
- 1 Recess week for College of Law full-time course C902
- 9 Tutorial week commences (except Kuring-gai)
- 24 Teaching ceases for College of Law co-operative course C289

November

- 12 Formal examinations commence for School of Nursing (Gore Hill)
- 12 Project and Directed Activity week commences (Faculty of Adult Education)
- 19 Formal examination period commences
- 26 Examinations commence for Architecture and Building, and Engineering
- 30 End of formal examination period (Kuring-gai only)
- 30 Last day of teaching semester (Faculty of Adult Education)

December

- 7 End of formal examination period (except Kuring-gai)
- 14 Teaching ceases for College of Law full-time course C902
- 24 End of academic year

Nursing Practical Experience for Kuring-gai students is ongoing throughout each semester. Details are in the *Clinical Experience Handbook* issued by the School of Nursing.

Kuring-gai Campus Practical Legal Training Courses.**First Half-Year Full-Time 901**

January 15 - June 22

Recess: April 9 - April 16 (incl)

Second Half-Year Full-Time 902

July 9 - December 14

Recess: October 1 - October 5 (incl)

Co-Operative First Half-Year: Course C190

Session I: January 3 - February 13, 1990

Session II: August 20 - September 14, 1990

Session III: April 2 - April 30, 1991

Weekend Seminar - May 5 and 6, 1990

Co-Operative Second Half-Year: Course C290

Session I: July 2 - August 10, 1990

Session II: February 25 - March 22, 1991

Session III: October 8 - November 4, 1991

Weekend Seminar - November 10 and 11, 1990

1990 Academic Year

Autumn Semester

January 29 - June 29

Spring Semester

July 23 - December 24

1990 Public Holidays

Australia Day	January 26
Easter	April 13 - April 16
Anzac Day	April 25
Queen's Birthday	June 11
Labour Day	October 1

1990 TAFE and Public School Holidays

April 13 - April 22

July 2 - July 15

September 24 - October 5

December 17 - January 28

GENERAL INFORMATION

The School of Mathematical Sciences Office is located in Room 1523, Level 15, Building 1 at Broadway. The School of Computing Sciences Office is located in Room G30, Building 4, at Broadway.

The **UTS Information Service** is located in the foyer of the Tower Building at Broadway. It provides information and assistance to the public with all aspects of application for UTS courses. As the student centre it is the principal point of contact between students and the central administration. Through this centre students can obtain assistance with the broadest range of enquiries.

The **Student Health and Counselling Services** are located on the Broadway and Kuring-gai campuses, telephone 218 9145 (Broadway) or 413 8342 (Kuring-gai), and provide the following specialised services.

Student Counselling: The aim of this service is to assist students to perform to the best of their ability. Problems of a personal nature, study difficulties, selection of courses or anything else that is likely to affect a student's progress, may be discussed in confidence with the student counsellors.

Health Service: A free health service is provided for students of the University. A medical practitioner and a nursing sister staff the service and all consultations are considered strictly confidential.

Student Welfare Service: A Welfare Officer co-ordinates several distinct areas of student welfare including Accommodation, Student loans, Austudy applications; advocacy role (if needed) with academic and administrative problems. All interviews are confidential and suggestions for services required by students are welcome.

Students with Physical Disability: The Special Needs Co-ordinator is able to assist students with an increasing range of services. These include parking arrangements; amanuensis (note taker); hearing enhancement equipment; tape recorders; examination concessions (time and print size of paper). A seminar is held early in semester informing students with special needs of UTS policy.

A Learning Skills Counsellor is available to assist students with their study methods, particularly those students returning to study after some years absence.

The ***International Students Counsellor*** assists those students coming to UTS from overseas, with any difficulty they may have in successfully pursuing their course.

English classes: The University offers a variety of English classes particularly for overseas students. Interested students should contact the Student Services Unit in the first instance for further details.

Child Care: The Magic Pudding Child Care Centre provides full-time and part-time care for children of both students and staff. Care is available for children aged up to five years, Monday to Friday (8.00am - 10.00pm). Fees are calculated on a sliding scale based on family income.

For further information please call 218 9507 or drop into the Centre at Broadway campus.

Financial Assistance is available to Australian residents under the AUSTUDY Assistance Scheme. The Australian Government provides means-tested living and other allowances to full-time and sandwich students undertaking approved tertiary and postsecondary courses. Further information is available from: The Director, Department of Employment, Education and Training, Plaza Building, 59 Goulburn Street, Sydney, NSW 2000. Telephone: (02) 218 8800. Information booklets and application forms are also available from the Student Welfare Officer in the Student Services Unit at the University.

Fees and the Higher Education Contribution Scheme (HECS): Compulsory fees are payable to the University Union and Students' Association. The 1990 fees are \$155 for new students and \$137 for continuing students.

The Higher Education Contribution Scheme (HECS), introduced by the Commonwealth Government, collects a contribution from higher education students towards the cost of their education. Students (with the exception of some categories) are required to make a contribution of 20 per cent of their course costs. In 1990 this is about \$1882 for a full-time course load. The contributions will only be required if and when the person has the capacity to pay.

Under HECS, an annual course charge of \$1882 will apply for each year of equivalent full-time study undertaken. Relative charges will apply according to the actual proportion of equivalent full-time load being undertaken. If a student undertakes 75 per cent of a full-time load then she or he will be charged about \$1,412 (75 per cent of \$1,882). The charge increases annually in line with tertiary education costs.

Student compulsory fees and HECS "upfront" charges are due and payable by a date determined by the Registrar and Secretary.

The Students' Association (SA) represents all students at the University. The Students' Council is the governing body of the SA. Elected by students, it is accountable to the student body. Each Faculty and the School of Design is represented on the Council along with a number of general members elected by all students.

The full-time paid President of the SA is directly elected by students. An Executive Committee assists the President in carrying out the directions of the Students' Council and the day to day management of the Association. The Vice-President is employed full-time to represent student education interests.

In general the SA plays a representative and advocacy role on behalf of students. It liaises closely with the University Union and the Student Services Unit. Additionally, it negotiates with, and/or lobbies government and non-government organisations on education and welfare issues in the interests of the students.

The Students' Association maintains close links with student bodies in other tertiary institutions and has a political role to play in maintaining educational standards and conditions for students both within the University and the tertiary sector as a whole.

The main office of the SA is located at the Broadway Campus on Level 3A of the Tower Building (telephone 218 9064). Opening hours - 9am to 6pm.

Equal Opportunity Co-ordinator

The Equal Opportunity Co-ordinator is available to assist any students who feel they have been discriminated against in their study. Whether the problem is sexual harassment or other unfair treatment because of race, sex, marital status, physical disability, racial vilification, homosexuality - you will be assured of a confidential hearing. You can contact her on 20930.

The **University Union** acts as the University's community centre and provides a focus for the social, cultural and recreational activities of the whole of the University community. All students are members of, and pay fees, to the Union: all University staff, whose fees are paid by way of an annual lump sum grant from the University to the Union, are also members; all graduates are eligible for life membership of the Union.

The Union fulfills its objectives by providing food services, licensed bars, lounge, meeting and function rooms, stationery shops, newsagency, sporting facilities (including squash courts, gymnasium, weights rooms and basketball/volleyball court), sports programmes and activities programmes which include dances, concerts, lunchtime speakers and entertainment, films and creative leisure courses. The Union also provides considerable financial and other assistance to affiliated clubs and societies. Miscellaneous services include free accident insurance, free legal advice, free diaries and other publications, lockers, telephones and TVs.

The Union also established the University's Careers and Appointments Service, which provides a graduate placement service, casual employment and careers counselling.

The Union is controlled by a board of 15 persons, including eight students. Elections are usually held in September of each year and all interested students are encouraged to stand for a position on the board.

For further information, contact the Union Office on Level 6 of the Tower Building, phone 218 9403.

The **University Library** offers information from libraries on the Haymarket Campus, North Shore and Kuring-gai Campuses. The Faculty of Design has an Information Resource Centre (Library) at the Balmain campus. A wide variety of materials is available. Tours are given by library staff at the beginning of each semester as well as comprehensive sessions on the literature of various subjects.

The **Computing Services Division** provides a variety of facilities and services for undergraduate students. The main installation is on Level 9 of the Tower Building at Broadway with additional locations at Broadway and at the other campuses.

Scholarships: From time to time a number of companies, institutions and government authorities offer scholarships, cadetships, or employment to students about to commence courses at the University. Details are usually advertised in the press in the latter part of the year or early January. The UTS Information Service maintains a noticeboard devoted to such press clippings in the foyer of the Tower Building.

Prizes are awarded annually to students at UTS for excellence in study. These are made available through the generosity of private individuals and public organisations.

FURTHER INFORMATION

The information given above is a summary only. Further and more detailed information on each of the aspects covered may be obtained from the UTS Information Service or Faculty and School offices at the University.

An Information Evening or Open Day is normally held mid-year and prospective students are encouraged to attend and discuss their proposed courses and careers with members of academic staff. Information concerning the day may be obtained from the UTS Information Service.

STAFF

Senior Lecturer and Dean of Mathematical and Computing Sciences

J. Hughes, BSc (Syd), MIEEE, FACS, MBCS

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Graduate Assistant

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Professor of Applied Mathematics and Deputy Head of School

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Vacant

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E. Lindsay

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J.M. Hogg, BSc (Syd), MSc (Ops Res) (NSW), MASOR

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Vacant

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Associate Professor and Head of Department

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School of Computing Sciences

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Associate Professor, Director, Key Centre for Advanced Computing Sciences and Director, Centre for Graduate and External Studies

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J.M. Potter, BSc, (Adel), ME, PhD (Ncle), MIEEE

K.G. Suffern, BSc, MSc (Monash), MSc (Cornell), PhD (Syd), MACS

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C.W. Johnson, MAppSc (NSWIT), MComp (Macq), Grad RACI, MACS

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U. Szewcow, BSc, DipNAAC (Syd), MEngSc (NSW), MIEEE, MACS

Visiting Lecturer

D. Corbett, BS (ICS, UC Irvine), MS (CS, Wright State U), AAI, ACM

Senior Tutor

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Tutor

G. Jones, BSc (ANU), GradDip Computer Studies (CCAE), MINNS, MACCS

Department of Information Systems

Professor of Computing Science and Head of Department

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D.N. Wilson, BSc (Brighton Polytech), MBCS, MACS, MACM

Lecturers

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J.H. Hammond, BA, DipTchg (NZ), MBCS, FACS, MACE

D.F. Jinks, BSc (ANU), MACS

R. Raban, MEng (Warsaw)

J. Underwood, BSc (NSW), GradDipRecPlan, GradDipAdmin (CCAE)

Senior Tutor

J. El-Den, BScCompEng, MSc (METU Ankara), MScCompEng (METU, Ankara)

Tutor

N. Sood, BSc (London), MSc (Leeds)

FACULTY BOARD

Ex-Officio Members

Dean of the Faculty

J. Hughes (Chair)

Heads of School

I. Hawryszkiewicz

B.S. Thornton

Professors, Associate Professors, Principal Lecturers and Heads of Department

L.C. Botten

J.K. Debenham

T. Hintz

G.J. McLelland

A. Shannon (Deputy Chair)

Sub-Dean

Vacant

Nominated Members

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J. Bell, School of Physical Sciences

M. Schueler, School of Accounting

Vacant, School of Humanities and Social Sciences

J. Richards, University Library

K. Trigwell, Centre for Learning and Teaching

Faculty Staff Members

School of Computing Sciences

P. Bebbington

J. Edwards

J. Hammond

C. Johnson

J. Robb

K. Suffern

J. Underwood

School of Mathematical Sciences

G.L. Cohen

J. Hogg

T. Langtry

E. Lidums

P. Petocz

J.G. Sekhon

R. Sorli

Student Members

School of Computing Sciences

A. Oxenburgh

C. Yong

School of Mathematical Sciences

M. Duggan

D. Hill

COMPUTING SCIENCES COURSE ADVISORY COMMITTEE

Ex-Officio Members

Head, School of Computing Sciences

I. Hawryszkiewicz (Chair)

Dean of the Faculty

J. Hughes

Assoc Prof, School of Computing Sciences

Vacant

Registrar and Secretary's Representative

Vacant

Other Members

M. Alexander, Expertise Australia Pty Ltd

C. Connaughton, Computer Sciences of Australia Pty Ltd

D. Easter, Westpac

J.A. Goddard, Australian Computer Society Inc

H. Meredith, The Australian

A. Stark, Stowe Computing Australia Pty Ltd

P. Steele, Totalizator Agency Board

K. Willitt, Commonwealth Bank

FACULTY OF MATHEMATICAL AND COMPUTING SCIENCES

The Faculty consists of the School of Mathematical Sciences and the School of Computing Sciences. These Schools offer courses leading to the awards of Bachelor of Applied Science, Bachelor of Technology in Information Systems, Graduate Diploma in Data Processing, Graduate Diploma in Operations Research, Master of Applied Science by thesis, Master of Applied Science (Operations Research) and Master of Applied Science (Information Science) (both by Course Work), and Doctor of Philosophy.

Admission Requirements

Admission to the courses offered by the Faculty will be in accordance with the general requirements for admission to the University as set out in the Calendar. There are no formal subject requirements for students with the Higher School Certificate although a level of 2 Unit Mathematics will be assumed, and 3 Unit Mathematics is recommended. It is recommended that intending students have a combined minimum of 5 Units of Mathematics and Science at the HSC for the School of Mathematics. The School of Computing Sciences requires a high level of communication skills.

Students may enter the courses with advanced standing: admission is determined in individual cases based on merit. However, a minimum of two-thirds of the prescribed

course must be completed in order to qualify for an award unless prior approval is granted by Academic Board.

Requirements to Graduate

In order to become eligible for any award, students are required to satisfactorily complete the course program for the course in which they are enrolled by:

- (a) obtaining at least pass level for the subjects, or
- (b) being granted an exemption from subjects on the basis of equivalent study, or
- (c) completing approved alternative subjects.

SCHOOL OF MATHEMATICAL SCIENCES

The School of Mathematical Sciences offers four major courses:

1. A degree course in mathematics leading to the Bachelor of Applied Science;
2. A Graduate Diploma in Operations Research;
3. A Master of Applied Science awarded on the basis of approved Research Work and Thesis; and
4. A Master of Applied Science (Operations Research) by Course Work. Special entrance is permitted to students who have satisfactorily completed the Graduate Diploma in Operations Research (UTS). Prospective applicants should ascertain from the Graduate Studies Officer whether they conform with the general University requirements for admission to this degree before consulting with the Head of School about special requirements.

