1989

# POSTGRADUATE STUDIES 1989



## Faculty of Mathematical and Computing Sciences

UNIVERSITY OF TECHNOLOGY, SYDNEY

*EQUAL OPPORTUNITY AND AFFIRMATIVE ACTION*

*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 or homosexuality.*

# CONTENTS



*For further information about all courses, regulations and facilities of the University of Technology, Sydney, prospective students are advised to consult the annual University Calendar which may be purchased from the Co-operative Bookshop at 11 Broadway, Broadway, or by mail from the Public Affairs and Publications Unit, University of Technology, Sydney, PO Box 123, Broadway, NSW 2007.*

*Information in this booklet is correct as at 1 August 1988. The University reserves the right to alter any information contained therein at any time without notice.*

# FACULTY OF MATHEMATICAL AND COMPUTING SCIENCES

# GRADUATE STUDIES HANDBOOK

The academic year at the University of Technology, Sydney is divided into two semesters, Students in the Faculty of Mathematical and Computing Sciences enrol in first (Autumn) semester. As a general rule, all applications should be lodged by the last working day in November, though there is provision for late enrolment.

## THE SCHOOL OF MATHEMATICAL SCIENCES

### GENERAL ADMISSION REQUIREMENTS

In certain circumstances consideration may be given to applicants not possessing formal academic qualifications but who are deemed to have suitable professional qualifications and experience to enable them to pursue graduate studies. Such applicants may be required to undertake appropriate prerequisite subjects or, in the case of the Masters course, a formal qualifying program before being admitted to the course proper.

1. **Doctorate**
   Students wishing to undertake studies within the School of Mathematical Sciences leading to the award of PhD are advised to contact the Head of School or the Graduate Assistant on 218 9609. It is suggested that indication of the field of interest be made in writing to the Head of School.
2. **Master of Applied Science (by Thesis)**
   Intending applicants to the Masters program by thesis in the School of Mathematical Sciences should contact the Graduate Assistant (218 9609) to arrange for an interview. Students should consider a possible area of research within the interests of the School, prior to their enquiry.

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 interest and specialisations exist in the following areas; some current staff project titles are also included.

**Operations Research**
Manpower Planning, Computerisation and Effects on Company Profitability
Delivery of Health Services (costs, management, computers)
Modelling of Energy Systems, Simulation Techniques

**Optics, Electronmagnetic Diffraction Theory**
Neutron Diffraction by Polycrystalline Materials
Phase Constraints for Lossy Symmetric Structures
Absorbing Diffracting Structures of Infinitesimal Thickness

**Geophysical Applications of Mathematics**
Seismic Ray Theory for Slightly Heterogeneous Lithospheric Structures
Properties of Normal Rays
Seismic Wave Propagation
Seismic Velocity Inversion
The Inverse Geophysical Problem

**Differential Geometry**
Topology and Ricci Curvature
Integral Formulas of Submanifolds of a Riemannian Manifold

**Clinical Trials, Modelling Medical Data**
Solid State Memory problems Applied to Arrays of Cells in a Tissue
Inversion of Raman Spectra of Living Cells
Stability and Uniqueness Problems in Compartmental Models for Medical Applications
Diabetic Control
Insulin Sensitivity
Modelling of Glucose and C-peptide Response Curves

**Number Theory**
Recurring Sequences
Odd Perfect and Odd Multiperfect Numbers
Primitive Abundant Numbers

**Mathematics Education**
The PhD Education of Industrial Mathematics in Australia
The Mathematical Education of Engineers
Tertiary Education in Applied Mathematics
Implications of Technological Change for Education

**Computing**
Computer-aided Instruction in Mathematics
Developments in Microcomputing Using the Apple II Series of Microcomputers
Assembly Language for Apple II Series Microcomputers
Database Management System for Diabetes
Computer Performance Modelling Using Queuing Networks
Developments of a General Purpose Graphics Package

**Statistics**
Statistics in Medicine
Measurement and Test Design
Aspects of the Problem of Permissible Statistics
Simulation of a stationary Markov sequence
Density Estimation for a Stationary Markov Sequence

**Stability Theory and Macroeconomic Modelling**
The Economics of Exhaustible Resources
Dynamics of Macroeconomic Models

Staff are involved in consulting, as well as research, and have continuing industrial contacts. They are also active in relevant professional societies and publish numerous books and journals.

## PROGRESS THROUGH THE COURSES

Masters Degree programs are normally of two-years duration on a full-time basis and three-years 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 less time. Applicants who believe themselves qualified for a reduction in time are advised to contact the Head of School, the Director of Graduate Studies or other senior members of staff in the School to discuss the matter. An overriding university requirement is that two years must elapse before the award is officially conferred.

For all graduate courses in the School of Mathematical Sciences, the Faculty Board in Mathematical and Computing Sciences has resolved that:

> Any student who records any two failures shall be automatically required to show cause to the Head of School, as to why the student should be permitted to continue, with further action being at the discretion of the Head of School.

Further information on all Gradute programs may be obtained, and interviews arranged as necessary, by contacting Mr C. Malanos, Director of Graduate Studies, School of Mathematical Sciences, Building One, UTS, PO Box 123, Broadway, 2007, or by telephoning the Graduate Assistant.

## COMPUTING RESOURCES

The School of Mathematical Sciences makes extensive use of the University's central facilities which consist of an Amdahl 470V/8 system, with 16 Mbytes of central memory and 2.5 Gbytes of disc storage, running under Amdahl UTS/V, a derivative of AT & T System 5.2 Unix.

The School also owns and operates two powerful minicomputer systems. They are - HP-9000/500 triple processor system and a MIPS M800 each with 8 Mbytes of memory and having 404 Mbytes and 256 Mbytes of disc storage respectively. The systems are each capable of supporting 32 users and run under the HP-UX (ATT System 5.2 Unix) and UMIPS/V (ATT Systems 5.3 Unix) operating sytems respectively.

