E UNIVERSITY OF NEWCASTLE

New South Wales


# FACULTY OF MATHEMATICS HANDBOOK

CALENDAR
1982

## Volume 8

# THE UNIVERSITY OF NEWCASTLE

## NEW SOUTH WALES

LEGEND

| BUILDINGS | DESIGNATION |
|---|---|
| ARTS/ADMINISTRATION | A |
| LG = LOWER GROUND FLOOR | |
| G = GROUND FLOOR | |
| 1 = FIRST FLOOR | |
| ADMINISTRATION | LG, G & 1 |
| CLASSICS | LG |
| COMMUNITY PROGRAMMES | LG |
| COMPUTING CENTRE | G |
| ENGLISH | 1 |
| HERSU | 1 |
| HISTORY | LG |
| LINGUISTICS | 1 |
| MODERN LANGUAGES | G |
| PHILOSOPHY | 1 |
| UNIVERSITY COUNSELLING SERVICE | LG |
| MAIN LECTURE THEATRE | B |
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| CHEMICAL ENGINEERING | EA |
| CIVIL ENGINEERING | EA |
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| CENTRAL FACILITIES | HA |
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| WARDENS RESIDENCE | HR |
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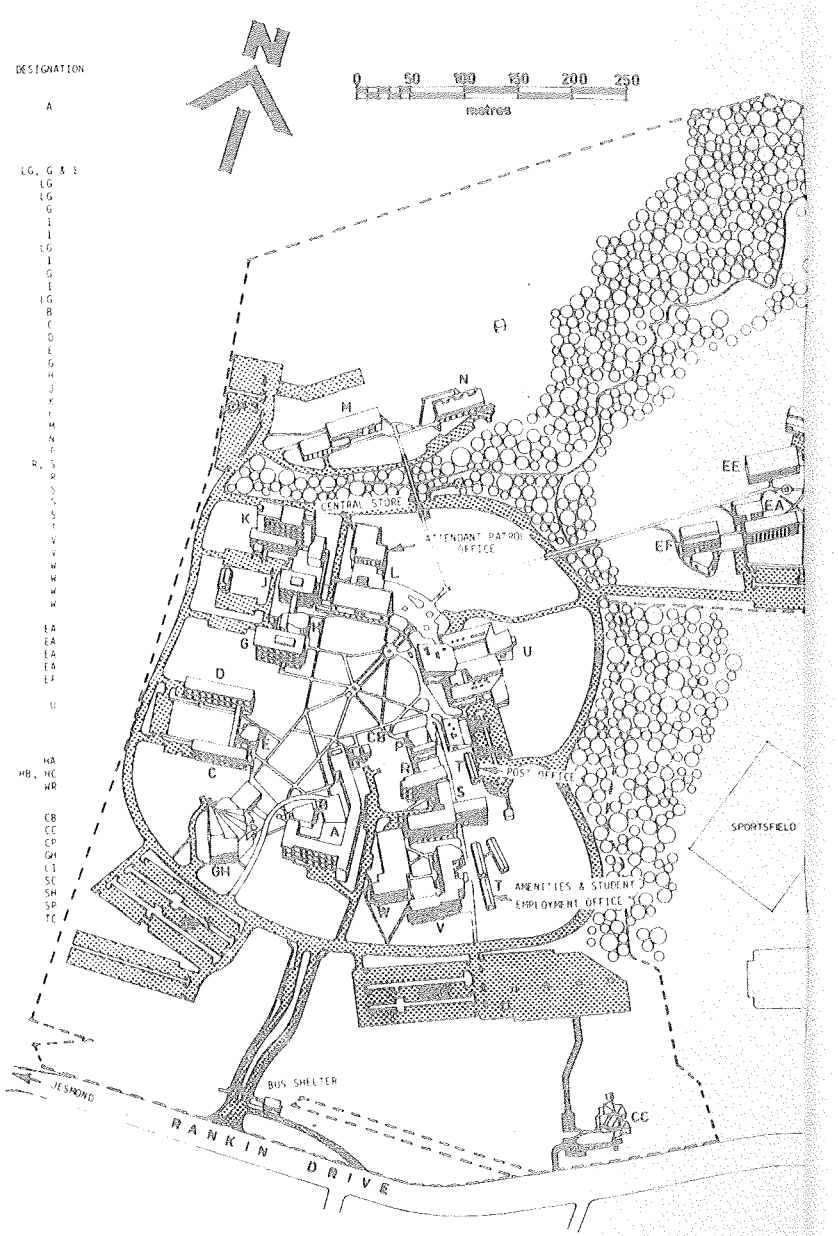
| COMMONWEALTH BANK | CB |
| COMMUNITY CHILD CARE CENTRE | CC |
| CAR PARK | CP |
| GREAT HALL | GH |
| LODGE | LI |
| AUCHMUTY SPORTS CENTRE | SC |
| STAFF HOUSE | SH |
| SPORTS PAVILION | SP |
| TENNIS COURTS | TC |