The School provides a variety of subjects for other Schools and many of these are open to students who wish to enrol for a single subject.

Doctor of Philosophy (By Thesis)

Applications to undertake the Doctor of Philosophy degree will be considered.

Applicants should initially:

- (a) approach a suitable member of the Schools academic staff directly and discuss the proposed research, *or*
- (b) send a summary proposal of about 1,000 words to the Head, School of Mathematical Sciences, *or*
- (c) contact the Deans Assistant on 218 9609 or care of Building 4, Room G30, Broadway.

General information and application forms may be obtained from the Central Information Service, University of Technology, Sydney.

Master of Applied Science (by Thesis)

The main interests of the School of Mathematical Sciences are in Applied Mathematics, Operations Research and

Stochastic and Statistical Methods. Although a wide range of topics can be covered by the abilities and experience of staff, particular interests and specialisations exist in the following areas:

- Stability theory and macroeconomic modelling
- Optics and electromagnetic diffraction theory
- Theoretical analysis and simulation of queueing systems
- Clinical trials and modelling medical data
- Non-linear differential equations
- Geophysical applications of mathematics
- Mathematical modelling of natural resources problems
- Energy modelling
- Optimal delivery of health services
- Number theory
- Mathematics education and computer-aided instruction
- Differential geometry and relativity
- Manpower planning
- Financial Modelling

Masters degree programs are normally of two years duration on a full-time basis and three years duration on a part-time basis. In some cases a student with appropriate advanced study and/or relevant work experience may be permitted to complete the program in a shorter time. Applicants who think they may be qualified for a reduction in time are advised to contact the Head of School or other senior staff member in the School to discuss the matter.

Students should have considered a possible area of research within the interests of the School before making enquiries about this programme.

Master of Applied Science (Operations Research) (by Course Work)

The objective of this course is to prepare students for high level professional work in the application of operations research to the problems of modern society. Graduates from this course will have gained a sound qualification in a variety of basic disciplines and some of the techniques of operations research and its methodology. The special emphasis of the course is in the applications of Operations Research to the optimal delivery of health services and to manpower planning.

The entry requirement is graduate standing, or equivalent, in an appropriate discipline and the consent of the Head of School or his/her nominee. Special entrance is permitted to applicants who have satisfactorily completed the Graduate Diploma in Operations Research (UTS).

The course comprises a total of 54 semester hours on a part-time basis extending over six semesters. Each

semester requires nine hours of attendance per week. The academic award for satisfactory completion of the course is a Master of Applied Science; abbreviated MAppSc (UTS).

The course programme follows:

SEMESTER 1	<i>Hours/Week</i>
33880 O.R. Models and Methodology	3
33830 Simulation Techniques	3
33832 Linear Programming	3

SEMESTER 2	
33831 Optimisation Techniques	3
33833 Dynamic Optimisation	3
33836 Decision Theory	3

SEMESTER 3	
33835 Inventory Control	3
33834 Network Optimisation	3
33847 Stochastic Processes	3

SEMESTER 4	
33850 O.R. in Health Services 1	3
33855 Manpower Planning	3
..... Special Elective	3

SEMESTER 5	
33860 Corporate Financial Decisions and Investment Analysis	3
33806 Report	6

SEMESTER 6	
33823 Seminar	3
33806 Report	6

Special Electives	
33844 Queueing Systems: Theory and Applications	3
33851 O.R. in Health Services 2	3
33853 Energy and Environmental Modelling	3
33857 Large-Scale Mathematical Programming	3
33858 Stochastic Models in Operations Research	3
33859 Engineering Applications in Operations Research	3
33861 Operations Research in Public Sector Services	3

In lieu of subjects for which students have been granted exemptions, the following elective subjects may be selected, depending on availability:

Electives	
33814 Applied Linear Algebra	3
33817 Numerical Analysis	3

33848	Industrial Statistics	3
33845	Design of Experiments	3
33870	Mathematical Modelling in the Biomedical Sciences	3
33871	Impact of Computers on Traditional Mathematics	3
33872	Data Analysis	3
33873	Modelling with Differential Equations	3

Graduate Diploma in Operations Research

This course is designed to train practising professional people in the application of operations research principles and methods. The entry requirement to the course is graduate standing or equivalent in any discipline, and a sound working knowledge of calculus and statistics. Because of the possible divergency of backgrounds, each applicant will be assisted by being interviewed prior to enrolment. As a result of this interview and assessment he/she will be directed to either: (i) undertake any preliminary subjects considered necessary; or (ii) enter the normal course; or (iii) enter the course with advanced standing.

The course is structured for study on a part-time basis over a period of four semesters, each comprising ten hours attendance per week. In the normal course, students undertake a basic core of consolidation subjects followed in the second semester by a study of the mathematical methods required for operations research, and model building.

In the third and fourth semesters specific mathematical techniques used commonly in operations research are treated and students undertake a project designed to integrate their knowledge and provide wider experience than is possible on an individual subject basis.

The course programme is flexible in that students may enter the course with advanced standing. Applicants who enter the course at a later stage or who have had some formal qualification in one or more of the specified operations research topics may be counselled to select alternative topics from additional electives. Exemptions are permitted up to a maximum of 13 semester hours. Thus a minimum attendance of 27 semester hours is required.

The academic award for satisfactory completion of the course is a graduate diploma with the nomenclature: Graduate Diploma in Operations Research, abbreviated GradDipOR (UTS). The award will be made in one of three grades - Distinction, Credit or Pass - based on the overall level of performance throughout the course. The award with Distinction requires a demonstration of outstanding comprehension and ability in the theory and application of operations research.

A basic programme follows:

SEMESTER 1	<i>Hours/Week</i>
33702 Statistical Methods	3
33730 Simulation Techniques	3
33732 Linear Programming	3
33780 Introduction to O.R. Models	3

SEMESTER 2

33717 Numerical Methods	3
33736 Decision Theory	3
33747 Stochastic Processes	3

SEMESTER 3

33734 Network Optimisation	3
33735 Inventory Control	3
33760 Financial Modelling Techniques	3

SEMESTER 4

33731 Optimisation Techniques	3
33733 Dynamic Optimisation	3
33700 Project	4

Subject to demand, additional elective subjects may be offered each year. Students will be required to indicate in Semester 3 their order of preference from the following topics:

33744 Queuing Theory	3
33745 Design of Experiments	3
33748 Industrial Statistics	3

Bachelor of Applied Science (Mathematics)

The object of this course in Mathematics leading to the degree of Bachelor of Applied Science is to prepare professional people for employment in industry, commerce and education by providing thorough studies in basic mathematical and computing principles and their applications, involving the latest techniques in mathematics, computing, stochastic and statistical methods, and operations research.

The course provides an in-depth treatment of a broad range of mathematical and computing subjects. It aims to help the student acquire sufficient experience and understanding of those subjects so as to enable him or her to apply mathematical and computing techniques and thinking to industrial and commercial problems. The course comprises studies in mathematics, operations research, statistics and computing as well as electives from subjects offered by other Schools.

Students must complete a major in one of the following areas of applicable mathematics: Operations Research, Statistics or Applied Mathematics. Facilities also exist for students to complete a double major: in Computing and

one of the above areas of mathematics. The course is structured to permit a delayed choice of the mathematics area in which the student wishes to major.

Within this framework a specialised study in a mathematics application area is taken up in the third year. A specialisation in Operations Research involves such subjects as Linear Programming, Simulation and Optimisation. The Statistics option aims to expose students to realistic statistical problems and it prepares them to cope with data and the 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 specialisation aims to develop these ideas and apply them in a variety of complex and practical situations.

The Computing major area of study, if elected, must be commenced in Stage 1. It consists of the following subjects:

34107	Computing 1
34117	Commercial Computing 1
34127	Information Systems 1
34137	Computing Systems 1
34217	Commercial Computing 2
34227	Information Systems 2
34307	Computing 2
34407	Computing 3
34417	Numerical Methods 1
34418	Numerical Methods 2*
34507	Computing 4
34517	Commercial Computing 3*
34607	Computing 5
34627	Information Systems 3
34628	Information Systems 4*
34667	Computer Graphics*
34682	Special Applications in Computing*

*Any two of these subjects.

A total of approximately 108 semester hours of attendance at lectures and tutorials is required for the course which may be taken in one of four patterns:

- six stages on a part-time basis for a duration of six years;
- two stages on a full-time basis, followed by four stages on a part-time basis, for a duration of five years;
- four stages on a full-time basis, followed by two stages on a part-time basis, for a duration of four years;
- six stages on a full-time basis, for a duration of three years.

The course is as follows:

FULL-TIME PROGRAMME

YEAR 1

<i>Autumn Semester</i>	<i>Hours/Week</i>
34100 Algebra 1	4
34101 Calculus 1	4
34107 Computing 1 (and Lab.) (3)	4
..... Electives	6
<i>Spring Semester</i>	
34102 Calculus 2	4
34141 Statistics 1	3
34214 Algebra 2	3
34251 Macroeconomic Models	3
..... Electives	5

YEAR 2

<i>Autumn Semester</i>	
34213 Ordinary Differential Equations	3
34212 Vector Calculus	3
34307 Computing 2 (and Lab.) (2)	2
34480 Introduction to O.R. Models	3
34570 Algebra 3	3
..... Electives	4
<i>Spring Semester</i>	
33320 Partial Differential Equations	3
34419 Complex Variables	3
34342 Statistics 2	3
34527 Real Variables	3
34417 Numerical Methods 1	3
..... Electives	3

YEAR 3

Major & Electives

PART-TIME PROGRAMME

YEAR 1

<i>Autumn Semester</i>	<i>Hours/Week</i>
34107 Computing 1 (and Lab.) (3)	4
34101 Calculus 1	4
<i>Spring Semester</i>	
34100 Algebra 1	4
34102 Calculus 2	4
..... Electives	2

YEAR 2

<i>Autumn Semester</i>	
34214 Algebra 2	3
..... Electives	6
<i>Spring Semester</i>	
34251 Macroeconomic Models	3
34141 Statistics 1	3
..... Electives	3

YEAR 3

Autumn Semester

34307	Computing 2 (and Lab.) (2)	2
34212	Vector Calculus	3
.....	Electives	4
<i>Spring Semester</i>		
34342	Statistics 2	3
34480	Introduction to O.R. Models	3
34213	Ordinary Differential Equations	3

YEAR 4

<i>Autumn Semester</i>		
33320	Partial Differential Equations	3
34570	Algebra 3	3
34527	Real Variables	3
<i>Spring Semester</i>		
34417	Numerical Methods 1	3
34419	Complex Variables	3
.....	Electives	3

YEAR 5 & 6

Major & Electives

Major Areas of Study

Students are to choose one of the following areas as a major area of study: Computing, Operations Research, Statistics, Physical Applied Mathematics, or Modern Applied Mathematics. Note that students who have elected to do the Computing major area of study must, *in addition*, complete one of the other major areas of study.

Computing

FULL TIME

YEAR 1

<i>Autumn Semester</i>		<i>Hours/Week</i>
34127	Information Systems 1	3
34137	Computer Systems I (and Lab.) (2)	3

Spring Semester

34117	Commercial Computing 1 (and Lab.) (2)	2
34227	Information Systems 2	3

YEAR 2

<i>Autumn Semester</i>		
34217	Commercial Computing 2 (and Lab.) (3)	4

Spring Semester

34407	Computing 3 (and Lab.) (3)	3
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YEAR 3

<i>Autumn Semester</i>		
34627	Information Systems 3	3
34507	Computing 4 (and Lab.) (3)	3
.....	Computing Elective	3

Spring Semester

34607	Computing 5 (and Lab.) (3)	3
34628	Information Systems 4 (and Lab.) (3)	3
.....	Computing Elective	3

PART TIME

YEAR 1

Spring Semester

34117	Commercial Computing 1 (and Lab.) (2)	2
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YEAR 2

Autumn Semester

34127	Information Systems 1	3
34137	Computer Systems I (and Lab.) (2)	3

Spring Semester

34227	Information Systems 2	3
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YEAR 3

Autumn Semester

34217	Commercial Computing 2 (and Lab.) (3)	4
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YEAR 4

Spring Semester

34407	Computing 3 (and Lab.) (3)	3
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YEAR 5/6

Autumn Semester

34627	Information Systems 3	3
34507	Computing 4 (and Lab.) (3)	3
.....	Computing Elective	3

Spring Semester

34607	Computing 5 (and Lab.) (3)	3
34628	Information Systems 4 (and Lab.) (3)	3
.....	Computing Elective	3

Note: The number in parentheses refers to the laboratory hours, which although compulsory are not credited to the 108 semester hours required for the degree.

Operations Research

YEAR 3 Full time

YEAR 5/6 Part time

Autumn Semester

34630	Simulation Techniques	3
34547	Stochastic Processes	3
34452	Financial Modelling Techniques	3
.....	Electives	9

Spring Semester

.....	OR Optimisation Elective	3
34636	Decision Theory	3
34532	Linear Programming	3
.....	Electives	9

Statistics

YEAR 3 Full time

YEAR 5/6 Part time

Autumn Semester

34544	Regression Analysis	3
34547	Stochastic Processes	3
34642	Statistics 3	3

.....	Electives	9
<i>Spring Semester</i>		
34545	Design of Experiments	3
34343	Theory of Probability	3
34548	Industrial Statistics	3
.....	Electives	9

Applied Mathematics

YEAR 3 Full time

YEAR 5/6 Part time

Autumn Semester

34528	Modern Analysis	3
34621	Mathematical Methods 1	3
	Applied Mathematics	3
.....	Elective	3
.....	Electives	9

Spring Semester

34572	Fourier Analysis	3
34418	Numerical Methods 2	3
	Applied Mathematics	3
.....	Elective	3
.....	Electives	9

Electives

There are 36 hours of electives (30 hours are pre-determined for students selecting a Computing Major). These electives may be chosen from:

1. subjects from majors offered by the School of Mathematical Sciences other than a student's chosen major;
2. subjects offered by other Schools of the University;
3. other electives offered by the School of Mathematical Sciences.