Access to these systems is from three laboratories owned and operated by the School, as well as the public access laboratories operated by the Computer Services Division. Two of the School's laboratories are each equipped with 24 terminals, allowing direct connect access to either the MIPS system or general access to all systems through the University's Ethernet local area network.

The third laboratory is equipped with 16 IBM PC-XT compatible microcomputers, each with a 20 Mbyte hard disc. These machines may be used as stand-alone systems or may be connected directly to the HP system or to the local area network.

Computer Graphics is well served in the School by a range of instruments including:

- HP 2397 colour graphics terminal,
- Tektronix 4014 monochrome terminal,
- IBM PC's emulating Tektronix 4014 monochrome terminals, and
- HP 7580a A1-sized drafting plotter.

At present the graphics software consists of an extensive library of Fortran subroutines which provide both 2D and 3D facilities, that has been written inhouse.

The School has also acquired a significant quantity of software running on the HP and MIPS systems and IBM microcomputers to support teaching and research in statistics, operations research, applied mathematics and computing. This is supplemented by other software resources that are supplied centrally by the Computer Services Division.

Teaching of computing and applications of computing is assisted by the use of a Sony projection television which is installed in one of the classrooms. This enables live demonstrations of both text and graphical output in lectures and tutorials, increasing the effectiveness of the teaching process.

## MASTER OF APPLIED SCIENCE IN OPERATIONS RESEARCH (BY COURSEWORK)

Operations Research may be defined, in the words of the Journal of the Operational Research Society of the United Kingdom,

as being "the application of the methods of science to the complex problems arising in the direction and management of large systems of men, machines, materials and money in industry, business, government and defence. The distinctive approach is to develop a scientific model of the system incorporating measurement of factors such as chance and risk, with which to predict and compare the outcomes of alternative decisions, strategies or controls".

The course objective is to prepare students for high level professional work in the application of operations research to the problems of modern society. The course has been specifically designed to tackle new classes of problems, many with strong sociological implications, which have emerged in recent years. In particular, special emphasis has been placed on the areas of

* Manpower Planning, Computerisation and Effects on Company Profitability
* Delivery of Health Services (costs, management, computers)
* Modelling of Energy Systems
* Financial Modelling

The degree is awarded after the completion of prescribed coursework and the presentation of the report. Students are encouraged to become members of the Australian Society for Operations Research and to attend meetings sponsored by the Society.

## ADMISSION REQUIREMENTS

The entry requirement to the course is graduate standing, or equivalent, in an appropriate discipline, usually with a strong foundation in mathematically related areas and computing, with the consent of the Director of Graduate Studies in Operations Research or his nominee.

Special entrance is permitted to applicants who have satisfactorily completed the Graduate Diploma in Operations Research (UTS).

These applicants are required to complete only the last three semesters (27 semester hours) of the course. Such students will, however, be required to devote additional time (up to nine semester hours) during the fourth semester of formal attendance towards the completion of a substantial report. For other students exemptions may be granted up to the maximum permissible for Graduate Diploma in Operations Research students at the University.

## COURSE STRUCTURE

The course comprises a total of 54 semester hours, undertaken on a part-time basis, extending over six semesters. Each semester requires nine hours of attendance per week. The report involves

not less than 12 semester hours. The course may be completed in two years on a full-time basis with the consent of the Director of Graduate Studies.

## COURSE PROGRAM

Semester hours appear in parentheses.

*Semester 1*
Operations Research and Methodology (3)
Simulation Techniques (3)
Linear Programming (3)

*Semester 2*
Optimisation Techniques (3)
Dymanic Optimisation (3)
Decision Theory (3)

*Semester 3*
Inventory Control (3)
Network Optimisation (3)
Stochastic Processes (3)

*Semester 4*
Operations Research in Health Services 1 (3)
Manpower Planning (3)
Special Elective (3)

*Semester 5*
Corporate Financial Decisions and Investment Analysis (3)
Report (6)

*Semester 6*
Seminar (3)
Report (6)

**Electives**
Depending on availability and demand will be selected from:
Industrial Statistics (3)
Design of Experiments (3)
Impact of Computers on Traditional Mathematics (3)
Modelling with Differential Equations (3)
Applied Linear Algebra (3)
Data Analysis (3)
Numerical Analysis (3)
Financial Modelling Techniques (3)

*Special Electives*
Operations Research in Health Services 2 (3)
Large Scale Mathematical Programming (3)
Engineering Applications in Operations Research (3)
Energy and Environmental Modelling (3)
Mathematical Modelling in the Biomedical Sciences (3)
Stochastic Models in Operations Research (3)
Queuing Theory (3)
Operations Research in Public Sector Services (3)

# GRADUATE DIPLOMA IN OPERATIONS RESEARCH

## COURSE OBJECTIVE

The course is designed to train practising professional people in the application of operations research techniques under the direction of a Senior Analyst.

Satisfactory completion of the course leads to the award of the Graduate Diploma, designated as the Graduate Diploma OR (UTS). Students are encouraged to become members of the Australian Society for Operations Research and to attend meetings sponsored by the Society.

## ADMISSION REQUIREMENTS

Applicants are expected to have a sound working knowledge of calculus, statistics and computing. 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 of the applicant's level of preparation, he or she will be directed to either (i) undertake any preliminary subjects considered necessary, (ii) enter the normal course, or (iii) enter the course with advanced standing.

## COURSE STRUCTURE

This is a part-time course intended essentially for persons who are currently employed. The normal length of the course is 40 semester hours (made of four semesters, each comprising 10 hours attendance per week). However, depending upon qualifications and experience, exemptions up to a maximum of 13 semester hours may be permitted, thus necessitating a minimum attendance of 27 semester hours. The course may be completed in one year on a full-time basis with the consent of the Director of Graduate Studies.