# FACULTY OF MATHEMATICS HANDBOOK 1982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## Preface

I am happy to welcome to the Faculty of Mathematics all those students who are enrolling for the B.Math. degree for the first time, and to welcome back those people who are now in their second or later years of study. I hope that we in the Faculty of Mathematics will have the pleasure of extending this welcome, eventually, to at least some of the readers of this Handbook who may be undecided on their exact course of study, but who are interested in some field of mathematics. If any information which you seek is not found in this Handbook, or if you simply have general questions about your course of study or about aspects of mathematics, please accept a standing invitation to discuss your questions with me. I expect that all members of the academic staff of the Faculty will be similarly able to help you with these questions.

Your desire to study mathematics is, I hope, based on the conviction that mathematics will be the most enjoyable of all those disciplines open to you — there can be no better reason. If you enjoy mathematics you will welcome the demands it makes upon you and your studies will be most rewarding. I would like to commend to you the essay on Mathematics by Professor E. C. Zeeman in the book **University Choice** (edited by Klaus Boehm) pp. 261-270, Penguin 1966.

Although Faculties of Mathematics are not uncommon overseas, particularly in universities which have been founded within the last twenty years, the Faculty of Mathematics at the University of Newcastle was the first in Australia. This lead has now been followed by several other Australian universities.

It is probably still true that the most common location for Departments concerned with mathematics in universities world-wide is in a Faculty of Science. This is an historical reflection of the fact that mathematics has been associated most closely with scientific subjects, particularly the physical sciences, and has played a crucial part in their development, in the last 150 years. Before this period, Faculties of arts were the most common homes for mathematics in universities, again for good historical reasons. The relatively recent arrival of Faculties of Mathematics on the scene is evidence of the increasing recognition of a more modern fact: that mathematics and the use of mathematical language and ideas have a place in all university studies, and are not exclusive to any one area. The best way in which we can do justice to this universality is to exist in a distinct Faculty of Mathematics having intellectual links with all other disciplines.

In Newcastle we have given practical effect to these links by introducing programmes of study which lead to the award of the B.Math degree together with other first degrees of the University. The other fields with which combined degree programmes have been available since 1975 are Arts, Science, Metallurgy and Commerce. More recently, we have put into effect arrangements for combined degree programmes with Engineering and with Economics. The details of the joint degree courses which are available this year are given in the section of this Handbook which begins at page 18.

The distinctive position that the Faculty of Mathematics occupies has advantages for all students with an interest in mathematics who wish to work towards a single degree. For those whose tastes are specifically mathematical, the advantages scarcely need any special comment. For other people, who may realise the need for mathematical study as an adjunct to their principal subjects, we provide a variety of courses, as set out in the following pages. We are always attentive to the advances in mathematics and related subjects which may make new or revised courses necessary; evidence of this is easy to find from a comparison of the contents of the present Handbook with the contents of previous editions.

Not all the areas of mathematical work which are of importance to the Faculty have the word "mathematics" in their titles. Operations research ("the mathematical description of what actually happens, rather than what ought to happen", according to one of the originators of the subject) is one example. Two others, in which the Faculty's activity is being expanded substantially at present, are statistics and computer science. For several years the Faculty has offered a postgraduate Diploma in Computer Science, and in 1977 it introduced the undergraduate subject Computer Science II. Our range of undergraduate studies in computer

science was completed in 1978 by the presentation of the new subject Computer Science III. A similar extension of our undergraduate offerings in statistics was provided in 1979 with the introduction of Statistics III. Both of these areas, of course, provide points of contact between mathematics and many other subjects. For that reason, mathematicians with special knowledge of computer science or of statistics can expect to be citizens whose skills will always be in demand. From this year graduates with such special knowledge will, if they so wish, complete the degree of B.Math with Computer Science or Statistics and have their testamur appropriately endorsed.

The Council of the University has now approved a course leading to a postgraduate Diploma in Medical Statistics; this course will be offered jointly by the Faculties of Mathematics and Medicine. The field of Medical Statistics is one for which a growing demand is evident in many countries overseas and there is an increasing demand in Australia for people trained in this profession. The Diploma will be offered for the first time in 1982 to students who have a suitable first degree; it is not available at any other University in Australia.

University education is not merely a question of attending courses. The University provides an environment in which your self-education can take place. Naturally, courses are part of the environment, but not the whole of it. The lecturer and the laboratory are not the only sources of information; you can reasonably expect to gain as much from discussions, debates and arguments with your fellow-students, because this type of interaction allows you to try out on other people with similar concerns your ideas about what you are learning. By "learning" I mean your appreciation of how the material you meet in your formal courses fits into a wider understanding of the world and of its problems. If you see your University education in this light, you can deduce that you should take every opportunity to broaden your outlook while you are here. The various student clubs and associations in the University provide one type of opportunity. There is another opportunity in the wide range of interests of your fellow-students; it is a better policy to find your friends and acquaintances at the University in a variety of studies than to confine yourself to meeting only with people whose courses are the same as yours.