Electives offered by this School

34203	Mechanics†**
34524	Wave Theory**
34531	Optimisation Techniques
34553	Multiple Regression Models
34554	Time Series Analysis
34571	Algebra 4**
34573	History of Mathematics
34418	Numerical Methods 2†*
34622	Mathematical Method 2**
34626	Control Theory**
34633	Dynamic Optimisation
34517	Commercial Computing 3 (& Laboratory)*
34634	Network Optimisation
34635	Inventory Control
34655	Simultaneous Equation Models
34667	Computer Graphics*
34673	Advanced Numerical Methods**
34675	Convexity and Optimisation**
34677	Integral Equations**
34681	Special Applications in Operations Research
34682	Special Applications in Computing*
34683	Special Applications in Statistics
34684	Special Applications in Physical Applied Mathematics
34685	Special Applications in

	Modern Applied Mathematics
34691-7	Project
34698	Seminar
34699	Seminar (Pascal)
33823	Seminar in Operations Research

†OR Optimisation Elective

*Electives to be taken within the Computing major.

**Electives to be taken within the Applied Mathematics Major.

SCHOOL OF COMPUTING SCIENCES

The School of Computing Sciences is one of the seven original Key Centres for Teaching and Research established by the Federal Government in 1985.

The School of Computing Sciences offers a degree course in Computing Science leading to the award of Bachelor of Applied Science. In 1988, following discussions between government and industry, a new degree course was introduced, leading to the award of Bachelor of Technology in Information Systems. In addition, the School offers a graduate course leading to the award of a Graduate Diploma in Data Processing.

The School offers a three-year, part-time course leading to a Master of Applied Science (Information Science) by course work. In addition, the School offers two degrees by research and thesis: the Master of Applied Science (by Thesis) and the Doctor of Philosophy.

Prospective applicants for graduate courses should firstly ascertain from the Graduate Studies Officer whether they conform with the general University requirements for admission before consulting with the School about special requirements.

The School has appointed a number of academic advisors: two for undergraduate full-time students; one for undergraduate part-time students; one for graduate diploma students; one for masters students; and one to advise prospective students.

The functions of the academic advisors are: (i) to advise students regarding their course progress and academic progression; (ii) to approve changes to enrolment details; (iii) to advise, when necessary, on personal matters; (iv) to arrange specialist tutorial assistance or counselling.

The School provides subjects in Computer Science for other Faculties.

Double Degree in Business and Computing Sciences

From 1989, a double degree in Business and Computing Science has been offered. Students initially enrol in the normal Bachelor of Business degree and take the Computing Science sub-major. On satisfactory completion of the Business Degree and the Computing Sciences sub-major, a student should then apply to be admitted to the Bachelor of Applied Science (Computing Science). On admittance, the student would be granted advanced standing.

Doctor of Philosophy (By Thesis)

In general terms, the PhD degree entails a more extensive investigation than the MAppSc (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
- Office Automation Systems
- Computer Graphics, Image Processing
- Artificial Intelligence, Expert Systems, Fifth Generation Technology
- Local Networks and Network Interface Technology
- Neural Networks
- Information Modelling
- Auditing Large Databases
- Transputers
- Microprocessors and their Applications
- Distributed Database
- Computer Systems Security

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 five years for full-time students and six years for part-time students.

Applicants should hold a first class, or second class division one, Bachelors 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 be interested in a specific area of research, and should have one or more particular 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.

Application forms may be obtained from the Central Information Service. General enquiries should be directed to either the Central Information Service, phone 20930 ext. 9071/9072, or the Faculty Graduate Assistant, phone 20930 ext. 9609. Note that all prospective applicants should contact the Faculty Graduate Assistant **BEFORE** submitting an application to this course.

Master of Applied Science (by Thesis)

The MAppSc (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
- Office Automation Systems
- Computer Graphics, Image Processing
- Artificial Intelligence, Expert Systems, Fifth Generation Technology
- Local Networks and Network Interface Technology
- Neural Networks
- Information Modelling
- Auditing Large Databases
- Transputers
- Microprocessors and their Applications
- Distributed Database
- Computer Systems Security

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.

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 be interested in a specific area of research, and should have one or more particular 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.

Application forms may be obtained from the UTS Information Service. General enquiries should be directed to either the UTS Information Service, phone 20930 ext. 9145/962, or the Faculty Graduate Assistant, phone 20930 ext. 9609. Note that all prospective applicants should obtain approval for their proposed research work **BEFORE** submitting an application to this course.

Master of Applied Science (by Course Work) in Information Science

The MAppSc (by Course Work) in Information Science enables graduates to select a programme of study which suits their own career goals. For example, a programme 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:

- (1) a bachelors 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 Universitys bachelors degree in computing science, and
- (2) an established professional career within the information industry. As a guide, the extent of the applicants 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 (three 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 per week for lectures, and at the periodical seminar evenings. Each semester the School publishes the MAppSc (by coursework) in Information Science Handbook. This Handbook 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 handbook and to study it carefully. An "admission package" containing a copy of the Handbook, the application forms and other relevant information is available from July onwards each year. Prospective applicants may obtain one of these packages by contacting either the Faculty Graduate Assistant (Phone 218 9606) or the University's Graduate Studies Office. 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 duration of the course is 54 semester hours consisting of the following:

- (a) Formal lectures and laboratory requirements will total a minimum of 40 semester hours.
- (b) There is a specific requirement for seminar attendance for one semester hour per week throughout the time

the candidate is enrolled. Thus, depending on the duration of the course, this will add a minimum of six semester hours to the total contact hours in the course.

- (c) The remainder of the course will be comprised of the equivalent of eight semester hours of Project work.

The course work is structured into four "strands". These four strands comprise the fundamental areas of Computing Systems, Information Systems and Computing Methods, as well as a Management strand. Students select a total of ten subjects. 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 last year of enrolment.

Any Masters degree candidate enrolled in the MAppSc (by Course Work) in Information Science who records two failures at any stage will be excluded from the course absolutely.

General Course Description

Students select their programme from the following subjects:

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 Data Base
- 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
- 22729 The Legal Environment of Business
- 32400 Accounting for Management
- 32401 Management Policy and Strategy

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 or other professional qualification in which computing has not been included or only covered lightly.

It is anticipated that students entering the course will have previously studied courses from a wide range of disciplines. Some will have graduated with no previous contact with computing and data processing; some will have had some familiarisation with computing; and 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

Prerequisite for entry to the Graduate Diploma in Data Processing is a working knowledge of the programming languages PASCAL and COBOL. For intending applicants who do not have the required knowledge in PASCAL and COBOL extension courses are offered by the University's Continuing Professional Education Directorate each semester. There is a cost attached to these which may be ascertained by contacting the Directorate on 218 9531.

The Directorate's courses in PASCAL and COBOL are each of 45 hours duration, and have been assessed by the School of Computing Sciences as meeting the standards required to satisfy the language component of the admission criteria. However, the number of applicants is always in excess of the number of places; therefore, completion of these courses does not guarantee a place in the Graduate Diploma in Data Processing. Applicants may present for consideration evidence of successful completion of any PASCAL and/or COBOL course. The committee will assess this evidence and ascertain whether it satisfies the prerequisites for the course. Any PASCAL or COBOL course undertaken should not, as a general rule, be shorter than that offered by the Directorate.

In addition, applicants should have a first degree, equivalent to an undergraduate three-year degree from the University of Technology, Sydney. If in doubt as to the ranking of your qualification, you should contact the Graduate Studies Office or the Admissions Branch at the University, or write to the Committee on Overseas Professional Qualifications in Canberra.

The decision of the School on all applications is final, and no correspondence will be entered into. Applications should be submitted no later than 31 October.

For further information, candidates should telephone Bruce Irvine on 218 9609 or the School Office on 218 9425 where a "call back" message may be left, or write to:

The Academic Advisor
Graduate Diploma in Data Processing
School of Computing Sciences
University of Technology, Sydney
PO Box 123, Broadway NSW 2007

Mode and Length of Study

The course is normally undertaken on a part-time attendance pattern over two years.

The attendance pattern for the two-year programme comprises nine hours per week (normally two evenings and one afternoon).

Students will not be permitted to spend more than eight semesters from initial registration to complete this course (see Rule 3.2.6).

All applications should be well documented, including proof of graduate status and the applicants academic record.

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 24 semester hours of the prescribed 36 hours for the course.

Exemptions will be granted normally only where a student has partially completed a similar Graduate Diploma elsewhere. A maximum of 12 semester hours ONLY may be exempted. Where a student can demonstrate proficiency in a subject area, substitution of subjects from the undergraduate course will be permitted.

The course is not open to students who have already completed the Diploma of Technology (Information Processing), Bachelor of Applied Science (Computing Sciences), or a similar course at an equivalent level. The course offered is part-time only with classes generally scheduled for the evenings.

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

UNSATISFACTORY STUDENT PROGRESS

All students in the Graduate Diploma in Data Processing course should be aware that unsatisfactory performance in the course will result in the Faculty Board in

Mathematical and Computing Sciences ruling that the student's enrolment is terminated, as provided for in University Rule 3.2.6.2. Any of the following will be taken to indicate unsatisfactory progress:

1. Failure to complete the course in 8 semesters from the time of registration in the case of a part-time student, or in 4 semesters from the time of registration in the case of a full-time student. This is not inclusive of periods of leave of absence.
2. Failure in any subject 3 times.
3. More than 8 failures at any time during the course.

Students will be required at enrolment each semester to sign a declaration indicating that they understand and accept these conditions.

A PROPOSED* RECOMMENDED PART-TIME PROGRAMME FOR STUDENTS WHO COMMENCE IN 1989 OR LATER

SEMESTER 1 (Autumn)

- 31071 Introduction to Information Systems
 31073 Introduction to Computer Systems
 31021 Systems Analysis

SEMESTER 2 (Spring)

- 31022 Commercial Programme Development
 31031 Database
or
 31026 Probability and Statistics
or
 31024 Data Structure and Algorithms
or another subject

In Semester 2, three subjects are studied. Students study Commercial Programme Development and Database. They have a choice for the third subject. They may study Data Structures and Algorithms or Probability and Statistics or, subject to approval, may substitute another approved subject from the BAppSc (Computing Science), subject to satisfactory completion of subject prerequisites.

SEMESTER 3 (Autumn)**

- | | <i>Hours/Week</i> |
|-----------------------------------|-------------------|
| 31032 Communications and Networks |3 |
| <i>and/or</i> | |
| 31017 Accounting Fundamentals |3 |
| 31015 Discrete Mathematics |3 |
| 31033 Operating Systems |3 |
| 31041 Systems Design |3 |
| 31042 On-Line Systems |3 |
| 31058 Project Management |3 |

**In Semester 3, three subjects are studied. Students may choose to study either Communications and Networks or Accounting Fundamentals and two other subjects from the above list, or may study both Communications and Networks and Accounting Fundamentals and one other subject from the above list. It is also possible for students, with approval, to substitute for any subject (other than Communications and Networks or Accounting Fundamentals) by studying another approved subject from the BAppSc (Computing Science), subject to satisfactory completion of subject prerequisites.

SEMESTER 4 (Spring)***

- | | <i>Hours/Week</i> |
|--|-------------------|
| 31024 Data Structures and Algorithms |3 |
| 31025 Introduction to Software Engineering |3 |
| 31026 Probability and Statistics |3 |
| 31033 Operating Systems |3 |
| 31041 Systems Design |3 |
| 31042 On-Line Systems |3 |
| 31047 Management Control Systems |3 |
| 31048 Business Tools and Applications |3 |
| 31053 Communications Software |3 |
| 31058 Project Management |3 |

***In Semester 4, students may choose three subjects from the range of subjects listed or may, with approval, undertake other approved subjects from the BAppSc (Computing Science) undergraduate course, subject to satisfactory completion of subject prerequisites.

Bachelor of Applied Science (Computing Science)

The object 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 his or her 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 provide a basis from which postgraduate studies may begin.

The course comprises six academic semesters of full-time study and a year of Industrial Training and may be completed by part-time attendance.

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

Industrial Training

All students in the BAppSc (Computing Sciences) are required to enrol in, and pass, the two Industrial Training subjects. There are a substantial number of prerequisites for Industrial Training; these prerequisites 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 with the Information Industry. The duration of industrial training is nine months for full-time students and 18 months for part-time students. During their 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 students responsibility, the School will assist students in their placement.

Those who wish to seek an Industrial Training position without the direct assistance of the School should first make an appointment to see the Schools Industrial Liaison Officer who will provide a description of the requirements of an Industrial Training position. If a student finds employment they should make an appointment to see the Schools Industrial Liaison Officer and obtain certification that the employment is suitable for Industrial Training.

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 should carefully study the procedure to be followed.

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

In general, students find their Industrial Training extremely beneficial in relating their final year of course work to the practical needs of the information industry, and they can cite this experience when applying for their career positions.

STUDENTS WHO COMMENCE BEFORE 1989

There are a number of changes to the BAppSc course which came into effect in 1989. Depending on what year or stage a student is in, some of these changes may affect students who began the course before 1989. Full details of how the changes affect existing students are given in the School handbook.

STUDENTS WHO COMMENCE IN 1989 OR LATER

As mentioned earlier, students who start in 1989 or later will undertake the following programme. Some parts of this programme may also be applicable to students who were enrolled before 1989.

Electives

All students must take four electives from within the School of Computing Sciences. These are indicated in the program as CS/IS Electives 1-4 and would normally be taken one per semester in Years 2 and 4 for full-time students and one per Stage in Stages 3-6 for part-time students, depending on the availability of a students choices. It is hoped that students would follow a major strand for these electives.

In addition all students must do a further 18 semester hours of electives. These may all be taken within the School of Computing Sciences or as an approved 18 hour sub-major or sequence from another School or Faculty within the University or an approved external sequence.