## COURSE PROGRAM

The semester hours for each subject are given in parentheses:

| *Semester 1* | *Semester 2* |
|---|---|
| Simulation Techniques (3) | Numerical Methods (3) |
| Statistical Methods (3) | Decision Theory (3) |
| Linear Programming (3) | Stochastic Processes (3) |
| Introduction to Operations Research Models (3) | |

| *Semester 3* | *Semester 4* |
|---|---|
| Network Optimisation (3) | Optimisation Techniques (3) |
| Inventory Control (3) | Dynamic Optimisation (3) |
| Financial Modelling Techniques (3) | Project (4) |

*Electives* (subject to demand):

| | |
|---|---|
| Queuing Theory (3) | Industrial Statistics (3) |
| Design of Experiments (3) | |

## SUBJECT SYNOPSES

**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.

**33817 Numerical Analysis**
Three semester hours
*Prerequisite: Applied Linear Algebra*

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 eigenevalue problem - Jacobi's method, QR methods etc.
Interpolation - use of splines.
Solutions of non-linear equations - fixed point method, Newton's method, analysis of convergence, algorithms for complex roots.
Quadrature - the Newton-Cotes methods, extrapolation error analysis.

Solution of ordinary differential equaitons - series methods, Runge-Kutta methods, Predictor-Corrector methods, error analysis.

**33871 Impact of Computers on Traditional Mathematics**
Three semester hours

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 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. Other topics include classical control problems and partial differential equations.

**33872 Data Analysis**
Three semester hours

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, mata-analysis in the biological and social sciences.

**33873 Modelling with Differential Equations**
Three semester hours

A look at differential equations from a modern viewpoint which represents 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.

**33814 Applied Linear Algebra**
Three semester hours

Concepts of rank, kernal 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 eignevalue problem (motivated by examples from discrete and continuous systems modelling).
Similarity transformations, unitary matrices. Eigensystems of normal matrices and the least squares problems. Singular value decompositions. The generalised inverse and the least square problem. The Jordon canonical form matrix exponentials and applications.

**33730/ Simulation Techniques**
**33830**
Three semester hours
*Corequisite: Computer programming (Fortran or equivalent) and basic probability and statistics*

Fundamentals of modelling, programming, and execution of discrete event digital simulation and survey of applications. Methodological topics include modelling, random number generation, input data analaysis, initial conditions and transients sampling techniques (variance reduction techniques), verification, validation and the employment of computer languages for discrete event simulation (GASP, SEESIM, SIMSCRIPT II. 5).

**33731 Optimisation Techniques**
**33831**
Three semester hours
*Prerequisites: Linear Programming, Computer Programming and Advanced Calculus*

Review of classical optimisation methods, 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, Newton's methods, conjugate direction methods, feasible descent algorithms for constrained optimisation, quadratic programming, survey of available computer codes, geometric programming.

**33732/ Linear Programming**
**33832**
Three semester hours
*Prerequisite: Computing 2*
*Corequisite: Algebra 2*

Formulation of linear programming problems. The simplex method and its variants. Duality theory, degeneracy and post optimal analysis. Applications to industrial systems, including transportation problems, production scheduling, management games and optimisation problems.

**33735/ Inventory Control**
**33835**
Three semester hours
*Prerequisite: 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.

**33736/ Decision Theory**
**33836**
Three semester hours
*Prerequisite: Introduction to Operations Research Models*

Consideration of the general problem of decision making under risk and uncertainty. Bayesian decision analysis. Continuous prior distributions. Sampling. Utility. Game theory. Risk Analysis. Multiple objective decision making. Multiattribute utility.

**33745/ Design of Experiments**
**33845**
Three semester hours
*Prerequisite: Regression Analysis*

Design and analysis of experiments. Completely randomised, 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 MINITAB, SPSS, SAS and GLIM.

**33743/ Industrial Statistics**
**33843**
Three semester hours
*Prerequisite: Statistics 2*

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

**33747/ Stochastic Processes**
**33847**
Three semester hours
*Prerequisite: Statistics 2*

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

**33850 Operations Research in Health Services 1**
Three semester hours
*Prerequisite: Completion of subjects in first three semesters or equivalent by consent*

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 adaptation) of the appropriate techniques. Methods discussed include queueing theory, decision analysis, mathematical programming, Markov chains, simulation, inventory control. Applications will be taken from studies. Areas of application will include appointment systems, blood banking, manpower planning and scheduling, centralisation versus decentralisation. An

important consideration will be the quality of health care in terms of efficiency of provisioning of services.

**33880 Operations Research Models and Methodology**
Three semester hours
*Prerequisites: Substantial Mathematics, Statistics and Computing*

Formulation of operations research problems, construction of models, consideration of basic model prototypes (linear, network, dynamic and stochastic models), derivation of a solution, model testing and solution evaluation, implementation and maintenance, emphasis on the methodology of operations research and case studies.

**33799 Project**
Four semester hours

Investigation of an approved topics selected by the students and carried out under supervision. The aim is to develop the student's ability in the formulation and solution of an operations research-type problem from a real-life situation. Formal report of the investigation required for satisfactory completion of the project.

**33801/ Report (Masters [Operations Research])**
**33812**
One to twelve semester hours

**33823 Seminar**
Three semester hours

Formal surveys of current literature and discussion of on-going and prospective research and applicaitons of operations research. Speakers from appropriate government and industrial organisations and visiting operations research academics will be invited to participate in the seminars from time to time.

**33780 Introduction to Operations Research Models**
Threee semester hours

Formulation of operations research problems, construction of models, consideration of basic model prototypes (linear, network, dynamic and stochastic models), derivation of a solution, model testing and solution evaluation, implementation and maintenance.