I repeat my earlier welcome to you all, and wish you an enjoyable and constructive stay at the University.

R. G. KEATS,
**Dean, Faculty of Mathematics.**



CONTENTS

**Faculty of Mathematics**

## FACULTY OF MATHEMATICS

**Dean**
Professor R. G. Keats, BSc, PhD(Adelaide), DMath(Waterloo), FIMA, FASA

**Sub-Dean**
Dr. D. L. S. McElwain, BSc(Queensland), PhD(York, Canada)

**Faculty Secretary**
Linda S. Harrigan, BA

## MATHEMATICS

**Professors**
R. G. Keats, BSc, PhD(Adelaide), DMath(Waterloo), FIMA, FASA
R. W. Robinson, BA, MA(Dartmouth), PhD(Cornell)

**Associate Professors**
W. Brisley, BSc(Sydney), MSc(New South Wales), PhD; DipEd(New England) **(Head of Department)**
C. A. Croxton, BSc(Leicester), MA, PhD(Cambridge), FAIP, FInstP(Lond)
J. R. Giles, BA(Sydney), PhD; DipEd(Sydney)
A. J. Guttmann, MSc(Melbourne), PhD(New South Wales)
P. K. Smrz, PromPhys, CSc, RNDr(Charles)
W. D. Wallis, BSc, PhD(Sydney)

**Senior Lecturers**
Annette J. Dobson, BSc(Adelaide), MSc, PhD(James Cook)
R. B. Eggleton, BSc, MA(Melbourne), PhD(Calgary)
V. Ficker, PromMat, CSc, RNDr(Comenius)
R. W. Gibberd, BSc, PhD(Adelaide)
W. T. F. Lau, ME(New South Wales), PhD(Sydney), MAIAA
D. L. S. McElwain, BSc(Queensland), PhD(York (Canada) )
T. K. Sheng, BA(Marian College), BSc(Malaya & London), PhD(Malaya)
R. J. Vaughan, BSc, MEngSc, ME(New South Wales), PhD(Adelaide), FSS

**Lecturers**
R. F. Berghout, MSc(Sydney)
D. W. E. Blatt, BSc(CompSc), BSc, PhD(Sydney)
J. G. Couper, BSc, PhD(New England)
M. J. Hayes, BA(Cambridge)
W. Summerfield, BSc(Adelaide), PhD(Flinders)
W. P. Wood, BSc, PhD(New South Wales), FRAS

**Senior Tutors**
C. J. Ashman, BA, LittB(New England)
G. W. Southern, BA(New South Wales), DipCompSc

**Honorary Associate**
I. L. Rose, BE(Sydney), PhD(New South Wales)

**Research Fellow**
J. Reeve, MSc(Canterbury), PhD(Alberta)

**Computer Programmer**
A. Nymeyer, BMath, DipCompSc

**Departmental Office Staff**
Cath Claydon
Jan Garnsey
Julie H. Latimer
Anne M. McKim

Students are invited to discuss their interests in a particular branch of mathematics with members of the Department who are working in that branch. The appropriate staff members



for each branch may be determined by reference to the section entitled "Research in the Department of Mathematics" p. 109.

### A Guide to Students Enrolling in the Course Leading to the Degree of Bachelor of Mathematics

1. It is usually assumed that students will have studied 2-unit Mathematics. Lectures in Mathematics I have been planned to accommodate students who have taken 2-unit Mathematics. Those students who have taken more units of Mathematics will find the extra knowledge and practice very helpful. Experience has shown that students who undertake first year programmes consisting mainly of subjects which rely heavily on Mathematics are much more successful if they have at least 3 unit Mathematics. A programme of this sort is Mathematics I, Physics IA, Engineering I and Chemistry I.

2. The requirements for the degree allow for up to four of the nine subjects to be chosen from subjects offered in other degree courses. Subjects which have been approved in the past are listed below.

| | Part I | Part II |
|---|---|---|
| Accounting I | Geology I | Biology IIA, IIB & IIIA |
| Biology I | German IS or IN | Chemistry IIA |
| Chemistry I | Greek I | Classical Civilisation II |
| Classical Civilisation I | History I | Economics IIA & IIB |
| Drama I | Japanese I | Education II |
| Economics IA | Latin I | Electronics & Instrumentation II |
| English I | Legal Studies I | English IIA |
| French IN or IS | Linguistics I | French IIA, IIS & IIB |
| Geography I | Philosophy I | Geography IIA, IIB, & IIIB |
| | Physics IA or IB | Geology IIA & IIB |
| | Psychology I | German IIA, IIS & IIB |
| | Sanskrit I | History IIA, IIB & IIC |
| | Sociology I | Japanese IIA |
| | | Legal Studies IIA |
| | | Philosophy IIA & IIB |
| | | Physics II |
| | | Psychology IIA & IIB |

3. Enrolment in the following subjects is restricted as indicated below.

   *Economics IIA* — Students should also include the Part II Mathematics Topic H, Probability and Statistics, in their course.