A RECOMMENDED FULL-TIME PROGRAMME

YEAR 1

<i>Autumn Semester</i>	<i>Hours/Week</i>
31615 Discrete Mathematics	5
31617 Accounting Fundamentals	3
31611 Information Systems	4
31613 Computer Systems Architecture 1	3
31614 Programming Principles	7
51370 Human Communications	2
<i>Spring Semester</i>	
31626 Probability and Statistics	3
31621 Systems Analysis	3
31622 Commercial Programming Development	5
31623 Computer Systems Architecture 2	5
31624 Data Structures and Algorithms	5
31625 Software Engineering	3

YEAR 2

<i>Autumn Semester</i>	
31636 Simulation and Modelling	4
31631 Database	4
31632 Communications and Networks	5
31633 Operating Systems	5
..... CS/IS Elective 1	3
..... Elective 1	3

Spring Semester

31641	Systems Design	4
31647	Management Control Systems	4
31642	On-Line Systems	5
31648	Business Tools and Applications	5
.....	CS/IS Elective 2	3
.....	Elective 2	3

YEAR 3

Autumn Semester

31696	Industrial Training	6
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Spring Semester

31697	Industrial Training	6
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YEAR 4

Autumn Semester

31655	Theory of Computer Science	4.5
31658	Project Management	4.5
31653	Communications Software	6
.....	CS/IS Elective 3	3
.....	Elective 3	3
.....	Elective 4	3

Spring Semester

31662	Information Systems Case Study	6
31669	Social Implications of Computers	3
31666	Performance Evaluation	6
.....	CS/IS Elective 4	3
.....	Elective 5	3
.....	Elective 6	3

A RECOMMENDED PART-TIME PROGRAMME

YEAR 1

Autumn Semester

	<i>Hours/Week</i>
31615	Discrete Mathematics
31617	Accounting Fundamentals
31611	Information Systems

Spring Semester

31613	Computer Systems Architecture I	3
31614	Programming Principles	7
51370	Human Communications	2

YEAR 2

Autumn Semester

31621	Systems Analysis	3
31622	Commercial Programming Development	5
31623	Computer Systems Architecture 2	5

Spring Semester

31624	Data Structures and Algorithms	5
31625	Software Engineering	3
31626	Probability and Statistics	3

YEAR 3

Autumn Semester

31631	Database	4
31632	Communications and Networks	5

.....	CS/IS Elective 1	3
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Spring Semester

31633	Operating Systems	5
31648	Business Tools and Applications	5
.....	Elective 1	3

YEAR 4

Autumn Semester

31641	Systems Design	4
31642	On-Line Systems	5
.....	CS/IS Elective 2	3

Spring Semester

31636	Simulation and Modelling	4
31647	Management Control Systems	4
.....	Elective 2	3

YEAR 5

Autumn Semester

31655	Theory of Computer Science	4.5
31658	Project Management	4.5
.....	CS/IS Elective 3	3
31698	Industrial Training	3

Spring Semester

31653	Communications Software	6
.....	Elective 3	3
.....	Elective 4	3
31698	Industrial Training	3

YEAR 6

Autumn Semester

31133	Social Implications of Computers	3
31666	Performance Evaluation	6
.....	CS/IS Elective 4	3
31699	Industrial Training	3

Spring Semester

31622	Information Systems Case Study	6
.....	Elective 5	3
.....	Elective 6	3
31699	Industrial Training	3

Bachelor of Technology in Information Systems

This course was first offered in 1988. It is part of a new co-operative education programme in computer information systems. The course 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. It differs from existing co-operative education courses in that, during the industrial semesters, students will follow a structured programme designed jointly by the University and the employer group, including several formal course work subjects taught in industry. A 44-week academic year is the norm for the course. Subject to satisfactory progress, each student admitted to the

course will receive a scholarship of \$8,800 per annum, donated by the industry sponsors of the programme.

Selection to the course will be conducted by a panel comprising representatives of the University and the employer group associated with the programme. Applicants will be interviewed to assess their suitability for the industrial as well as the academic aspects of the course.

RECOMMENDED PROGRAMME

SEMESTER 1 (UTS)	Hours/ Week
31717 Accounting Fundamentals	3
31721 Systems Analysis	3
31711 Information Systems	4
31714 Programming Principles	7
31715 Discrete Mathematics	5
31713 Computer Systems Architecture	3

SEMESTER 2 (Industry)	
31722 Commercial Programming	5
31771 Business Requirements Analysis	3
31779 Applications of Information Technology 1	3
31770 Industry Project 1	14

SEMESTER 3 (UTS)	
23106 Economics	3
24201 Principles of Marketing	3
31738 Management Principles for IT Professionals	3
31731 Database	4
31732 Communications and Networks	5
31733 Operating Systems	5

WINTER	
31780 Industry Studies	4

SEMESTER 4 (UTS)	
31747 Management Control Systems	3
31788 Organisation Theory for IT Professionals	3
31741 Systems Design	4
31742 On-Line Systems	5
31725 Software Engineering	6
31726 Probability and Statistics	3

SEMESTER 5 (Industry)	
31758 Project Management	3
31781 Business Systems Design	3
31789 Applications of Information Technology 2	3
31790 Industry Project 2	14

SEMESTER 6 (UTS)	
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25301 Financial Management	3
31767 Auditing the Computer	6
31768 Business Planning for IT Professionals	3
31762 Technology Planning	3
31769 Social Implications of Computers	3
31766 Performance Modelling and Management	6

Extension Courses

The School offers three courses which run regularly each semester for 15 weeks, one evening per week, in UNIX/ C, COBOL, and Pascal. Other extension courses offered at various times include:

Computers for Small Business
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
BASIC Programming.
Software Quality Assurance
Object Oriented Programming in Eiffel
Object oriented Design

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

SYNOPSIS

UNIX/C Extension Course

Three semester hours

An introduction to the C programming language and the Unix* operating system. Students enrolling in this course are expected to have programming experience.

*Unix is a trademark of AT&T and Bell Laboratories.

COBOL Extension Course

Three semester hours

Students are trained in the use of computers 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.

Pascal Extension Course

Three semester hours

An introduction to the analysis and design of computer algorithms and their implementation in Pascal. The practical work will cover numeric and non-numeric aspects of computing, with the emphasis on writing well-structured and documented programmes.

31015 DISCRETE MATHEMATICS

Five semesters

This subject develops the mathematics needed for software engineering. 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 is used to illustrate the mathematical concepts introduced; a brief comparison with logic programming is given.

31017 ACCOUNTING FUNDAMENTALS

Three semester hours

This subject provides 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.

31021 SYSTEMS ANALYSIS

Three semester hours

Prerequisite: 31071 Introduction to Information Systems

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.

31022 COMMERCIAL PROGRAMMING DEVELOPMENT

Three semester hours

Prerequisite: 31071 Introduction to Information Systems

This subject covers structured design techniques and their application to COBOL programming in an offline commercial environment. Advanced features of COBOL are presented to give the student a complete knowledge of the language.

31024 DATA STRUCTURES AND ALGORITHMS

Three semester hours

Prerequisite or Corequisite: 31025 Software Engineering

Structured approach to programming including: abstract modelling, modular design, step-wise refinement, documentation and layout, complexity analysis of algorithms for efficiency, programme correctness. Abstract and dynamic data types are covered notionally and formally, with associated insertion, deletion, selection, searching and sorting methods and algorithms for manipulating data in these structures. Systematic methods for attempting common problems.

31025 SOFTWARE ENGINEERING

Three semester hours

Prerequisite: 31015 Discrete Mathematics

This subject introduces the formal aspects of modern software engineering. Topics: an overview of the software engineering environment, the practice of formal mathematical specification, programme development via refinement of specifications, programmes correctness, machine executable specifications, an overview of software testing and reliability.

31026 PROBABILITY AND STATISTICS

Three semester hours

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.

31031 DATABASE

Three semester hours

Prerequisite: 31021 Systems Analysis

Designing database applications given a set of user requirements. Describes how models of data are converted to databases and methods used to maintain data in databases. Included are conversion to relational databases and the use of SQL for data retrieval and updates and the controls necessary to maintain data integrity during updates. Development of application programmes using application generators with SQL interface. Introduction to network and hierarchical databases and methods used to design such databases.

31032 COMMUNICATIONS AND NETWORKS

Three semester hours

Prerequisite: 31073 Introduction to Computer Systems

This subject introduces communication concepts and terminology. It describes the problems involved in the Physical and Data Link Layers of communication and their solutions. It discusses network architectures, topologies and carrier services.

31033 OPERATING SYSTEMS

Three semester hours

Prerequisite: 31073 Introduction to Computer Systems

An introduction to the student of the concepts and facilities available in computer operating systems. The subject includes scheduling, multiprogramming, protection and resource control.

31041 SYSTEMS DESIGN

Three semester hours

Prerequisite: 31031 Database

This subject develops a systems model to a structured physical design. A variety of implementation strategies are introduced such as fourth generation languages, prototyping, information centres and end-user tools. Human aspects of systems design covers screen and forms design, operations, procedures, etc.

31042 ON-LINE SYSTEMS

Three semester hours

Prerequisites: 31022 Commercial Programming Development, 31032 Communications and Networks
Pre or Corequisite: 31041 Systems Design

This subject covers the life cycle of on-line commercial application systems from a programmers point of view. It includes design, development, testing, implementation and maintenance issues with particular emphasis on structured design using COBOL. Students work in project teams to produce a working on-line system.

31047 MANAGEMENT CONTROL SYSTEMS

Three semester hours

Prerequisite: 31017 Accounting Fundamentals

The principles and techniques of cost accounting, budgeting and financial planning and their use in computer based accounting and business decision making systems.

31048 BUSINESS TOOLS AND APPLICATIONS

Three semester hours

Prerequisites: 31031 Database, 31017 Accounting Fundamentals

This subject aims to give students familiarity with microcomputers in the office and business environment and as stand-alone machines or workstations. The problems of linking microcomputers into local communication networks, 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 and spreadsheets and programme development aids.

31053 COMMUNICATIONS SOFTWARE

Three semester hours

Prerequisites: 31033 Operating Systems, 31032 Communications and Networks

This subject discusses the services provided by the various layers of a communications system and the protocols used to implement these services. Discussion is based, primarily, around the use of the ISO reference model for Open System Interconnection. Some aspects of the effect of design decisions on systems users are also covered.

31058 PROJECT MANAGEMENT

Three semester hours

Defines the role of the project manager/leader and introduces project management techniques. Students will gain an overall view of information systems development from project conception through to successful implementation and an understanding of the qualities of an effective leader.

31071 INTRODUCTION TO INFORMATION SYSTEMS

Three semester hours

This subject provides a fundamental foundation for the understanding of information systems and their applications to common computer-based business practices and procedures. Elementary system models, and a range of techniques and resources used in developing and designing information systems are examined. Illustrations taken from common business applications are considered.

31073 INTRODUCTION TO COMPUTER SYSTEMS

Three semester hours

An introduction to the internal components of computers, and how these are interrelated. Assembler language is introduced as a vehicle for describing computer organisations.

31140 INTRODUCTION TO COMPUTER GRAPHICS

Three semester hours

Prerequisite: 31642 Data Structures and Algorithms

This subject provides a thorough introduction to the field of computer graphics. Topics covered are: passive and interactive graphics hardware devices and programming; mathematical tools for two- and three-dimensional graphics; two- and three-dimensional vector and raster graphics algorithms, colour in computer graphics; graphics standards; graphics packages; applications of computer graphics — business graphics, computer-aided design, cartography, animation and advertising.

31163 KNOWLEDGE-BASED SYSTEMS (Elective)

Three semester hours

Prerequisites: 31896 Artificial Intelligence Programming, 31901 Artificial Intelligence Theory

This subject introduces the student 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

Three semester hours

Prerequisite: 31140 Introduction to Computer Graphics

This subject provides a study of several additional computer graphics topics: some elementary, and some of a more advanced nature. These topics include: raster algorithms - antialiasing techniques and clipping algorithms; hidden line and surface algorithms; computer animation techniques; realistic image synthesis techniques - illumination and shading models, ray tracing and transparency, texture mapping, modelling of natural phenomena; current research directions in computer graphics.

31351 PROJECT (31350, 31351, 31352 and 31894)

Three or six semester hours

Prerequisite: 31641 Systems Design

A project is intended to give a student experience in working independently and responsibility for the complete development of a small system from the initial analysis through to the user documentation. Students are required to attend several introductory lectures on research methods, report writing, etc. Projects may be drawn from any area of the course or suggested by the students industrial experience.

31611 INFORMATION SYSTEMS

Four semester hours

This subject focuses on the use of computer based systems in an organisational context. Typical computer based systems: data processing and information systems, office support systems, personal computers, embedded systems. Organisational benefits of computer based systems, objectives, costs and risks. On-line, off-line, real-time systems. Batch, interactive and transaction processing. Description of data flows: process flow charting. Introduction to simple business applications and the commercial system development life cycle. Operational issues.

31613 COMPUTER SYSTEMS ARCHITECTURE 1

Three semester hours

This subject is 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 programme.

31614 PROGRAMMING PRINCIPLES

Seven semester hours

This subject provides an introduction to computer operating systems and to problem analysis and solution on the computer. Students gain experience at using the Unix operating system. Methods of problem analysis, pseudocoding, coding, debugging, testing and documentation are introduced through the use of the procedural language Pascal. The concepts of program compilation and execution and interactive and noninteractive processing are introduced. The principles of object oriented programming will be discussed.

31615 DISCRETE MATHEMATICS

Five semester hours

This subject develops the mathematics needed for software engineering. 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 is used to illustrate the mathematical concepts introduced; a brief comparison with logic programming is given.

31617 ACCOUNTING FUNDAMENTALS

Three semester hours

This subject provides 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.

31621 SYSTEMS ANALYSIS

Three semester hours

Pre or Corequisite: 31611 Information Systems

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

Five semester hours

Prerequisites: 31614 Programming Principles, 31611 Information Systems

This subject covers structured design techniques and their application to COBOL programming in an off-line commercial environment.

31623 COMPUTER SYSTEMS ARCHITECTURE 2

Five semester hours

Prerequisites: 31613 Computer Systems Architecture 1, 31614 Programming Principles

This subject is a continuation of Computer Systems Architecture 1. The concepts introduced there are elaborated and assembler language programming is practised; additional requirements of architectures for

performance enhancement and support of high-level languages and operating systems are discussed.

31624 DATA STRUCTURES AND ALGORITHMS

Five semester hours

Prerequisites: 31614 *Programming Principles*, 31615 *Discrete Mathematics*

Pre or Corequisite: 31625 *Software Engineering*

Structured approach to programming including: abstract modelling, modular design, step-wise refinement, documentation and layout, complexity analysis of algorithms for efficiency, program correctness. Abstract and dynamic data types are covered notionally and formally, with associated insertion, deletion, selection, searching and sorting methods and algorithms for manipulating data in these structures. Systematic methods for attempting common problems.