**33717 Numerical Methods**
Three semester hours
*Prerequisites: Algebra 2, Computing 2*
*Corequisite: Ordinary Differential Equations*

Error analysis: discussion of the source and propagation of errors. Numerical linear algebra - Solution of linear equations: Gaussian elimination, pivoting, iterative methods. An introduction to the

eigenvalue problem: power method. Solution of non-linear equations: fixed point and Newton's methods, analysis of convergence. Interpolation: Lagrangian, divided difference interpolation. Approximation of functions: Taylor series, method of least squares, orthogonal polynomials and economisation of power series. Numerical differentiation and quadrature: instability of numerical differentiation, Newton-Cotes and Gaussian integration, Richardson's extrapolation, analysis of convergence. Ordinary differential equations: series, Runge-Kutta, predictor-corrector techniques, analysis of convergence. This is substantially a methods course which requires the students to write a number of programs demonstrating the techniques described above.

**33734/ Network Optimisation**
**33834**
Three semester hours
*Prerequisite: Introduction to OR Models*
*Corerequisite: Linear Programming*

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

**33760 Financial Modelling Techniques**
Three semester hours
*Prerequisites: Statistics 1, Calculus 2*

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.

**33733/ Dynamic Optimisation**
**33833**
Three semester hours
*Prerequisite: Statistics 1*

Bellman's principle of optimality. Recursive relations. Resource allocation. Production scheduling. Equipment replacement. Two or more state variables. Continuous state variables. Application

to linear and non-linear programming. Computer solutions. Stochastic dynamic optimisation. Optimisation over an unbounded horizon. Markovian decision processes. Approximation in policy space with discounting.

**33744 Queuing Theory**
Three semester hours
*Prerequisites: Statistics 2, 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 result for single and multiple server queues, method of stages. Special emphasis on the use of computer simulation.

**33743 Industrial Statistics**
Three semester hours
*Prerequisite: Statistics 2*

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

**33855 Manpower Planning**
Three semester hours

Manpower planning and scheduling in companies and 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 and public facilities, e.g. a hospital radiology department and telephone exchanges. Relationship between manpower, computerisation and company profitability.

**33860 Corporate Financial Decisions and Investment Analysis**
Three semester hours
*Prerequisite: Financial Modelling Techniques* (or consent of lecturer)

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

## SPECIAL ELECTIVES

**33851 Operations Research in Health Services 2**
Three semester hours
*Prerequisite: Operations Research in Health Services 1*

Continuation of operations research in Health Services 1 with additional techniques and survey of current literature on recent applicatons of operations research to health systems.

**33853 Energy and Environmental Modelling**
Three semester hours
*Prerequisite: By consent*

Modelling of energy systems on a global and 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.

**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 of single and multiple server queues, method of stages, priority queuing, applications to communication systems, data-processing systems, queues in networks.

**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, mechancial etc.) to be formulated in consultation with senior members of staff of the Faculty of Engineering.

**33857 Large-scale Mathematical Programming**
Three semester hours
*Prerequisite: Optimisation Techniques*

Theory and computational methods for optimising large-scale linear and non-linear programs, exploitation of special structure, data handling, Dantzig-Wolfe decomposition, Benders

decomposition, surrogate programming, consideration of models and applications giving rise to large-scale mathematical programs 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: Completion of subjects in first three semesters or equivalent 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 LP formulations and chance-constrained programming), finite horizon probabilistic dynamic programming, Markov chains and Markovian decision processes, and probabilistic inventory models (infinite horizon continuous review).

**33861 Operations Research in Public Sector Services**
Three semester hours
*Prerequisite: Manpower Planning*

Application of OR to selected services 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 (benefits versus cost), complexities in facilities decisions (multiple interest and uncertainty). Topics will be selected from local, state and national government levels, including urban service system, 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.

# SCHOOL OF COMPUTING SCIENCES and KEY CENTRE FOR ADVANCED COMPUTING SCIENCES

The School of Computing Sciences at the University of Technology, Sydney is one of the largest in Australia, with an academic establishment of 40 in addition to technical staff and support staff. The School of Computing Sciences is the only federally funded Centre for Advanced Computing Sciences in Australia. During 1985 the Federal Government established seven Key Centres for Teaching and Research in universities and colleges; the School of Computing Sciences at UTS was chosen as the Key Centre for Computing. The award of this Federal research funding, officially acknowledges the School's pre-eminent position in Australia. The University's main objective is to provide higher education for professionals. In line with this objective, the academic staff in the School of Computing Sciences combine high academic qualifications with years of industrial experience. Research in the School is conducted across the full spectrum from problems in pure computer science to the investigation of pragmatic issues in the Information Industry.

The staff of the School are divided into four academic groups:

Information Systems Department
Computer Science Department, comprising
- Computing Systems Unit
- Computing Methods Unit

Centre for Graduate and External Studies

The Information Systems Department is concerned both with advanced methods for holding, accessing, analysing and communicating large quantities of information, and with how these methods may be employed to advantage in a commercial environment. The Computing Systems unit deals with design and performance of systems software and hardware. The Computing Methods unit is concerned with programming style, mathematical techniques, machine intelligence, computer graphics and the theory of computation. The Centre for Graduate and External Studies is responsible for the general administration of the post-graduate programs.

The School has a number of computing facilities which are available for research work. These include an IBM 9370 Model 40, two Plexus P25's, a 4MB Gould 32/6750, a Digital Electronics Unity, specialised microcomputers and graphics equipment. The School has its own local area network which provides access to the University's local area network. The School is a major

user of the University Computer Centre's network which is based on a 16MB Amdahl 470 V/8 and supports some 200 terminals.