   *Economics IIB* — This subject would not normally be included in the Bachelor of Mathematics course. However if permission is given to include this subject then the content should be discussed with the Dean.

   A student may not include both Physics IA and Physics IB in his course.

4. Permission will normally be given for the inclusion in a student's course of subjects which are prerequisites of corequisites of subjects appearing in the schedules.

### Review of Academic Progress in the Faculty of Mathematics

Acting under the Regulations Governing Unsatisfactory Progress, as set out in Volume I of the Calendar, the Faculty Board will review:

(1) all full-time students who have failed to pass at least four subjects at the end of the second year of attendance;

(2) all part-time students who have failed to pass at least four subjects at the end of the fourth year of attendance;

(3) all students who have failed to pass at least four subjects after one full-time and two part-time years; and

(4) all students, whether part-time or full-time, who in their first year of attendance have a record of complete failure,

and may take action under the Regulations.

Unless there are mitigating circumstances, a student who fails any subject twice may not be permitted to enrol again in that subject.

## Prerequisites for Curriculum and Method Subjects Offered in the Diploma in Education

Students in the Faculty of Mathematics who are intending to study for the postgraduate Diploma in Education may be interested in the following prerequisite subjects for that Diploma.

These prerequisites are stated in terms of subjects of the University of Newcastle. Applicants with qualifications from other universities, or in 1981 or 1982 from this University whose courses of study have included subjects which are deemed for this purpose to provide an equivalent foundation, may be admitted by the Dean of the Faculty of Education on the recommendation of the Head of the Department of Education.

In the Diploma course the Curriculum and Method units, now known as Group C, are grouped as follows:

Humanities (English, History)
Geography and Social Science (Geography, Commerce, Social Science)
Mathematics and Science
Languages (French, German)
Primary

**Prerequisites**

For *secondary* methods a Part III subject in the main teaching area and a Part II subject in another teaching area.

For *primary* method a Part III subject in at least one teaching area, or a Part III subject in Psychology or Education together with a Part II subject in a teaching area.

**Note**

A Part II subject assumes as a prerequisite a pass in a Part I subject in the same discipline. A Part III subject assumes a pass in a Part I subject and a Part II subject in the same discipline.

## Mathematics Education Subjects

Candidates for the degree of Bachelor of Mathematics intending a career in teaching may wish to include professional studies related directly to teaching in addition to, and concurrently with, the normal course of study in the second and third years by enrolling in Mathematics Education II and Mathematics Education III, the contents of which are set out below.

**160406 Mathematics Education II** — T. H. MacDonald (not offered in 1982)

| | |
|---|---|
| *Prerequisite* | Mathematics I |
| *Pre- or Corequisite* | A Part II Mathematics subject |
| *Hours* | 1 lecture hour per week and two 5-day schoolroom observation periods |
| *Examination* | One 2-hour paper |



*Content*

Learning mechanisms, stages of development as delineated by Piaget and others, discovery method and its limitations, Bruner model, and multiple embodiment principle; these topics are central to understanding the learning process and the conditions which make learning possible. Equivalence and equality, consistency and meaning in mathematical definitions, sets and intellectualism in mathematics, finite and categorical geometrics; these topics are chosen to illuminate the rationale for teaching mathematics and the problem of developing strategies for teaching school mathematics, particularly in the light of the rapid development of mathematics since the seventeenth century. Psychopathological aspects of arithmetic, pedagogical problems associated with geometries, imagery and problem solving; these and other topics bear on how much in the way of new concepts pupils can be expected to absorb at various levels.

| | |
|---|---|
| *Text* | Nil |
| *References* | |
| Berlinghoff | *Mathematics: The Art of Reason* |
| Eves & Newsome | *An Introduction to the Foundations and Fundamental Concepts of Mathematics* |
| Pedoe | *The Gentle Art of Mathematics* |

**160407 Mathematics Education III** — T. H. MacDonald (not offered in 1982)

| | |
|---|---|
| *Prerequisite* | Mathematics Education II |
| *Pre-or Corequisite* | A Part III Mathematics subject or Statistics III |
| *Hours* | 1 lecture hour per week and two 5-day schoolroom observation periods |
| *Examination* | One 2-hour paper |

*Content*

Building on the foundation laid in Mathematics Education II, a more thorough study is made of the psychology of learning, limits on the ability to learn and the development of teaching strategies in mathematics. Assignments will require students to articulate mathematical insights they are acquiring concurrently in the academic mathematics topics. The integration of mathematical ideas from different topics will be emphasized, as this is required for effective teaching. In the observation periods, lesson plans will be studied and compared with the results in the classroom.