31625 SOFTWARE ENGINEERING

Three semester hours

Prerequisites: 31614 *Programming Principles*, 31615 *Discrete Mathematics*

This subject introduces the formal aspects of modern software engineering. Topics: an overview of the software engineering environment, the practice of formal mathematical specification, programme development via refinement of specifications, programme correctness, machine executable specifications, an overview of software testing and reliability.

31626 PROBABILITY AND STATISTICS

Three semester hours

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

Four semester hours

Prerequisite: 31621 *Systems Analysis*

Designing database applications given a set of user requirements. Describes how models of data are converted to databases and methods used to maintain data in databases. Included are conversion to relational databases and the use of SQL for data retrieval and updates and the controls necessary to maintain data integrity during updates. Development of application programmes using application generators with SQL interface. Introduction to network and hierarchical databases and methods used to design such databases.

31632 COMMUNICATIONS AND NETWORKS

Five semester hours

Prerequisite: 31611 *Information Systems*, 31613 *Computer Systems Architecture 1*

This subject introduces communication concepts and terminology. It describes the problems involved in the Physical and Data Link Layers of communication and their solutions. It discusses network architectures, topologies and carrier services.

31633 OPERATING SYSTEMS

Five semester hours

Prerequisites: 31623 *Computer Systems Architecture 2*, 31624 *Data Structures and Algorithms*

An introduction to the student of the concepts and facilities available in computer operating systems. The subject includes scheduling, multiprogramming, protection and resource control.

31636 SIMULATION AND MODELLING

Four semester hours

Prerequisites: 31626 *Probability and Statistics*, 31624 *Data Structures and Algorithms*

Principles and practice of modelling: analysis, data gathering, solution, validation, implementation. Modelling in and of computer systems, queuing theory, continuous simulation, languages, corporate modelling, forecasting and inventory.

31641 SYSTEMS DESIGN

Four semester hours

Prerequisite: 31631 *Database*

This subject develops a systems model to a structured physical design. A variety of implementation strategies are introduced such as fourth generation languages, prototyping, information centres and end-user tools. Human aspects of systems design covers screen and forms design, operations, procedures, etc.

31642 ON-LINE SYSTEMS

Five semester hours

Prerequisites: 31622 *Commercial Programming Development*, 31632 *Communications and Networks*
Pre or Corequisite: 31641 *Systems Design*

This subject covers the life cycle of on-line commercial application systems from a programmers point of view. It includes design, development, testing, implementation and maintenance issues with particular emphasis on structured design using COBOL. Students work in project teams to produce a working on-line system.

31647 MANAGEMENT CONTROL SYSTEMS

Four semester hours

Prerequisite: 31617 *Accounting Fundamentals*

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

Five semester hours

Prerequisites: 31631 *Database*, 31617 *Accounting Fundamentals*

This subject aims to give students familiarity with microcomputers in the office and business environment

and as stand-alone machines or workstations. The problems of linking microcomputers into local communication networks, the use of database and file management programmes and the physical operation of microcomputers are discussed. Students will become familiar with specific packages such as business databases and spreadsheets and programme development aids.

31653 COMMUNICATIONS SOFTWARE

Six semester hours

Prerequisites: 31633 *Operating Systems*, 31632 *Communications and Networks*

This subject discusses the services provided by the various layers of a communications system and the protocols used to implement these services. Discussion is based, primarily, around the use of the ISO reference model for Open System Interconnection. Some aspects of the effect of design decisions on systems users are also covered.

31655 THEORY OF COMPUTER SCIENCE

Four and one half semester hours

Prerequisites: 31624 *Data Structures and Algorithms*, 31625 *Software Engineering*

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

Four and one half semester hours

Prerequisite: *Industrial Training*

Defines the role of the project manager/leader and introduces project management techniques. Students will gain an overall view of information systems development from project conception through to successful implementation and an understanding of the qualities of an effective leader.

31662 INFORMATION SYSTEM CASE STUDY

Six semester hours

Prerequisites: 31658 *Project Management*, 31641 *Systems Design*, 31642 *On-Line Systems*

Pre or Corequisite: 31666 *Performance Evaluation*

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 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

Six semester hours

Prerequisite: 31636 *Simulation and Modelling*

This subject 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

Three semester hours

Prerequisite: *Industrial Training*

This subject aims to identify 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, social responsibility of computer practitioners, privacy, the DP workforce.

31696 INDUSTRIAL TRAINING (F/T - first)

Six semester hours

Prerequisites: 31621 *Systems Analysis*, 31622 *Commercial Programming Development*, 31624 *Data Structures and Algorithms*, 31633 *Operating Systems* plus at least nine other core subjects from the BAppSc programme.

31697 INDUSTRIAL TRAINING (F/T - second)

Six semester hours

Prerequisites: 31696 *Industrial Training*

The first and second semesters of the compulsory industrial requirement for the course. ALL F/T 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 F/T semesters before obtaining employment.

31698 INDUSTRIAL TRAINING (P/T - first - Stage 5)

Three semester hours for two semesters

Prerequisites: 31621 *Systems Analysis*, 31622 *Commercial Programming Development*, 31624 *Data Structures and Algorithms*, 31633 *Operating Systems* plus at least nine other core subjects from the BAppSc programme.

31699 INDUSTRIAL TRAINING (P/T - second - Stage 6)

Three semester hours for two semesters

Prerequisites: 31698 *Industrial Training*

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 P/T students must enrol in these subjects and obtain a minimum of 18 months of full-time employment.

31711 INFORMATION SYSTEMS

Four semester hours

This subject focuses on the use of computer-based systems in an organisational context. Typical computer-based systems: data processing and information systems, office support systems, personal computers, embedded systems. Organisational benefits of computer-based systems, objectives, costs and risks. On-line, off-line, real-time systems. Batch, interactive and transaction processing. Description of data flows: process flow charting. Introduction to simple business applications and the

commercial system development life cycle. Operational issues.

31713 COMPUTER SYSTEMS ARCHITECTURE I

Three semester hours

This subject is 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 programme.

31714 PROGRAMMING PRINCIPLES

Seven semester hours

This subject provides an introduction to computer operating systems and to problem analysis and solution on the computer. Students gain experience at using the Unix operating system. Methods of problem analysis, pseudocoding, coding, debugging, testing and documentation are introduced through the use of the procedural language Pascal. The concepts of program compilation and execution and interactive and noninteractive processing are introduced. The principles of object oriented programming will be discussed.

31715 DISCRETE MATHEMATICS

Five semester hours

This subject develops the mathematics needed for software engineering. 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 is used to illustrate the mathematical concepts introduced; a brief comparison with logic programming is given.

31717 ACCOUNTING FUNDAMENTALS

Three semester hours

This subject provides 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.

31721 SYSTEMS ANALYSIS

Three semester hours

Pre or Corequisite: 31711 Information Systems

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.

31722 COMMERCIAL PROGRAMMING DEVELOPMENT

Five semester hours

Prerequisites: 31711 Information Systems, 31714 Programming Principles

Commercial structured design techniques and third generation commercial programming in a batch environment. Students will be taught the design technique and language of the particular industry organisation using approved assignment work. The Jackson structured design technique will be studied.

31725 SOFTWARE ENGINEERING

Six semester hours

Prerequisites: 31714 Programming Principles, 31715 Discrete Mathematics

This subject introduces the formal aspects of modern software engineering. Topics: an overview of the software engineering environment, the practice of formal mathematical specification, programme development via refinement of specifications, programme correctness, machine executable specifications, an overview of software testing and reliability.

31726 PROBABILITY AND STATISTICS

Three semester hours

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.

31731 DATABASE

Four semester hours

Prerequisites: 31721 Systems Analysis, 31711 Information Systems

Designing database applications given a set of user requirements. Describes how models of data are converted to databases and methods used to maintain data in databases. Included are conversion to relational databases and the use of SQL for data retrieval and updates and the controls necessary to maintain data integrity during updates. Development of application programmes using application generators with SQL interface. Introduction to network and hierarchical databases and methods used to design such databases.

31732 COMMUNICATIONS AND NETWORKS

Five semester hours

Prerequisites: 31711 Information Systems, 31713 Computer Systems Architecture I

This subject introduces communication concepts and terminology. It describes the problems involved in the Physical and Data Link Layers of communication and their solutions. It discusses network architectures, topologies and carrier services.

31733 OPERATING SYSTEMS

Five semester hours

Prerequisite: 31713 Computer Systems Architecture 1

An introduction to the student of the concepts and facilities available in computer operating systems. The subject includes scheduling, multiprogramming, protection and resource control.

31738 MANAGEMENT PRINCIPLES FOR IT PROFESSIONALS

Three semester hours

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.

31741 SYSTEMS DESIGN

Four semester hours

Prerequisites: 31731 Database, 31721 Systems Analysis

This subject develops a systems model to a structured physical design. A variety of implementation strategies are introduced such as fourth generation languages, prototyping, information centres and end-user tools. Human aspects of systems design covers screen and forms design, operations, procedures, etc.

31742 ON-LINE SYSTEMS

Five semester hours

Prerequisites: 31722 Commercial Programming Development, 31732 Communications and Networks
Pre or Corequisite: 31741 Systems Design

This subject covers the life cycle of on-line commercial application systems from a programmers point of view. It includes design, development, testing, implementation and maintenance issues with particular emphasis on structured design using COBOL. Students work in project teams to produce a working on-line system.

31747 MANAGEMENT CONTROL SYSTEMS

Three semester hours

Prerequisite: 31717 Accounting Fundamentals

The principles and techniques of cost accounting, budgeting and financial planning and their use in computer based accounting and business decision making systems.

31758 PROJECT MANAGEMENT

Three semester hours

Prerequisite: 31788 Organisation Theory for IT Professionals

Practical knowledge and skills plus specific techniques required for effective management in the software development project environment. Leadership, people management, communication and control. Planning a software project, life cycles, phases and milestones, development plans. Software time and cost estimation. Controlling a software project. Development aids and alternatives.

31761 TECHNOLOGY PLANNING

Three semester hours

Prerequisites: 31756 Project Management, 31781 Business Systems Design

The various frameworks within which a business and its information system operates, taking into account goals, objectives and strategies. Enterprise analysis - high level, in terms of mission, goals, strategies; enterprise business modelling - top-down development of function and data models; information systems architecture — development of standard policies within which information systems can be established; business systems planning - prioritising information systems projects to best meet the overall needs of an organisation.

31766 PERFORMANCE MODELLING AND MANAGEMENT

Six semester hours

Prerequisites: 31733 Operating Systems, 31726 Probability and Statistics

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 queuing 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.

31767 AUDITING THE COMPUTER

Six semester hours

Prerequisite: 31747 Management Control Systems

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.

31768 BUSINESS PLANNING FOR IT PROFESSIONALS

Three semester hours

Prerequisite: 31758 Project Management

Developing corporate strategies in general, and for information processing in particular. Developing skills in the selection and use of appropriate techniques. Business planning, analysing business priorities and objectives, models, techniques and performance indicators. Tools for strategic planning, business systems planning, critical success factors. Corporate needs for information technology.

31769 SOCIAL IMPLICATIONS OF COMPUTERS

Three semester hours

This subject aims to identify 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, social responsibility of computer practitioners, privacy, the DP workforce.

31770 INDUSTRY PROJECT 1

Fourteen semester hours

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 2.

31771 BUSINESS REQUIREMENTS ANALYSIS

Three semester hours

Prerequisite: 31721 Systems Analysis

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.

31779 APPLICATIONS OF INFORMATION TECHNOLOGY 1

Three semester hours

Prerequisite: 31711 Information Systems

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 2 to ensure a common level of experience for all students.

31780 INDUSTRY STUDIES

Four semester hours

Prerequisite: 31770 Industry Project 1

In this subject students undertake surveys of industry sponsors of the programme, investigating contemporary topics in the field of information systems. Students may also be required to undertake other formal activities to complement the industrial objectives of the programme.

31781 BUSINESS SYSTEMS DESIGN

Three semester hours

Prerequisites: 31771 Business Requirements Analysis, 31741 Systems Design

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

Three semester hours

Prerequisite: 31738 Management Principles for IT Professionals

The basic structural forms of business organisations and the behavioural science foundations that are the basis for improving organisation performance and for facilitating change. Organisation theory, and the information resource - architecture and operation. Organisation development. Groups within organisations. The information systems organisation.

31789 APPLICATIONS OF INFORMATION TECHNOLOGY 2

Three semester hours

Prerequisite: 31779 Applications of Information Technology 1

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 1 to ensure a common level of experience for all students.

31790 INDUSTRY PROJECT 2

Fourteen semester hours

Prerequisite: 31780 Industry Studies

Experience of work as an analyst/programmer in a real project team. Students must also be able to relate that work experience (via written report) to the business' organisational goals and objectives, and to the user function serviced by the project. 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 1.

31799 COMPUTING 1

Four semester hours

(For Science students only)

The aim of this subject is to introduce Science students to computers and their use. Programming skills will be developed using Fortran 77 language on the University's Amdahl Unix system.

The emphasis is on structured programming techniques, and the subject contains a significant element of practical

programming work. Examples will be presented in the lectures with relevance to topics in science and engineering.

31853 OFFICE AUTOMATION (Elective)

Three semester hours

Prerequisite: 31641 Systems Design

Covers the advanced concepts of office automation at the corporate level. Corporate integration concerns the link between office systems and corporate information systems and databases. Office level issues concern the integration of data from multiple inputs into single documents and the integration of office procedures that lead to the concept of the paperless office. Methods of arranging and designing integrated systems and the hardware and software solutions for such systems will be covered.

31854 DISTRIBUTED DATABASES (Elective)

Three semester hours

Prerequisites: 31631 Database, 31632 Communications & Networks

Describes the characteristics and methods of designing distributed databases. Covers important distribution issues including location transparency, replication and concurrency and the problems associated with querying and updating distributed databases. Design issues such as conceptual models of distributed databases and systems dictionaries are covered as well as the managerial issues of implementing them. Practical examples of access to distributed databases through high level languages are covered.

31882 ADVANCED THEORETICAL COMPUTER SCIENCE

Three semester hours

Prerequisite: 31655 Theory of Computer Science

A review of advanced work in the theory of machines, theory of languages, theory of programs and theory of data.