The School of Computing Sciences enrols post-graduate students in the following degree courses:

- Master of Applied Science (by thesis)
- Doctor of Philosophy (by thesis)
- Master of Applied Science (by coursework)
- Graduate diploma in Data Processing (by course work)

Descriptions of these four degree courses follow.

## 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 Data Bases
- Transputers
- Microprocessors and their Applications
- Distributed Databases
- 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. The School of Computing Sciences has a strong preference for research work which proceeds at a full-time pace. This preference should not be seen as a deterrent to those students who wish to remain in employment. External students, who are working in a full-time job, are encouraged to select a topic for their research which is closely aligned with their professional work. Once such a topic has been selected, the School usually requires that the student's employer provide a statement to the effect that *at least* half of the student's working week will be devoted to work which is directly relevant to the research. The student is then expected to contribute some of his or her own time to

the project which brings the total number of hours devoted to research within that expected of full-time attendance.

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. To gain this approval, applicants should initially

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

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

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

Application forms may be obtained from the Central Information Service. General enquiries should be directed to either the Central Information Service, phone 20930 ext. 9145/9262, or the Faculty Graduate Assistant, phone 20930 ext. 9609. Note that all prospective applicants should obtain approval for their proposed research work *either* from the Director, Centre for Graduate and External Studies, *or* from their chosen supervisor *before* submitting an application form for admission to this course.

## DOCTOR OF PHILOSOPHY (BY THESIS)

Until recently the Doctor of Philosophy (by thesis) was offered in association with Macquarie University. The University of Technology, Sydney is presently drawing up its own regulations for the Doctor of Philosophy degree and should be in a position to consider applications for this degree soon. In general terms, the PhD entails a more extensive investigation than the MAppSc (by thesis). 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 PhD in the School of Computing Sciences include:

- Operating Systems
- Computer Performance Evaulation
- 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 Data Bases
- Transputers
- Microprocessors and their Applications
- Distributed Databases
- Computer Systems Security

The PhD 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. The School of Computing Sciences has a strong preference for research work which proceeds at a full-time pace. This preference should not be seen as a deterrent to those students who wish to remain in employment. Students, who are working in a full-time job, are encouraged to select a topic for their research which is closely aligned with their professional work. Once such a topic has been selected, the School usually requires that the student's employer provide a statement to the effect that *at least* half of the student's working week will be devoted to work which is directly relevant to the research. The student is then expected to contribute some of his or her own time to the project which brings the total number of hours devoted to research within that expected of full-time attendance.

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. To gain this approval, applicants should initially

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

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

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

Application forms may be obtained from the Central Information Service. General enquiries should be directed to either the Central Information Service, phone 218 9145 or 218 9262 or the Faculty Graduate Assistant, phone 218 9609. Note that all prospective applicants should obtain approval for their proposed research work *either* from the Director, Centre for Graduate and External Studies, *or* from their chosen supervisor *before* submitting an application form for admission to this course.

## MASTER OF OF APPLIED SCIENCE (by course work) in Information Science

The Master of Applied Science (by course work) in Information Science degree is intended for professionals who wish to generally update their knowledge, to develop specialist skills or to prepare themselves for a career in corporate management. Students in this degree course choose 10 subjects from 16 available subjects which are grouped into four strands:

- Information Systems
- Computing Systems
- Management
- Computing Methods

In addition to their course work, students complete a major project which may be closely related to an activity in their professional life.

This degree is available on a part-time basis only. The normal duration of enrolment for this degree is three years.

A summary of the regulations for the Master of Applied Science (by course work) in Information Science follows.

## ADMISSION: The General Procedure

Prospective applicants should prepare application forms, evidence of graduate status and evidence of professional status, where:
**Application forms** refer to the two forms:
(1) *"Details of Proposed Study"*
*(2) "Application for admission - Graduate Course"*
These forms are available by writing to:
Centre for Graduate and External Studies,
School of Computing Sciences,
University of Technology, Sydney,
PO Box 123,
Broadway 2007

**Evidence of Graduate Status** should consist of a certified photocopy of a degree certificate and a certified photocopy of an authorised academic record.
**Evidence of Professional Status** should consist of a curriculum vitae containing the address of at least one referee from whom authentication can be obtained.
When these documents have been lodged with:
The Registrar and Secretary
c/- The Central Information Service,
the applicant is considered to be a **candidate for admission.**

Candidates who do not satisfy the **basic requirements** (see **ADMISSION: The Basic Requirements)** are advised directly. The remaining candidates are interviewed. Interviews commence at the end of November. As a result of the interviews, the candidate's status is determined, and a suitable academic program will be identified.

The candidate's status will be one of:
(1) an offer of a place in the course which, if accepted, leads to registration as a Master's Degree Candidate.
(2) an offer of a place as Masters Qualifying Candidate (usually to candidates with insufficient formal qualifications in computing) which, if accepted, leads to registration as a Masters Qualifying Student. An offer of a place as a Masters Qualifying Candidate will incorporate a statement of the subjects to be undertaken in the qualifying program, and a statement of the standard which is to be attained in them. Qualifying students are considered to be responsible for ensuring that they fully understand the importance of the terms of their offer of a place as a Qualifying Candidate. If a student finds these terms unsatisfactory in any way then they should

be discussed with the Director, Centre for Graduate and External Studies **before** the qualifying program commences.

(3) no offer at all (i.e. the student is rejected). Sometimes the applicant will be advised to apply again in a subsequent year (for example, when the applicant is considered to have insufficient professional experience).

The School's decision is final for the year in question. Candidates to whom offers of a place (or a Masters Qualifying place) have been made will be advised of the enrolment procedure.

## ADMISSION: The Basic Requirements

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 University's bachelors degree in Computing Science.

and

(2) an established professional career within the information industry, As a guide, the extent of the applicant's professional experience should be equivalent to that of an Associate Member of the Australian Computer Society of at least two years standing.