| | |
|---|---|
| *Text* | Nil |
| *References* | |
| Courant & Robbins | *What is Mathematics?* |
| Polya | *Mathematical Discovery* |
| Waissmann | *Introduction to Mathematical Thinking* |

## *MATHEMATICS WITH ONE OTHER DISCIPLINE*

Although there is a wide range of optional subjects in the degree course for the Bachelor of Mathematics it is essential that these be chosen with care, especially by those candidates who aim to apply Mathematics to some specific discipline. In many such cases it is essential to include certain Part I subjects in the first year of the degree course if it is to be completed in minimum time. Specific programmes leading to a B.Math. with Computer Science or a B.Math. with Statistics are included in the degree requirements. Examples of other programmes are given below; the list is not exhaustive and students are invited to consult the Dean concerning other possible programmes, including part-time programmes.

*B.Math. with Accounting*

Year 1 Mathematics I, Accounting I, Legal Studies I and one other subject.
Year 2 Mathematics IIA, Mathematics IIC, Accounting IIC.

Year 3 Mathematics IIIA, Accounting IIIC (Accounting IIIB and Financial Management option).

The course should also include one additional subject chosen from (1) Taxation, or (2) Law of Contract and Law of Business Organisations.

Note (i) Taxation may, with the permission of the Dean, be included in the programme for Year 1.

(ii) Law of Contract and Law of Business Organisations count as one subject for the Degree of Bachelor of Mathematics.

(iii) In order to complete the educational requirements for the professional bodies, it is necessary to pass Auditing in addition to the above subjects. The student is advised to continue his studies by completing the Diploma in Business Studies in which case one of (a) Taxation, or (b) Law of Contract and Law of Business Organisations may be included in the Diploma together with Auditing.

*B.Math. with a discipline from the Faculty of Science, e.g., Psychology*

Year 1 Mathematics I, Psychology I and two other subjects.
Year 2 Mathematics IIA, Mathematics IIC and Psychology IIC.
Year 3 Mathematics IIIA, Psychology IIIC.

*B.Math. with an Engineering discipline, e.g., Civil Engineering*

Year 1 Mathematics I, Engineering I and two other subjects (Physics IA is recommended).
Year 2 Mathematics IIA, Mathematics IIC and Civil Engineering IIM.
Year 3 Mathematics IIIA and Civil Engineering IIIM.

*Concurrent B.Math. and Diploma in Computer Science**

Year 1 Mathematics I and three other subjects.
Year 2 Mathematics IIA, Mathematics IIC and one other subject.
Year 3 Mathematics IIIA and 5 or 6 units of work towards the Diploma in Computer Science.
Year 4 One other Part III subject (Statistics III for example) and the remainder of the work towards the Diploma in Computer Science.

* The normal programme of study for those wishing to major in Computer Science is to enrol in the B.Math. degree with Computer Science. The concurrent course is designed to satisfy the requirements of other students. For example, those within the Faculty of Mathematics who only decide at the third year level that they desire a qualification in Computer Science.



REQUIREMENTS FOR THE DEGREE OF BACHELOR OF MATHEMATICS

## Section I — General

1. *Definitions*
In these Requirements, unless the context or subject-matter otherwise indicates or requires, "the Faculty" means the Faculty of Mathematics, "the Faculty Board" means the Faculty Board of the Faculty of Mathematics and "the Dean" means the Dean of the Faculty of Mathematics.

2. *Grading of Degree*
The degree of Bachelor of Mathematics may be conferred either as an ordinary degree or as an honours degree.

3. *Approval of First Enrolment*
A candidate when enrolling in the Faculty for the first time shall report in person to the Dean, or his nominee, to have his enrolment for that year approved.

4. *Timetable Requirements*
No candidate may enrol in any year for any combination of subjects which is incompatible with the requirements of the timetable for that year.

5. *Annual Examinations*
The Annual Examinations shall normally be held at the end of third term and shall be conducted by means of written examinations supplemented by such oral or practical work testing as the examiners think fit.

6. *Special Examinations*
A candidate may be granted a special examination in accordance with the provisions of the Examination Regulations.

7. *A Subject*
(a) To complete a subject qualifying towards the degree, hereinafter called a subject, a candidate shall attend such lectures, tutorials, seminars, laboratory classes and field work and submit such written work as the Department concerned shall require.

(b) To pass a subject a candidate shall satisfy the requirements of sub-section 7(a) above and pass such examinations as the Faculty Board concerned shall require.

8. *Withdrawal*
(a) A candidate may withdraw from a subject only by notifying the Secretary to the University in writing of his withdrawal within seven days of the date of withdrawal.

(b) A candidate who withdraws after the sixth Monday in second term from a subject in which he has enrolled shall be deemed to have failed in that subject. However, such a candidate may apply to the Dean, who, after consultation with the Head of Department concerned, may allow him to withdraw without penalty.