31885 ADVANCED MATHEMATICS

Three semester hours

Prerequisite: 31615 Discrete Mathematics

Linear mathematics: matrices, determinants, eigenvalues and eigenvectors, inversion, pivoting and conditioning, complex numbers and functions.

Probability and statistics: binomial, Poisson, chi-square and hypergeometric distributions, combinatorial methods, hypothesis testing, confidence intervals and types of errors, correlation and regression, sampling theory and ANOVAs.

Calculus revision, ordinary and partial differential equations, graph theory, information theory, use of proof in problem solving.

31888 LOGIC DESIGN 1

Three semester hours

Prerequisite: 31623 Computer Systems Architecture

The subject provides an introduction to the concepts of logic design, gates, Boolean algebra, minimisation, combinational and sequential circuits.

31889 LOGIC DESIGN 2

Three semester hours

Prerequisite: 31888 Logic Design 1

This is a continuation of Logic Design 1 which includes the concepts of machine structure as a controlled combination of registers and gates.

31893 COMPARATIVE PROGRAMMING LANGUAGES

Three semester hours

Prerequisite: 31624 Data Structures and Algorithms

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

Three semester hours

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.

31896 ARTIFICIAL INTELLIGENCE PROGRAMMING

Three semester hours

Prerequisite: 31624 Data Structures and Algorithms

This subject provides a thorough coverage of the two main languages used to implement AI systems PROLOG and LISP. AI also provides the context for many of the tutorial exercises and assignments.

31897 COMPUTER SYSTEMS ARCHITECTURE 3

Three semester hours

Prerequisite: 31633 Operating Systems

A systematic treatment of more advanced topics in machine organisation and systems architecture.

31898 MICROPROCESSORS AND APPLICATIONS

Three semester hours

Prerequisite: 31623 Computer Systems Architecture 2

An examination of the current range of microprocessors and the applications of micros in embedded systems. The subject is highly practical. The student should develop skills in the construction of micro applications solutions, using standard device families and software logic.

31899 SYSTEMS ARCHITECTURE

Three semester hours

Prerequisite: 31897 Computer Systems Architecture 3

In-depth study at the architectural level of one or more state-of-the-art or experimental computer systems.

31901 ARTIFICIAL INTELLIGENCE THEORY

Three semester hours

Prerequisites: 31896 Artificial Intelligence Programming, 31624 Data Structures and Algorithms

Broad coverage of: algorithms underlying classical AI; modern AI including, knowledge representation, planning, image analysis, natural language understanding, problem solving, theorem proving, constraint-based systems, pattern recognition, approximate reasoning and learning.

31902 AUDITING THE COMPUTER

Three semester hours

Prerequisite: 31617 Accounting Fundamentals

An introduction to audit concepts and techniques in the EDP audit field. The emphasis is oriented to control measures in various computer systems, e.g. billing, creditors, payroll, etc. and non-monetary information systems.

31904 SYSTEMS PROGRAMMING (Elective)

Three semester hours

Prerequisite: 31633 Operating Systems

The role of the systems programmer. Comparison of programming languages for systems programming. UNIX operating system. C programming language. Comparison of using tools versus writing a new programme.

32100 ADVANCED PROGRAMMING TECHNIQUES

Four semester hours

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

Four semester hours

A subject concentrating on the transfer of research and development in Artificial Intelligence into functional systems. Topics treated include: expert systems, learning systems, natural language understanding, speech recognition and understanding, vision, cognitive modelling, intelligent computer-assisted instruction, logic programming, game playing, planning.

32104 DECISION MAKING AND MODELLING

Four semester hours

This subject looks at the theory and practice of both managerial decision making and modelling processes. Application areas for modelling include networks, queuing models, and corporate and financial models. Mathematical programming and simulation tools are discussed, as well as the role of problem formulation, data collection, sampling and sensitive 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

Four semester hours

A subject offering in-depth coverage of the theory and practice of selected key areas of Artificial Intelligence: expert systems, learning systems, speech recognition, natural language understanding, logic programming. The subject will be based on two substantial projects and underlying theory.

32200 INFORMATION PROCESSING STRATEGY

Four semester hours

Prerequisite: 32203 Information Management

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 DATA BASE

Four semester hours

Functional and data analysis using data modelling techniques. Logical and physical database design. Formulation and use of data dictionaries or metadatabases by the analyst, designer and programmer. Relational databases, advanced query languages and database standards. Operational design considerations, recovery and restart, security and database audit. Performance and reorganisation, efficiency and cost. These considerations are investigated for centralised and distributed systems, including current advantages and limitations. Tools and techniques for communications and control of databases, for distributed systems. Trends in hardware for associative memories and back processors, intelligent disc controllers and database machines, designs for secure database management. Current status of offerings including IMS, Total, Adabas, Codysl and relational implementations.

32202 COMMUNICATION SYSTEMS

Four semester hours

This subject is designed to develop understanding of typical data communication requirements in an organisation, familiarity with computer communication technologies, understanding of existing and evolving standards, proficiency in the requirements specification, design, sizing and acquisition of corporate communication facilities. Topics covered include historical evolution of computer communication, distributed information systems, ISO-OSI Reference Model, proprietary networking architectures, communication for message transmission, automated offices, etc., local networks, design procedures for corporate communication systems.

32203 INFORMATION MANAGEMENT

Four semester hours

Information as a resource, cost of collection, storage and 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 system design, implementation, testing and maintenance tools. Post-implementation reviews and audits.

32300 MICROPROCESSOR APPLICATIONS

Four semester hours

Architecture of current microprocessors. Configuration of microcomputers and peripherals, high-level and low-level languages. Development and future of microprocessors. The small business microcomputer. Applications of microprocessors: engineering control, monitoring, intelligent terminals, communications. Microcomputer networks and multiprocessors.

32301 PERFORMANCE EVALUATION

Four semester hours

Revision and extension of queueing theory. Analytic models of computer systems, and their application to performance evaluation. Operational analysis and its application to performance evaluation. Brief revision of EDP planning principles. Application of performance evaluation principles to the planning cycle — modelling the growing system.

32302 COMPUTER ARCHITECTURE

Four semester hours

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 covers 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.

32303 OPERATING SYSTEMS AND LANGUAGES

Four semester hours

Critical evaluation of different features of general purpose programming languages: program objects, expressions and commands, procedures, data structures, input/output, ADA. Concurrent facilities in programming languages: semaphores, monitors, CSP Concurrent Pascal, Edison. Non-procedural languages. Review of present operating systems. Multi-processor operating systems, high level job control languages. Provable systems. Secure systems.

32304 COMPUTER LANGUAGES

Four semester hours

Compiler techniques and their impact on programming language design. Concurrency facilities. Approaches to modularisation. List-structured, non-procedural, functional languages. Object-based systems.

32305 OPERATING SYSTEMS

Four semester hours

Topics in modern operating systems. Concurrency in closely coupled and loosely coupled systems. Programming support environments. User friendly system interfaces. Capability systems. Object-based systems. Fault-tolerant systems. Secure systems.

32400 ACCOUNTING FOR MANAGEMENT

Four semester hours

The managerial aspects of accounting are the main area of interest in this subject. This involves 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 are covered in some detail. The effects of inflation on costs, profits and capital replacement decisions are covered in depth. The use of funds analysis and balance sheet ratios to assess operational efficiency are also covered.

32401 MANAGEMENT POLICY AND STRATEGY

Four semester hours

This subject considers the essential tasks of management in formulating, organising and implementing strategy. The perspective of top management; assessing situations; formulating policies; discovering opportunities; estimating risks and planning programs of action; organising and administering personnel; follow-up and reappraisal; the role of top management in the world of the consumer.

PROJECT AND REPORT

32908 Eight semester hours

32912 Twelve semester hours

32916 Sixteen semester hours

All students in the MAppSc (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 eight semester hour project. In exceptional circumstances, and with the support of the project supervisor, permission may be granted for a student to enrol in the 12 or 16 hour project. The School publishes a substantial set of guidelines for this subject in the Masters Course Handbook.

32999 SEMINAR

One semester hour

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 not attended at least 70% of the Research Seminars in any semester will not normally be permitted to sit for examinations in that Semester. The three presentations which students are required to make are a literature review, a research seminar and an oral presentation of their project work.

33101 MATHEMATICS 1 (Life Sciences)

Three semester hours (1 s/hr lecture, 2 s/hrs workshop)

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 1 (Life Sciences)

Three semester hours (2 s/hrs lectures, 1 s/hr tutorial)

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 (Life Sciences)

Three semester hours (1 s/hr lecture, 2 s/hrs workshop)

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.

33107 BASIC MATHEMATICS

No credit

This is a basic course which includes operations of algebra, co-ordinate geometry, trigonometry and an introduction to calculus.

33120 ENGINEERING MATHEMATICS 1

Six semester hours (4 s/hrs lectures, 2 s/hrs tutorials)

Matrices and determinants. Vectors. Limits, continuity and differentiation. Applications of differentiation. Integration and applications. Elementary functions. Methods of integration. Sequences and series. Complex numbers.

33121 ENGINEERING MATHEMATICS 1A

Three semester hours (2 s/hrs lectures, 1 s/hr tutorial)

The syllabus is the first half of that of 33120, up to and including Applications of differentiation.

33122 ENGINEERING MATHEMATICS 1B

Three semester hours (2 s/hrs lectures, 1 s/hr tutorial)

Prerequisite: 33121 *Engineering Mathematics 1A*

This subject is a continuation of 33121. The two subjects cannot be taken concurrently. The syllabus is the second half of that for 33120.

33141 STATISTICS 1

Three semester hours

Descriptive statistics. Basic probability theory. Binomial and normal distribution. Standard tests of significance. Correlation and regression. Distribution-free tests.

33159A SCIENCE MATHEMATICS 1 (P/T)**33159S**

See 33160.

33160 SCIENCE MATHEMATICS 1 (F/T) (Physical Sciences)

Six semester hours (3 s/hrs lectures, 3 s/hrs tutorials)

Introduction to the derivative, local and global extreme values, instantaneous rates of change; non-time rates; continuity, introduction to the integral; area-predicting formulas; volumes of geometric solids; calculation of work; improper integrals; first and second derivative test; mean-value principle; composite functions and the chain rule; related rates; L'hospital's rule; differentials and implicit differentiation; change of variables techniques in integration, the indefinite integral, integration by parts.

33163 SCIENCE MATHEMATICS 2

(Physical Sciences)

Three semester hours (1 s/hrs lectures, 1 s/hrs tutorials)

Prerequisite: 33160 *Science Mathematics 1*

More antiderivatives; logarithmic laws and their applications; integration using the natural logarithm function; the number e ; the concept of inverse functions; the exponential function and its properties; arc length; surface area; method of partial fractions; introduction to differential equations; separation of variables technique.

33164 SCIENCE MATHEMATICS 3

(Physical Sciences)

Three semester hours (1 s/hrs lectures, 1 s/hrs tutorials)

Prerequisite: 33160 *Science Mathematics 1*

Corequisite: 33163 *Science Mathematics 2*

Matrices and determinants; inversion of a matrix; linear equations; eigenvalues and eigenvectors. Vectors in three dimensions; scalar, vector products; geometric applications. Complex numbers and series; De Moivre's theorem; Euler's result.

More calculus. Inverse hyperbolic functions with application to integration.

33220 ENGINEERING MATHEMATICS 2

Six semester hours

Prerequisite: 33120 *Engineering Mathematics 1* or 33122 *Engineering Mathematics 1B*

Partial derivatives. Double integrals and applications. Triple integrals and applications. Differential equations. Laplace transforms. Series solutions of differential equations. Boundary value problems. Vector calculus.

33221 ENGINEERING MATHEMATICS 2A

Three semester hours

Prerequisite: 33120 *Engineering Mathematics 1* or 33122 *Engineering Mathematics 1B*

The syllabus is the first half of that for 33220, up to and including Differential Equations.

33222 ENGINEERING MATHEMATICS 2B

Three semester hours

Prerequisite: 33221 *Engineering Mathematics 2A*

This subject is a continuation of 33221. The two subjects cannot be taken concurrently. The syllabus is the second half of that for 33220.

33319 ADVANCED CALCULUS

Three semester hours (2 s/hrs lectures, 1 s/hr tutorial)

Properties of vectors, differentiation. Concepts of div, grad, curl. Line integrals. Theorems of Gauss, Green and Stokes.

Review of matrix and determinantal algebra, linearly dependent and independent vectors, n-dimensional vector spaces, basis vectors, matrix transformations, diagonalisation and the eigenvalue problem. Applications. Special matrices for physics. Introduction to tensors (dielectric constants, conductivity, elasticity, moment of inertia).

Orthogonal and orthonormal functions, generalised Fourier expansion and generalised eigenvalue problem. Eigenvectors, boundary values and expansion coefficients.

33320 PARTIAL DIFFERENTIAL EQUATIONS

Three semester hours

Prerequisite: 34213 Ordinary Differential Equations

Solution of boundary value problems by separation of variables. Sturm Liouville theory. Orthogonality and completeness of eigenfunctions. Special functions. Eigenfunction expansions.

33321 PARTIAL DIFFERENTIAL EQUATIONS (Science)

Three semester hours

Prerequisites: 34213 Ordinary Differential Equations, 33212 Multivariable Calculus (or equivalent)

The derivation of the heat and wave equations; Sturm-Liouville systems; eigenvalues and eigenfunctions. Boundary value problems. Fourier integrals and applications; Bessel functions and applications; Legendre functions and applications.

33702 STATISTICAL METHODS

Three semester hours

Review of basic probability theory, hypothesis testing, standard tests of significance and expectation. Quality control and reliability. Regression analysis. Analysis of variance, Markov chains.

33717 NUMERICAL METHODS

Three semester hours

Prerequisites: 34307 Computing 2, 34214 Algebra 2

Corequisite: 34213 Ordinary Differential Equations

Introduction to numerical solutions of problems in science and engineering using digital computers. Solution of linear and non-linear equations. Interpolation and functional approximation. Numerical differentiation and integration. Numerical linear algebra. Solutions of ordinary differential equations. Numerical functions. Minimisation.

33730 SIMULATION TECHNIQUES

Three semester hours

Prerequisite: 34141 Statistics 1

Corequisite: 34307 Computing 2

Introduction to techniques of simulation as used in Operations Research. Special consideration is given to input data analysis, verification, validation and the

employment of high-level languages for discrete event simulation. (GASP, SEESIM, SIMSCRIPT II.s).