Consideration will be given to applicants whose background does not fit these two requirements provided that a case can be made to establish that their computing knowledge and practical experience is equivalent to that which is implied by these requirements.

An applicant with insufficient formal qualifications in computing will be required to register as a a Masters Qualifying Student. Progression to registration as a Masters Degree Candidate would then be dependent upon the results achieved in the Qualifying Program being of the standard specified in the offer of a place as a Masters Qualifying Student.

## ADMISSION: Contact Points

For further information candidates should either:
telephone:

(1) Bruce Irvine on 218 9609

(2) the School Office on 218 9245 where a "call back" message should be left.

or write to:

Director,
Centre for Graduate and External Studies,
School of Computing Sciences,
Unviersity of Technology, Sydney,
PO Box 123,
Broadway 2007.

## ADMISSION: Overseas Candidates

Students seeking admission from overseas or on student visas are requested to contact the University well in advance of the intended semester of registration. A period of six months is advised. An information sheet which is of assistance to overseas applicants is available from:

Graduate Studies Office,
Student Administrative Unit,
University of Technology, Sydney,
PO Box 123,
Broadway 2007,
Australia.

## COURSE DESCRIPTION: General

The course is only available part-time: all timetabled sessions are held in the evenings, usually between 5.00 pm and 9.00pm.

The course consists of:
(1) **subjects** (comprising: lectures, tutorials and laboratory sessions)
(2) project
(3) seminars

The subjects will be chosen from the 16 different subjects offered by the School. These are grouped into four strands of four subjects each. There will be four subjects to choose from in each semester, one from each of the four strands. It is important to note that the academic program chosen must contain one complete four subject strand and at least one subject from each of the other strands.

The subjects and project together must total 48 semester hours. Students normally complete eight subjects and an eight-hour project. However, if in the opinion of the project supervisor the topic chosen merits a more substantial investigation then permission may be given to extend the project to a 12-hour or 16-hour project. A student will usually enrol in two subjects (or equivalent hours of project) per semester. In addition, all students must enrol in the "Seminar" subject in every semester. Thus, a

student can expect to complete the course in three years of part-time study,

If a student wishes to change his academic program during a semester then the following rules apply. A student must enrol in all subjects in which the student wishes to be examined before the end of the fourth week of semester. If a student wishes to withdraw from a subject without penalty then the student must do so before the eighth week of semester. If a student is unable to attend classes at any time after the end of the eighth week then Bruce Irvine (telephone 218 9609) should be notified immediately.

Students are permitted at most one failure during the MAppSc in Information Science. A student obtaining a second failure will be totally excluded from the course. In addition, students are bound by the rules of the University, and are advised to refer to them. Two important rules are:

- A Masters Degree Candidate shall not normally be eligible for the award of a Masters Degree by Coursework until he/she has completed at least six semesters of a part-time course. A student who is specially qualified in a relevant discipline may, with the approval of the Academic Board, be allowed to complete the course in less than the minimum time.
- A student who fails to complete all of the work prescribed for the higher degree within nine semesters from the time of his/her registration as a part-time Masters Degree Candidate will only be permitted to continue with the approval of the Academic Board.

## COURSE DESCRIPTION: Fees

There are no tuition fees. Enrolling students are required to pay the following compulsory fees at the time of enrolment. Currently, they are:

| | |
|---|---|
| Students' Association | $ 37.00 |
| University Union | 100.00 |
| University Union Entrance Fee (non-refundable) | 15.00 |
| Total | $152.00* |

*subject to revision

In addition all students are required to pay an Administration Charge of $263 (also subject to revision). Some students are exempt from paying the administrative charge - please refer to the Central Information Service.

## COURSE DESCRIPTION: Prerequisites

All subjects in the MAppSc are presented entirely at the postgraduate level. Students are expected to be familiar with the undergraduate material which lies behind the postgraduate work. Before the start of each semester, a set of references to the presumed undergraduate material is given by each lecturer. It is important to note that these references are not "pre-reading", but are a summary of the undergraduate knowledge required by each subject. Students are responsible for ensuring that they are completely familiar with the undergraduate knowledge implied by the references. If they are not, then they should defer their enrolment in that subject and should attend suitable remedial undergraduate lectures.

In addition, there are prerequisite requirements within the structure of the course itself, see "COURSE DESCRIPTION: Subject Synopses".

## COURSE DESCRIPTION: Prizes

"The Datec Masters Project Award"
This prize of $350 will be awarded each year to the student who has obtained the highest mark in the Project subject of all students graduating in that year.

"The IBM Prize for Computing Research Seminar"
This prize of $200 will be awarded annually in recognising excellence in the presentation of research seminars.

## COURSE DESCRIPTION: Project

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

The topic for the project should be :
- of direct interest to the student; and
- of value to the student's professsional development.

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

Students are advised to seek the assistance of the lecturing staff in finalising the topic for their project.

The project will result in:

(1) the production of an extensive **written report**. Three copies of this report should be lodged with the Director, Centre for Graduate and External Studies before the end of the twelfth week of the semester in which the student wishes to be examined. All three copies will be retained by the School, one of these will be placed in the University Library.

(2) an **oral presentation** of 40 minutes followed by 20 minutes discussion with the examiners. Students should arrange a time for their own presentaiton with the Director, Centre for Graduate and External Studies when they submit their written report. The oral presentation should be delivered before the end of the fifteenth week of the semester in which the student wishes to be examined. The oral presentation should consist of a discussion of the more highly controversial or technical issues within the written report.

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

## COURSE DESCRIPTION: The Seminar Subject

All students should enrol in the **seminar subject** each semester. To pass the seminar subject students must attend the "research seminars" and contribute to the discussions following them, see (2) below. They must also deliver three presentations of satisfactory standard before completing the course. One objective of the seminar subject is to develop the student's skill in making a technical presentation.