9. *Prerequisites and Corequisites*
(1) Except with the permission of the Faculty Board, granted after considering any recommendation made by the Head of the Department offering a subject, no candidate may enrol in that subject unless he has passed the subjects prescribed as its prerequisites at any grade which may be specified and has already passed or concurrently enrols in or is already enrolled in the subjects prescribed as its corequisites.

(2) A candidate shall be deemed for the purposes of sub-section (1) of this section to have passed subjects in which he has been granted standing pursuant to Section 16.

(3) A candidate obtaining a Terminating Pass in a subject shall be deemed not to have passed that subject for pre-requisite purposes.

10. *Relaxing Clause*
In order to provide for exceptional circumstances arising in particular cases, the Senate, on the recommendation of the Faculty Board, may relax any provision of these Requirements.

## Section II — The Ordinary Degree

11. *Subjects Offered*
(a) A candidate shall select at least five of his subjects from the Schedules appended to these Requirements and shall comply with the rules relating to the selection of subjects set out in the Schedules.

(b) Up to four subjects from those offered in other courses in the University may, with the permission of the Dean, be counted as qualifying subjects for the degree. When approving a subject, the Dean shall determine whether the subject concerned shall be classified as Part I, Part II or Part III.

12. *Degree Patterns*
Except as provided in Section IV of these Requirements.
(a) to qualify for the degree of Bachelor of Mathematics, a candidate shall pass nine subjects, including:
Mathematics I, Mathematics IIA, Mathematics IIC, Mathematics IIIA, and either Mathematics IIIB or one Part III subject from Schedule B of the Schedule of Subjects;

(b) to qualify for the degree of Bachelor of Mathematics with Computer Science, a candidate shall pass nine subjects, including:
Mathematics I, Mathematics IIA, Mathematics IIC, Mathematics IIIA, Computer Science II and Computer Science III;

(c) to qualify for the degree of Bachelor of Mathematics with Statistics, a candidate shall pass nine subjects, including:
Mathematics I, Mathematics IIA, Mathematics IIC, Mathematics IIIA and Statistics III.

13. *Progression*
(a) Progression in the course is by subject. A full-time student is required to pass four subjects and a part-time student is required to pass two subjects in the first two years of his course. A part-time student is required to pass four subjects in the first four years of his course.

(b) The following restrictions on yearly course loads shall apply. The Dean may, in individual cases, relax restrictions (i), (ii), (iii), but only if he is satisfied that the academic merit of the candidate warrants such relaxation.
(i) No one academic year is to involve more than four subjects.
(ii) If four subjects are taken in any one year, at least three of them must be Part I subjects, and none may be a Part III subject.
(iii) If three subjects are taken in any one year, not more than two of them may be Part III subjects.



14. *Examination Grades*
The results of successful candidates at Annual Examinations and Special Examinations shall be classified:
High Distinction, Distinction, Credit, Terminating Pass, Ungraded Pass, Pass.

15. *Time Requirements*
Except with the special permission of the Faculty Board, a candidate shall complete the Requirements for the ordinary degree within nine calendar years of the commencement of the degree course. A candidate who has been granted standing in recognition of work completed elsewhere shall be deemed to have commenced his degree course from a date to be determined by the Dean.

16. *Standing*
The Faculty Board may grant standing under the following conditions.
(a) A candidate may be granted standing in recognition of work completed in another tertiary institution or faculty, *provided that*:
(i) the subjects for which credit is given shall have a reasonable correspondence with those offered in the Faculty;
(ii) an undergraduate of another tertiary institution shall not receive credit for more than four subjects;
(iii) a graduate or diplomate of another tertiary institution or faculty shall not receive credit for more than four subjects and if granted credit may not include as a qualifying subject any subject equivalent to one counted towards his previous qualification.

(b) Notwithstanding the provision of section (a) (i) of this sub-section, a graduate or undergraduate of another tertiary institution may be given credit for subjects not offered for the degree of Bachelor of Mathematics in the University of Newcastle *provided that*:
(i) the candidate complies with all other conditions of the Requirements;
(ii) the candidate has his proposed pattern of course approved at the time at which the concession is granted and does not depart from the proposed pattern without the approval of the Dean.

## Section III — The Honours Degree

17. *Admission to Candidature for the Honours Degree*
In order to be admitted to candidature for the Honours degree a candidate shall:
(a) have completed the requirements for admission to the ordinary degree;
(b) have completed any additional work prescribed by the Head of each Department concerned;
(c) have satisfactorily completed the prerequisites prescribed in one of the Schedules of Subjects for a Part IV subject; *and*
(d) have obtained the approval of the Head of each Department concerned. Application must be made by the date specified in the Faculty Handbook.