33731 OPTIMISATION TECHNIQUES

Three semester hours

Prerequisites: 34102 Calculus 2

A unified treatment of the solution of models derived from real-life situations. Derivation and application of Kuhn-Tucker theorem. Special treatment includes selected algorithms of non-linear programming.

33732 LINEAR PROGRAMMING

Three semester hours

Prerequisite: 34480 Introduction to O.R. Models

Corequisite: 34214 Algebra 2

Formulation of linear programming problems. The simplex method and its variants. Duality theory. Degeneracy and post-optimal analysis. Applications to deterministic systems arising in industry and management. Sensitivity analysis and parametric programming. Integer and quadratic programming. Multiple objective decision making.

33733 DYNAMIC OPTIMISATION

Three semester hours

Prerequisite: 34141 Statistics 1

The objectives of this subject are to introduce the elements of dynamic optimisation within a unified framework; to cultivate the art of formulating the solution of problems in terms of recursive relations; and to outline computer solutions to dynamic optimisation problems.

33734 NETWORK OPTIMISATION

Three semester hours

Prerequisite: 34480 Introduction to OR Models

Corequisite: 34532 Linear Programming

Applications of optimal network flows, the max-flow min-cut theorem, Ford and Fulkerson's labelling method, relations to linear programming, the out-of-kilter algorithm, project management including Critical Path Method, PERT and consideration of project cost curves, applications of graph and network models.

33735 INVENTORY CONTROL

Three semester hours

Corequisite: 34630 Simulation Techniques

Characterisation and development of optimal inventory policies for single-item and multi-inventory models. The deterministic problem. Determination of economic lot sizes. Survey of optimal policies, fixed ordering and probabilistic review policies. Forecasting techniques including general exponential smoothing. Development and use of computer packages relevant to industrial and commercial situations.

33736 DECISION THEORY

Three semester hours

Prerequisite: 33780 Introduction to O.R. Models

Consideration of the general problem of decision making under risk and uncertainty. Risk analysis. Utility. Decision

trees. Bayesian Revision. Theory of games. Multiple objective decision making. Goal programming. Multi attribute utility. Comparison of classical and Bayesian statistics.

33744 QUEUING THEORY

Three semester hours

Prerequisites: 34342 Statistics 2, 33730 Simulation Techniques

Fundamental results of queuing theory and their application to important systems of delay, analysis of various queuing (waiting line) systems, discrete and continuous time Markov processes, birth-and-death processes, equilibrium results for single and multiple server queues, method of stages, priority queuing, applications to communication systems, data processing systems, queues in networks.

33745 DESIGN OF EXPERIMENTS

See 34545.

33747 STOCHASTIC PROCESSES

See 34547.

33748 INDUSTRIAL STATISTICS

See 34548.

33780 INTRODUCTION TO O.R. MODELS

Three semester hours

Corequisite: 34141 Statistics I

This subject introduces the basic methodology of Operations Research emphasising the application of the scientific method to problem solving and decision making, and considers the general purpose models and computational methods of Operations Research (linear network, financial, dynamic and stochastic models).

33799 PROJECT

Four semester hours

An investigation of an approved topic selected by the student and carried out under supervision. The aim is to develop the students ability in the formulation and solution of an operations research-type problem from a real-life situation. A formal report of the investigation will be required for satisfactory completion of the project.

33801- REPORT

33812 One to twelve semester hours.

33814 APPLIED LINEAR ALGEBRA

Three semester hours

Prerequisite: By consent

This is a course in linear algebra motivated by relevant applications from areas such as operations research and modelling in the physical and biological sciences. Topics considered are:

- Concepts of rank, kernel and uniqueness introduced via systems of linear equations and the LU decomposition.
- Inner products and norms. Condition of linear systems. Perturbed systems of equations.
- The eigenvalue problem (motivated by examples from discrete and continuous systems modelling).
- Similarity transformations, unitary matrices. Eigensystems of normal matrices and the least squares problem. Singular value decompositions. The generalised inverse and the least squares problem.
- The Jordan canonical form, matrix exponentials and applications.

33817 NUMERICAL ANALYSIS

Three semester hours

Prerequisite: 33814 Applied Linear Algebra

This course is essentially a more comprehensive and a more analytic treatment of the material in 33717 Numerical Methods. Topics include:

- Computational linear algebra (relying on the foundation supplied by Applied Linear Algebra).
 - Practical solutions of linear equations " direct and iterative methods (including analysis of convergence).
 - The eigenvalue problem " Jacobi's method, QR methods etc.
- Interpolation " use of splines.
- Solution of non-linear equations " fixed point method, Newton's method, analysis of convergence, algorithms for complex roots.
- Quadrature " the Newton-Cotes methods, extrapolation methods, error analysis.
- Solution of ordinary differential equations " series methods, Runge-Kutta methods, predictor-corrector methods, error analysis.

33823 SEMINAR

Three semester hours

Application of operations research techniques to a particular field. Depending on staff availability and student demand, applications will be from the following: computing system performance, public sector applications, marketing and health planning.

33830 SIMULATION TECHNIQUES

See 33730.

33831 OPTIMISATION TECHNIQUES

Three semester hours

Prerequisites: 33732 Linear Programming, 34102 Calculus 2

Review of classical optimisation, theoretical foundations of non-linear programming, Kuhn-Tucker theorem, useful properties of convexity, line search by the Fibonacci method and by curve-fitting methods, steepest ascent, Newtons method, conjugate direction methods, feasible descent algorithms for constrained optimisation, quadratic programming, survey of available computer codes, geometric programming.

33832 LINEAR PROGRAMMING

See 33732.

33833 DYNAMIC OPTIMISATION

See 33733.

33834 NETWORK OPTIMISATION

See 33734.

33835 INVENTORY CONTROL

Three semester hours

Corequisite: 33830 Simulation Techniques

Characterisation and development of optimal inventory policies for single-item and multi-inventory models, the deterministic problem, determination of economic lot sizes, survey of optimal policies, fixed ordering and probabilistic review policies, forecasting techniques including general exponential smoothing, use of computer packages for multi-item systems.

33836 DECISION THEORY

See 33736.

33844 QUEUING SYSTEMS: Theory and Application

Three semester hours

Prerequisite: Probability theory

Fundamental results of queuing theory and their application to important systems of delay, analysis of various queuing (waiting line) systems, discrete and continuous time Markov processes, birth-and-death processes, equilibrium results for single and multiple server queues, method of stages, priority queuing, applications to communication systems, data-processing systems, queues in networks.

33845 DESIGN OF EXPERIMENTS

See 34545.

33847 STOCHASTIC PROCESSES

See 34547.

33848 INDUSTRIAL STATISTICS

See 34548.

33850 O.R. IN HEALTH SERVICES I

Three semester hours

Prerequisite: By consent

Corequisite: 33855 Manpower Planning

Recognition of problem areas and specific problems in the health field which can be solved and/or aided by operations research techniques, selection and application (with appropriate adaption) of the appropriate techniques. Methods discussed include queuing theory, decision analysis, mathematical programming, Markov chains, simulation, inventory control.

Areas of application include appointment systems, blood banking, manpower planning and scheduling, centralisation versus decentralisation. An important

consideration is the quality of health care in terms of efficiency of provision of services.

33851 O.R. IN HEALTH SERVICES 2

Three semester hours

Prerequisite: 33850 O.R. in Health Services I

Continuation of O.R. in Health Services I with additional techniques and survey of current literature on recent applications of O.R. to health systems.

33853 ENERGY AND ENVIRONMENTAL MODELLING

Three semester hours

Prerequisite: By consent

Modelling of energy systems on a global and a national (or regional) basis, large system simulation and industrial dynamics, risk-benefit analysis of alternative technologies, problems of pollution and resource exhaustion, demand projections, conservation proposals, environmental trade-offs, interdependence between the energy sector and the economy as a whole, relationship to international trade.

33855 MANPOWER PLANNING

Three semester hours

Prerequisite: By consent

Manpower planning and scheduling in companies and in public facilities such as health systems. Cohort analysis, measures of wastage, continuous methods (renewal equations), discontinuous methods, Markov-based examples, political, economic, social and technological changes, effects of computerisation, Grosch's Law, manpower equivalent of a computer, job displacement, penetration of computers into industries, Gompertz curve, effect of new computer-based technology on public facilities, e.g. a hospital radiology department.

33857 LARGE-SCALE MATHEMATICAL PROGRAMMING

Three semester hours

Prerequisite: 33831 Optimisation Techniques

Theory and computational methods for optimising large-scale linear and non-linear programmes, exploitation of special structures, data handling, Dantzig-Wolfe decomposition, Benders decomposition, surrogate programming, consideration of models and applications giving rise to large-scale mathematical programmes including multi-divisional problems (multi-plant productions, water resources systems, hierarchical and decentralised organisations), combinatorial problems (scheduling, distribution, sequencing), stochastic problems (programming under uncertainty), and dynamic problems (production planning).

33858 STOCHASTIC MODELS IN OPERATIONS RESEARCH

Three semester hours

Prerequisite: By consent

Survey of models, methods and applications for

operational problems characterised by uncertainty, including formulation of models, useful special structures, applicable solution approaches, insight gained from analysis of models, and selection between deterministic and stochastic models. Specific topics include stochastic linear programming, two-stage L.P. formulations and chance-constrained programming, finite horizon probabilistic dynamic programming, Markov chains and Markovian decision processes, and probabilistic inventory models (infinite horizon continuous review).

33859 ENGINEERING APPLICATIONS IN OPERATIONS RESEARCH

Three semester hours

Prerequisite: Consent based on relevant engineering background

Depending on demand, selected applications of operations research in specific areas of engineering, (electrical, mechanical etc.) to be formulated in consultation with senior members of staff of the Faculty of Engineering.

33860 CORPORATE FINANCIAL DECISION MAKING

Three semester hours

Prerequisite: 34452 *Financial Modelling Techniques (or consent of lecturer)*

This subject consolidates and develops the financial concepts introduced in Financial Modelling Techniques and develops further models in financial management and the mathematical techniques for their solution. Capital structure and valuation, measuring the cost of capital, the efficient market hypothesis, investment analysis via modern portfolio theory.

33861 OPERATIONS RESEARCH IN PUBLIC SECTOR SERVICES

Three semester hours

Prerequisite: 33855 *Manpower Planning; (Desirable: 33850 O.R. in Health Services 1 and 33853 Energy and Environmental Modelling)*

Applications of O.R. to selected service areas of the public sector. Development of economic and quantitative concepts applicable to investment planning for facility systems, problems of location, decisions and capacity planning over time, service level decisions (benefit versus cost), complexities in facilities decisions (multiple criteria, multiple interests and uncertainty). Topics are selected from local, state and national government levels, including urban service systems, location of emergency services, water resources, transportation systems, environmental considerations.

33870 MATHEMATICAL MODELLING IN THE BIOMEDICAL SCIENCES

Three semester hours

Prerequisite: By consent

Compartment models of diabetes and tumour growth, models of interacting populations, models of protein

synthesis. The identification and simulation of such models. The use of control theory ideas.

33871 IMPACT OF COMPUTERS ON TRADITIONAL MATHEMATICS

Three semester hours

Prerequisite: By consent

This course is intended to demonstrate how a number of traditional mathematics courses may be approached by making integrated use of the numerical and symbol manipulation capabilities of modern computers, e.g. traditional calculus is approached through the mechanical paradigms that give rise to the fundamental ideas. By relegating numerical and symbol manipulations to the computer, the student is encouraged to develop an intuitive feel for underlying scientific and technological problems. The need for a mathematics which answers questions that are not answerable on the computer is stressed. Other topics similarly treated include classical control problems and partial differential equations.

33872 DATA ANALYSIS

Three semester hours

Prerequisite: By consent

General ideas of time-series analysis: Tests of randomness. Trends and moving averages. Spectral analysis. Forecasting by autoprojective methods. Exploratory data analysis: displays, plots, smoothing data and coded tables. Meta-analysis: tests of statistical significance of combined results, coding, estimation of effect sizes; meta-analysis in the biological and social sciences.

33873 MODELLING WITH DIFFERENTIAL EQUATIONS

Three semester hours

Prerequisite: By consent

A look at differential equations from a modern viewpoint which presents a balance between qualitative-geometric solutions on the one hand and numerical solutions on the other. Modelling applications are the threads holding together the various concepts: applications include biological, mechanical and economic models.

33880 O.R. MODELS AND METHODOLOGY

Three semester hours

Prerequisite: By consent

Formulation of O.R. problems, construction of models, consideration of basic model prototypes (linear, network, financial, dynamic and stochastic models), derivation of a solution, model testing and solution evaluation, implementation and maintenance, emphasis on the methodology of O.R. Heuristic methods. The course will be based on Case Studies.

34100 ALGEBRA 1

Four semester hours

Complex numbers. Polynomials. Tableau methods for systems of linear equations. Determinants (up to 4×4).

Cramers Rule. Matrices, with emphasis on manipulations and applications. Eigenvalues and eigenvectors; diagonalisation. Vector algebra. Elementary propositional logic.

34101 CALCULUS 1

Four semester hours

Introduction to set theory. Limits and continuity. Differentiation. Mean-value theorem. Applications of differentiation. Integration. Fundamental theorem of calculus. Applications of Integration to areas, volumes and arc lengths.

34102 CALCULUS 2

Four semester hours

Prerequisite: 34101 Calculus 1

Trigonometric and hyperbolic functions. Methods of integration. Logarithm and exponential functions. L'Hopital's rule. Improper integrals. Sequences and series. Tests for convergence. Power series. Maclaurin series.

34107 COMPUTING 1

Four semester hours plus three laboratory hours

This subject provides an introduction to problem formulation and solution on the computer. Methods analysis, flowcharting, computer coding and documentation are taught and illustrated through the use of the procedural language, Pascal.

34117 COMMERCIAL COMPUTING 1

Two semester hours plus two laboratory hours

Introduction to data processing in a business environment. Emphasis is given to a structured approach to program design and development. Practical work involves the implementation of elementary functions of business data processing in Cobol.