The **seminar subject** refers collectively to three different activities:

(1) a **literature review** (10 minutes plus five minutes questions) of statisfactory standard must be presented. This is undertaken in the first year of study.

(2) a **research seminar** (40 minutes plus 10 minutes questions) of satisfactory standard must be presented. This is undertaken in the second year of study. See "COURSE DESCRIPTION: The Research Seminar" for a general description and specification of guidelines. The research seminars will be presented on an evening separate from, and additional to, the timetabled subjects. *All* students enrolled in the Master

of Applied Science in Information Science are required to attend the research seminars. Students who have failed to attend at least 70% of the scheduled seminars in any semester will not normally be permitted to present for examinations in that semester.

(3) an **oral presentation** (40 minutes plus 20 minutes discussion) which will be examined as part of the project work (see "COURSE DESCRIPTION: Project"). This is undertaken in the final year of study. The oral presentations will be timetabled before the end of the fifteenth week of the semester in which the student wishes to be examined. There is no requirement for students to attend the oral presentations of other students.

If a research seminar or literature review is judged to be of unsatisfactory standard then the student will be advised and given the opportunity to make another presentation possibly on a different topic.

Note the requirement in (2) above for *all* students to attend the research seminars.

## COURSE DESCRIPTION: Subject Synopses

## MANAGEMENT STRAND

**32400 Accounting for Management**
Four semester hours

The managerial aspects of accounting will be the main area of interest. This will involve consideration of the nature of accounting both in its traditional role and as an aide to management. The nature of costs and the various aspects of cost accounting will be covered in some costs and the various aspects of cost accounting will be covered in some detail. The effect of inflation on costs, profits and capital replacement decisions will be covered in depth. The use of funds analysis and balance sheet ratios to assess operational efficiency will also be covered.

**32401 Management Policy and Strategy**
Four semester hours

Management Policy and Strategy is a subject which considers the essential tasks of management in formulating, organising and implementing strategy; topics covered include: 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.

**21718 Organisation Analysis and Design**
Three semester hours

Historical perspective; components of organisational structure; consequences of structural deficiencies; structural contingencies; limitations of organisation design. Aspects of organisation design - job design; communication; differentiation; integration; control and organisation performance. Factors affecting organisation design - ideology of management; technology of organisation; personal skills of employees; environment of organisation; size of organisation; goals of organisation; politics of organisations. Organisational Futures - the development of large-scale organisation and bureaucracies; organisations of the future and "beyond the work ethic".

**22729 The Legal Environment of Business**
Three semester hours

This subject will examine the following topics: law, society and other values; parliament and government; the constitution; contracts; torts; industrial property; principal and agent; partnership; companies; restrictive trade practices; taxation; foreign investment regulation; The law of international business in Australia. Students have a choice of specialisation in Trade Practices or Computer Law.

## COMPUTING METHODS STRAND

**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 will include networks, queueing models, and corporate and financial models. Mathematical programming and simulation tools will be discussed, as will the role of problem formulation, data collection, sampling and sensitivity analysis. An analysis of decision processes will include a study of probabilistic modelling techniques, decision making under uncertainty, decision trees, influence diagrams, utility theory and risk analysis.

**32105 Specialist Topics in Artificial Intelligence**
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.

## INFORMATION SYSTEMS STRAND

**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 data base design. Formulation and use of data dictionaries or metadata bases by the analyst, designer and programmer. Relational data bases; advanced query languages and data base standards. Operational design considerations; recovery and restart, security and data base audit. Performance and reorganisation, efficiency and cost. These considerations to be investigated for centralised and distributed systems, including current advantages and limitations. Tools and techniques for communications and control of data bases, for distributed systems.

Trends in hardware for associative memories and back processors, intelligent disc controllers and data base machines; designs for secure data base management. Current status of offerings including IMS, Total, Adabas, Codysl and relational implementations.

**32202 Communication Systems**
Four semester hours

The 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, manipulation, validity, and timeliness, security and availability consistency and flows of information sets within an organisation, integration of functional systems through common flows, access, authorisation and encryption. Planning and implementation of enhanced information systems. Project control and estimation techniques, overall systems design, implementation, testing and maintenance tools. Post implementation reviews and audits.

## COMPUTING SYSTEMS STRAND

**32301 Performance Evaluation**
Four semester hours

Revision and extension of queueing theory. Analytic models of computer systems and their application to performance evaluation. Brief revision of EDP planning principles. Application of performance evaluation principles to capacity management - modelling the growing system.

**32302 Computer Architecture**
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.

**32304 Computer Languages**
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 will cover such topics as parallelism in processor design, the distribution of intelligence storage technology and the incorporation of high-level language capabilities as well as operating systems features in hardware.

**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.

## OTHER SUBJECTS

**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.

**Project**
**32908** 8 semester hours
**32912** 12 semester hours
**32916** 16 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.

# GRADUATE DIPLOMA IN DATA PROCESSING

## COURSE OBJECTIVES

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 course is a working knowledge of Pascal and COBOL. For intending applicants who do not have the required knowledge in COBOL and Pascal, extension courses are offered in these areas each semester. There is a cost attached to these which may be ascertained by contacting the School or Insearch Ltd. In addition, applicants should have graduate status, 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.

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

## COURSE PROGRAM

The course offered is part-time only, two evenings and one afternoon per week. The semester hours for each subject are indicated in parentheses. The course comprises a total of 36 semester hours of formal coursework. One semester hour means one hour per week for the semester.

Applicants should be aware that the course is at present being reviewed and the following should be taken as an approximate guide only.