18. *Time Requirements*
(a) Except with the special permission of the Faculty Board, a candidate for Honours shall complete the requirements within five years from the commencement of his degree course (not counting years for which leave of absence has been granted) provided that for a part-time student the corresponding period shall be seven years.

A candidate who has been given standing in recognition of work completed elsewhere shall be deemed to have commenced his degree course from a date determined by the Dean.

(b) The Dean may permit a part-time candidate for Honours to complete the Part IV subject or subjects over two successive years.

19. *Honours*
To qualify for admission to the Honours degree a candidate shall satisfactorily complete the Part IV subject in which he has enrolled.

20. *Classes of Honours*
There shall be three classes of Honours, namely Class I, Class II and Class III. Class II shall have two divisions, namely Division 1 and Division 2.

21. *Medal*
In each Part IV subject, including combined subjects, the Faculty Board may recommend the award of a University Medal to the most distinguished candidate or candidates of the year.

22. *Equivalent Honours*
(a) On the recommendation of the Heads of the Departments concerned and with the permission of the Dean, a graduate may enrol in a Part IV subject as a full-time or a part-time student, *provided that:*
(i) he has not completed a Part IV subject in the disciplines concerned at this or any other tertiary institution approved for this purpose by the Faculty Board;
(ii) he is not otherwise eligible to enrol in that Part IV subject pursuant to these degree Requirements.

(b) Such a graduate who satisfactorily completes the Part IV subject shall be issued with a statement to this effect by the Secretary; the statement shall indicate the Honours level equivalent to the standard achieved by the student in the Part IV subject.

## Section IV — Combined Degree Courses

23. *General*
A candidate may complete the Requirements for the degree of Bachelor of Mathematics in conjunction with another Bachelor's degree by completing a combined course approved by the Faculty Board of the Faculty of Mathematics and the other Faculty Board concerned provided that:
(i) admission to a combined course shall normally be at the end of the first year and shall be subject to the approval of the Deans of the two Faculties concerned;
(ii) admission to combined courses will be restricted to students with an average of at least Credit level;
(iii) the Deans of both Faculties shall certify that the work in the combined degree course is no less in quantity and quality than if the two courses were taken separately;
(iv) the Requirements for both degrees shall be satisfied except as provided below.

24. *Arts/Mathematics*
(a) A candidate shall comply with all the provisions of the Requirements for the degree of Bachelor of Arts other than Clause 12 and all the Requirements for the degree of Bachelor of Mathematics.



(b) To qualify for admission to the ordinary degrees of Bachelor of Arts and Bachelor of Mathematics, a candidate shall pass fourteen subjects, five of which shall be Mathematics I, Mathematics IIA, Mathematics IIC, Mathematics IIIA and one of Mathematics IIIB, Computer Science III, Statistics III or a Part III subject chosen from the Schedules of Subjects approved for the degree of Bachelor of Mathematics and the remainder of which shall be chosen from the other subjects listed in the Schedule of subjects approved for the degree of Bachelor of Arts, *provided that:*
(i) not more than three subjects from Group II of the Schedule of subjects approved for the degree of Bachelor of Arts may be counted;
(ii) not more than five Part I subjects out of the total fourteen may be counted;
(iii) at least three subjects shall be Part III subjects;
(iv) a candidate counting Psychology IIC shall not be entitled to count either Psychology IIA or IIB;
(v) a candidate counting Psychology IIIC shall not be entitled to count either Psychology IIIA or Psychology IIIB;
(vi) a candidate counting Economics IIIC shall not be entitled to count either Economics IIIA or Economics IIIB;
(vii) a candidate counting Geology IIIC shall not be entitled to count either Geology IIIA or Geology IIIB.

25. *Mathematics/Science*
After completing the first year of study towards either the degree of Bachelor of Mathematics or the degree of Bachelor of Science including a pass at a satisfactory level in the subject Mathematics I, a candidate may enrol in a combined Mathematics/Science course. A candidate who has enrolled in such a combined course shall qualify for admission to the ordinary degrees of Bachelor of Mathematics and Bachelor of Science by passing fourteen subjects as follows:
(a) five subjects, being Mathematics I, Mathematics IIA, Mathematics IIC, Mathematics IIIA and one of Mathematics IIIB, Computer Science III, Statistics III or a Part III subject chosen from the Schedules of Subjects approved for the degree of Bachelor of Mathematics *and*
(b) six subjects chosen from the other subjects listed in the Schedule of Subjects approved for the degree of Bachelor of Science *and*
(c) three subjects chosen, with the approval of the Deans of the Faculties of Mathematics and Science, from the subjects approved for any of the degree courses offered by the University *provided that:*
(i) the number of Part I subjects shall not exceed six;
(ii) the minimum number of Part III subjects shall be three;
(iii) a candidate counting Psychology IIC shall not be entitled to count either Psychology IIA or Psychology IIB;
(iv) a candidate counting Psychology IIIC shall not be entitled to count either Psychology IIIA or Psychology IIIB;
(v) a candidate counting Economics IIIC shall not be entitled to count either Economics IIIA or Economics IIIB;
(vi) a candidate counting Geology IIIC shall not be entitled to count Geology IIIA or Geology IIIB.