34127 INFORMATION SYSTEMS 1

Three semester hours

This subject focuses on the use of computer based systems in an organisational context. Typical computer-based systems: data processing and information systems, office support systems, personal computers, embedded systems. Organisational benefits of computer based systems, objectives, costs, and risks. On-line, off-line, real-time systems. Batch, interactive and transaction processing. Description of data flows: process flow charting. Introduction to simple business applications and system development life cycle. Operational issues.

34137 COMPUTER SYSTEMS 1

Three semester hours

A general overview of computer components, configurations, and relative performances. Principles of data flow through a computer system. Internal and external representation of data. Structure of the CPU and main storage; loading and execution of programmes; registers; addressing; introduction to Boolean logic.

34141 STATISTICS 1

Three semester hours

Corequisite: 34102 Calculus 2

Descriptive statistics. Probability. Random variables; expectation; standard distributions. Inference on means and variances. Distribution-free tests. Goodness-of-fit tests. Linear regression.

34203 MECHANICS

Three semester hours

Prerequisites: 34213 Ordinary Differential Equations, 34212 Vector Calculus

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

34212 VECTOR CALCULUS

Three semester hours

Prerequisite: 34102 Calculus 2

Partial derivatives. Multiple integrals. Vector fields. Line and surface integrals. Integral theorems.

34213 ORDINARY DIFFERENTIAL EQUATIONS

Three semester hours

Prerequisite: 34102 Calculus 2

First order equations. Theory of linear equations. Use of auxiliary equations, undetermined coefficients and variation of constants. Laplace transforms. Power series methods. Singular points. Bessel and Legendre equations.

34214 ALGEBRA 2

Three semester hours

Prerequisite: 34100 Algebra 1

Vector spaces. Subspaces. Basis and dimension. Euclidean spaces. Cauchy-Schwarz inequality. Orthogonality and orthonormal bases. Projection and Gram-Schmidt Process. Linear transformations and their matrix representations. Eigenvalues and eigenvectors. Diagonalisation. Quadratic forms and conic sections. Differential equations. Power method.

34217 COMMERCIAL COMPUTING 2

Four semester hours plus three laboratory hours

Prerequisites: 34117 Commercial Computing 1, 34127 Information Systems 1

Applications of COBOL programming to commercial systems. The students design, test and document an integrated, batch-oriented system.

34227 INFORMATION SYSTEMS 2

Three semester hours

Prerequisite: 34127 Information Systems 1

The organisation of records in serial and direct access files. Controls, security, recovery and audit requirements. Capacity and timing calculations. Data capture, entry and display.

34251 MACROECONOMIC MODELS

Three semester hours

Prerequisite: 34101 Calculus 1

Elementary theory of supply and demand is introduced. Dynamic models are developed by means of linear second order difference equations, which form the basic mathematical tool for the course.

A simple dynamic macroeconomic model consisting of an output and money market is then developed and the effects of various government stabilisation policies are investigated within the framework of the model. The main aim of the course is to introduce students to mathematical modelling in macroeconomics.

34307 COMPUTING 2

Two semester hours plus two laboratory hours

Prerequisites: 34107 Computing 1, 34101 Calculus 1

ANSI standard FORTRAN 77. Subroutine packages. File handling, use of terminals and editing. Elementary numerical methods: selection from numerical integration, linear equations, non-linear equations, function evaluation.

34342 STATISTICS 2

Three semester hours

Prerequisite: 34141 Statistics 1

Random variables; moments; characteristic function. Bivariate distribution. Transformation of variables. Limit theorems. Sampling distributions. Point estimation; maximum likelihood, Neyman-Pearson lemma.

34343 THEORY OF PROBABILITY

Three semester hours

Corequisite: 34342 Statistics 2

Combinatorial analysis. Infinite sequences of trials. The Borel-Cantelli lemmas. Laws of large numbers. Generating functions. Characteristic functions. Other limit theorems.

34407 COMPUTING 3

Three semester hours plus three laboratory hours

Prerequisite: 34307 Computing 2

Programming techniques for organisation and manipulation of data in main storage. Emphasis on methodology, i.e. top down approach, structured programming and controlled testing. Topics include: data structures such as lists, trees, sorting and searching techniques.

34417 NUMERICAL METHODS 1

Three semester hours

Prerequisites: 34307 Computing 2, 34214 Algebra 2

Corequisite: 34213 Ordinary Differential Equations

Introduction to numerical solutions of problems in science and engineering using digital computers. Solution of linear and non-linear equations. Interpolation and functional approximation. Numerical differentiation and integration.

Numerical linear algebra. Solutions of ordinary differential equations. Numerical functions. Minimisation.

34418 NUMERICAL METHODS 2

Three semester hours

Prerequisites: 34417 Numerical Methods 1, 34213 Ordinary Differential Equations

Advanced numerical methods. Boundary value problems. Approximation of functions. Solution of partial differential equations. Monte Carlo methods. Fast Fourier transforms.

34419 COMPLEX VARIABLES

Three semester hours

Prerequisites: 34102 Calculus 2, 34212 Vector Calculus

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

34452 FINANCIAL MODELLING TECHNIQUES

Three semester hours

Prerequisites: 34141 Statistics 1, 34102 Calculus

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 firm's 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.

34480 INTRODUCTION TO O.R. MODELS

See 33780.

34507 COMPUTING 4

Three semester hours plus three laboratory hours

Prerequisite: 34407 Computing 3

Data structures: implementation of stacks, queues, linked lists, trees etc. in Fortran. Sparse matrices: storage and manipulation. Simulation: design and implementation of a discrete event simulator. Recursion: implementation and elimination of recursion. Graphics: 2D function plots, histograms, pie charts, 3D function plots, wire frame shapes. Programming packages: design and implementation of user-friendly interfaces. Particular applications include rational, multiprecision and interval arithmetic and a symbolic polynomial manipulation package.

34517 COMMERCIAL COMPUTING 3

Three semester hours plus three laboratory hours

Prerequisites: 34217 Commercial Computing 2, 34627 Information Systems 3

Programming techniques for the implementation of on-line systems & screen data entry, menu driven programmes, system integrity. Experience in design, testing and maintenance.

34524 WAVE THEORY

Three semester hours

Prerequisites: 34621 Mathematical Methods 1, 33320 Partial Differential Equations

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

34527 REAL VARIABLES

Three semester hours

Prerequisite: 34102 Calculus 2

The real number system. Countability. Limits, continuity and differentiability. The Riemann integral. Review of sequences and series. Taylors theorem. Series of functions.

34528 MODERN ANALYSIS

Three semester hours

Prerequisite: 34527 Real Variables

Metric spaces. Completeness. Compactness. The fixed point theorem. Banach space. Linear mappings on a normed space. Hilbert space.

34531 OPTIMISATION TECHNIQUES

See 33731.

34532 LINEAR PROGRAMMING

See 33732.

34544 REGRESSION ANALYSIS

Three semester hours

Prerequisite: 34342 Statistics 2

Simple linear regression. Multiple regression. Polynomial regression. General linear model. Multivariate normal distribution. Generalised linear models. Use of computer packages.

34545 DESIGN OF EXPERIMENTS

Three semester hours

Prerequisite: 34544 Regression Analysis

Design and analysis of experiments. Completely randomised blocks and latin square designs. Factorial experiments. Hierarchical experiments. Introduction to confounding, split plots, fractional replication, incomplete blocks, analysis of covariance, use of computer packages.

34547 STOCHASTIC PROCESSES

Three semester hours

Prerequisite: 34342 Statistics 2

Random walks. Markov chains: classification of states: limit results for irreducible recurrent chain: absorption probabilities. Discrete state Markov processes: Poisson process: pure birth process: birth-death processes: application to queuing problems. Stationary processes: moving average and autoregressive models. Introduction to Wiener process and renewal processes.

34548 INDUSTRIAL STATISTICS

Three semester hours

Prerequisite: 34342 Statistics 2

Sampling inspection: acceptance sampling: AOQ Curve: the process curve: inspection by variables. Sequential statistical tests. Distribution of order statistics. Control charts: cumulative sum charts. Reliability: reliability of systems.

34553 MULTIPLE REGRESSION MODELS

Three semester hours

Prerequisite: 34342 Statistics 2

Thorough study of the linear normal regression model including generalised least squares, nature and consequences of autocorrelation, dummy variables.

34554 TIME SERIES ANALYSIS

Three semester hours

Identification and estimation of univariate time series. Application of time series techniques to macroeconomic forecasting.

34570 ALGEBRA 3

Three semester hours

Prerequisites: 34214 Algebra 2, 34101 Calculus 1

Indexed sets, partitions, equivalence relations. Group theory: definitions, elementary properties, cosets and quotient groups. Lagrange's theorem. Ring Theory: definitions of rings and fields, subrings, ideals and quotient rings. Applications to polynomial fitting, finite differences.

34571 ALGEBRA 4

Three semester hours

Prerequisite: 34570 Algebra 3

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.

34572 FOURIER ANALYSIS

Three semester hours

Prerequisite: 34527 Real Variables

One-dimensional measure theory: the Lebesgue integral. Mean convergence. Convergence properties of Fourier series. Generalised Fourier series.

34573 HISTORY OF MATHEMATICS

Two semester hours

The great mathematicians and the history of mathematics from a problem-solving point of view.

34607 COMPUTING 5

Three semester hours

Prerequisites: 34137 Computer Systems 1, 34507 Computing 4

Topics include: operating systems - structure, resource management and performance - case studies of IBM VM

and Unix S user/system interface and JCL. Language structures and compilers - grammars, lexical analysis, parsing and code generation. Design and implementation of a small practical language.

34621 MATHEMATICAL METHODS 1

Three semester hours

Prerequisites: 34419 *Complex Variables*, 34213 *Ordinary Differential Equations*, 34212 *Vector Calculus*

Theory of partial differential equations. Integral transforms. Greens function. Integral equations. Asymptotic expansions. Introduction to calculus of variations.

34622 MATHEMATICAL METHODS 2

Three semester hours

Prerequisite: 34621 *Mathematical Methods 1*

Orthogonal curvilinear coordinates. Laplaces equation and spherical harmonics. Legendre polynomials. Elastic waves. Greens functions.

34626 CONTROL THEORY

Three semester hours

Prerequisite: 34621 *Mathematical Methods 1*

Optimisation problems for dynamic systems. Pontryagins maximum principle (heuristic derivation). Brief discussion of the second variation. Numerical solution of optimal control problem. Introduction to optimal filtering and prediction.

34627 INFORMATION SYSTEMS 3

Three semester hours

Prerequisite: 34227 *Information Systems 2*

The systems development lifecycle, tools for system and process representation, analysis of existing information systems, proposal formulation and feasibility analysis, logical and physical design, structural design, system implementation, project management.

34628 INFORMATION SYSTEMS 4

Three semester hours

Prerequisite: 34627 *Information Systems 3*

Principles of data base management organisation. Codasyl and relational models examined. Experience and evaluation in use of DDL and DML for a data base system.

34630 SIMULATION TECHNIQUES

See 33730.

34633 DYNAMIC OPTIMISATION

See 33733.

34634 NETWORK OPTIMISATION

See 33734.

34635 INVENTORY CONTROL

See 33735.

34636 DECISION THEORY

See 33736.

34642 STATISTICS 3

Three semester hours

Prerequisite: 34342 *Statistics 2*

Point estimation; sufficiency, UMVU estimators. Hypothesis testing; Neyman-Pearson lemma, likelihood ratio tests. Bayesian methods. Finite sampling; stratified sampling; ratio estimation; cluster sampling. Simple multivariate methods.

34655 SIMULTANEOUS EQUATION MODELS

Three semester hours

Prerequisite: 34553 *Multiple Regression Models*

Identification and estimation of multiple input, multiple output models.

34667 COMPUTER GRAPHICS

Three semester hours plus three laboratory hours

Corequisite: 34507 *Computing 4*

Hardware: capabilities of typical devices such as plotters and raster-scan devices. Elementary system software: point plotting and line drawing, transformations in two dimensions (scaling, translations, rotations), clipping and windowing. Numerical algorithms for curve drawing: interpolation, splines and contour graphs. Three-dimensional transformations and co-ordinate systems. Hidden line routines.

34668 COMPUTATIONAL NUMBER THEORY

Three semester hours

Prerequisite: 34307 *Computing 2*

Prime numbers, arithmetical functions, congruences. Factorisation and primality testing, applications to cryptography. Quadratic residues. Continued fractions.

34673 ADVANCED NUMERICAL METHODS

Three semester hours

Prerequisite: 34528 *Modern Analysis*

Differentiation in normed linear spaces. Mean Value Theorem and Taylor's Theorem. Product spaces and partial differentials. Non-linear equations and Newton-Kantorovich method.

34675 CONVEXITY AND OPTIMISATION

Three semester hours

Prerequisite: 34528 *Modern Analysis*

Geometric background; convex functions. Convexity in normed space. Hahn-Banach and Krein-Millman theorems.

34677 INTEGRAL EQUATIONS

Three semester hours

Prerequisite: 34528 *Modern Analysis*

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

**34681 SPECIAL APPLICATIONS IN
OPERATIONS RESEARCH**

Three semester hours

34682 SPECIAL APPLICATIONS IN COMPUTING

Three semester hours

34683 SPECIAL APPLICATIONS IN STATISTICS

Three semester hours

**34684 SPECIAL APPLICATIONS IN
PHYSICAL APPLIED MATHEMATICS**

Three semester hours

**34685 SPECIAL APPLICATIONS IN MODERN
APPLIED MATHEMATICS**

Three semester hours

34691- PROJECT

34697 One to seven semester hours

An investigation of a topic selected by the student with the approval of the Head of School or his/her designated representative. A formal report of the investigation must be submitted. Although this is a final year subject, consideration should be given to the selection of a topic the preceding year.

34698 SEMINAR

Two semester hours

Group studies of selected topics which may vary from year to year. Topics may include hybrid computation, theory of oscillations, non-linear differential equations or aspects of computer science and operations research.

**SUBJECT OFFERED TO STUDENTS OF FACULTY
OF MATHEMATICAL AND COMPUTING SCIENCES
BY THE FACULTY OF HUMANITIES AND SOCIAL
SCIENCES**

51370 HUMAN COMMUNICATION

This course is designed to improve the student's understanding of the processes of interpersonal communication and the way these affect human interaction of work and in society.

Through workshops, seminars, and practical application, students gain experience in discussion, questioning, argument and decision making.

A second strand of the course critically examines the role and influence of the communication media in our society.

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