*Semester 1 (Autumn)*
Introduction to Information Systems (3)
Introduction to Computer Systems (3)
Programming Techniques (3)

*Semester 2 (Spring)*
Information Systems 2 (3)
Commercial Programming 1 (4)
System Analysis and Design 1 (3)

*Semester 3 (Autumn)*
Select 3 subjects
31913 Accounting Systems (3)
31757 Languages & Processors (3)
31820 Systems Analysis & Design 2 (3)
31825 Data Processing Management (3)
31832 Data Communications & Computer Networks (3)
31836 Commercial Programming 2 (3)

Or other approved subjects from the undergraduate program.

*Semester 4 (Spring)*
Select 3 subjects
31758 Communications Programming (3)
31760 Performance Evaluation (3)
31829 Operating Systems (3)
31835 Programming Packages (3)
31838 Information Systems 3 (3)

or other approved subjects from the undergraduate program.

## SUBJECT SYNOPSES

**31757 Language and Processors**
Three semester hours
*Prerequisites: Programming Techniques, Introduction to Computer Systems, Programming Principles 2*

Provides an introduction to languge processors, eg compilers, and the study of programming languages. Students are set an assignment consisting of the writing of a compiler for a simple language.

**31758 Communications Programming**
Three semester hours
*Prerequisites: Operating Systems, Data Communications & Network Systems*

Discusses the mechanics of operation of communications systems using the ISO reference model for layered protocols. Some aspects of communications systems implementation, and the effects of design decisions on system users are also covered.

**31760 Performance Evaluation**
Three semester hours
*Prerequisites: Data Communications & Network Systems*

This course 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.

**31802 Introduction to Information Systems**
Three semester hours

An introduction to the applications of information systems and typical measurements, techniques and resources used in information systems. Common business applications and business systems are examined with general illustrations from word processing and small business computers rather than from specific computer types and techniques examined in later subjects.

**31805 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.

**31815 Commercial Programming 1**
Four semester hours
*Prerequisites: COBOL and Introduction to Information Systems or equivalent*

The application of structured design techniques to COBOL programming in batch-oriented commercial systems. The students design, document, implement and test an integrated system.

**31816 Information Systems 2**
Three semester hours
*Prerequisite: Introduction to Information Systems*

Develop familiarity with file concepts and terminology, standard file organisations used in commercial data processing and the hardware and software required to support them. Students should be able to assess the suitability of various file organisations for given applications including retrieval on multiple keys.

Standard procedures for security; backup and recovery in file systems is also covered.

**31819 Systems Analysis/Design 1**
Three semester hours
*Prerequisite: Introduction to Information Systems or Information Systems 1 (Laboratory)*

This subject covers the theory and practice of Information Systems work using the logical modelling tools of Structured Analysis. It shows how this specification methodology is used in the derivation and evaluation of competing design options for the physical implementation of systems (elaborated in SAD2). The variety of information systems and the different approaches to their analysis are also considered.

**31820 Systems Analysis/Design 2**
Three semester hours
*Prerequisite: Systems Analysis/Design 1*

This subject develops one of the options produced by the analysis (covered in SAD1) from a systems model to a physical design. Computer Systems Design covers the tools and qualities of structured design, including packaging, testing and implementation. Human aspects of Systems Design covers screen and forms design, operations, procedures, etc.

**31825 Data Processing Management**
Three semester hours
*Prerequisite: Industrial Experience*

Develops skills in managing a DP system, in establishing effective controls and in making written presentations.

**31829 Operating Systems**
Three semester hours
*Prerequisite: Introduction to Computer Systems*
*Corequisite or Prerequisite: Programming Techniques*

Introduces the student to the concepts and facilities available in a computer operating system. The course includes scheduling, multi-programming and job control language.

**31831 Programming Techniques**
Three semester hours
*Prerequisite: PASCAL, COBOL*

Structured programming techniques such as modular design, documentation and layout, program specification and verification. The basic data types are covered and associated searching, selecting, sorting, additions and deletion methods for manipulating data in these structures are given, analysed for efficiency and proved correct. The subject serves to introduce the systematic solution of common problems as well as providing an introduction to program analysis and verification.

**31832 Data Communications and Computer Networks**
Three semester hours
*Prerequisite: Introduction to Information Systems or Information Systems 1 (Laboratory)*

The study of data communication in computer and terminal networks. Basic data communication concepts, network components, network design, telecommunication facilities, introduction to communication protocols and network architectures.

**31835 Programming Packages**
Three semester hours
*Prerequisite: Commercial Programming 1 or Commercial Programming 1 (Laboratory)*

The principle of design and use of programming packages. The material will include packages used in commerce, management science, industry and specialised areas.

**31836 Commercial**

**31836 Commercial Programming 2**
Three semester hours
*Prerequisite: Commercial Programming 1*

This subject covers the life cycle of on-line commercial application systems from a programmer's 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.

The design and implementation of on-line commercial software systems. Maintenance programming and application software development teams. RPG programming.

**31838 Information Systems 3**
Three semester hours
*Prerequisites: Commercial Programming 1 and Information Systems 2*
*Corerequisite: Systems Analysis/Design 2*

The main objective of this subject is to provide a comprehensive introduction to database management. Students will be introduced to basic components of database systems and the methodology of database design.

The relational approach will be emphasised throughout this subject and extensive use of Structured Query Language (SQL) will be made. The subject involves a practical introduction to

a Relational Database System using the Oracle UNIX Relational DBMS running under the O/S on the Amdahl computer at the University.

A review of the concepts and principles of database management.

The use of data modelling in the design and implementation of a database. The student will do simple assignments using database software, to provide sufficient background to contribute to major database systems.

**31913 Accounting Systems**
Three semester hours

Accounting Systems is concerned with achieving an overall appreciation of accounting, to understand its processes and methods. The subject is in two parts, firstly a study of financial accounting and double entry booking, secondly an examination of management accounting in order to understand cost accumulation methods and use of accounting for planning and control.

PUBLIC AFFAIRS AND PUBLICATIONS
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