26. *Mathematics/Metallurgy*
After completing a successful first year of study towards either the degree of Bachelor of Mathematics of the degree of Bachelor of Metallurgy, a candidate may enrol in a Mathematics/Metallurgy course. A candidate who has enrolled in such a combined course shall qualify for admission to the ordinary degree of Bachelor of Mathematics

and the degree of Bachelor of Metallurgy by passing Mathematics I, Mathematics IIA, Mathematics IIC, Mathematics IIIA and one of Mathematics IIIB, Computer Science III, Statistics III or a Part III subject chosen from the Schedules of Subjects approved for the degree of Bachelor of Mathematics and by satisfactorily completing other subjects to a minimum value of 48 units selected from the programme of subjects approved for the degree of Bachelor of Metallurgy.

27. *Commerce/Mathematics*
After completing the first year of study towards either the degree of Bachelor of Commerce or the degree of Bachelor of Mathematics, including a pass at a satisfactory level in the subject Mathematics I, a candidate may enrol in a combined Commerce/Mathematics course. A candidate who has enrolled in such a combined course shall qualify for admission to the ordinary degrees of Bachelor of Commerce and Bachelor of Mathematics by passing seventeen subjects, five of which shall be Mathematics I, Mathematics IIA, Mathematics IIC, Mathematics IIIA and one of Mathematics IIIB, Computer Science III, Statistics III or a Part III subject chosen from the Schedules of Subjects approved for the degree of Bachelor of Mathematics and the remainder of which shall by themselves satisfy the Requirements for the degree of Bachelor of Commerce.

28. *Engineering/Mathematics*
After completing a successful first year of study towards either the degree of Bachelor of Engineering or the degree of Bachelor of Mathematics, a candidate may enrol in an Engineering/Mathematics course. A candidate who has enrolled in such a combined course shall qualify for admission to the degree of Bachelor of Engineering and the ordinary degree of Bachelor of Mathematics, by passing Mathematics I, Mathematics IIA, Mathematics IIC, Mathematics IIIA and one of Mathematics IIIB, Computer Science III, Statistics III or a Part III subject chosen from the Schedule of Subjects approved for the degree of Bachelor of Mathematics, and by satisfactorily completing other subjects to a minimum value of 48 units selected from the programme of subjects approved for the degree of Bachelor of Engineering (Mechanical), Bachelor of Engineering (Industrial), Bachelor of Engineering (Electrical), Bachelor of Engineering (Chemical), Bachelor of Engineering (Civil) or Bachelor of Engineering (Computer).

29. *Economics/Mathematics*
After completing the first year of study towards either the degree of Bachelor of Economics or the degree of Bachelor of Mathematics, including a pass at a satisfactory level in the subject Mathematics I, a candidate may enrol in a combined Economics/Mathematics course. A candidate who has enrolled in such a combined course shall qualify for admission to the ordinary degrees of Bachelor of Economics and Bachelor of Mathematics by passing seventeen subjects, five of which shall be Mathematics I, Mathematics IIA, Mathematics IIC, Mathematics IIIA and one of Mathematics IIIB, Computer Science III, Statistics III or a Part III subject chosen from the Schedules of Subjects approved for the degree of Bachelor of Mathematics and the remainder of which shall by themselves complete the requirements for the degree of Bachelor of Economics.

SCHEDULE A

**Mathematics Subjects**

| **Subject** | **Remarks including Prerequisites and Corequisites** |
|---|---|
| **Part I** | |
| Mathematics I | It is assumed that students have studied Higher School Certificate Mathematics at the two-unit level or higher |



| | |
|---|---|
| **Part II** | |
| Mathematics IIA | **Prerequisite** Mathematics I |
| Mathematics IIB | **Prerequisite** Mathematics I<br>The Dean may permit a candidate to take this subject in two parts, each of three terms duration |
| Mathematics IIC | **Prerequisite** Mathematics I<br>**Pre- or Corequisite** Mathematics IIA |
| **Part III** | |
| Mathematics IIIA | **Prerequisites** Mathematics IIA & Mathematics IIC |
| Mathematics IIIB | **Pre-or Corequisite** Mathematics IIIA |
| **Part IV** | |
| Mathematics IV | **Prerequisites** Mathematics IIIA & one of Mathematics IIIB, Computer Science III or Statistics III |

**Computer Science Subjects**

| **Subject** | **Remarks including Prerequisites and Corequisites** |
|---|---|
| **Part II** | |
| Computer Science II | **Prerequisite** Mathematics I |
| **Part III** | |
| Computer Science III | **Prerequisites** Computer Science II, Mathematics IIA & Mathematics IIC |

**Statistics Subject**

| | |
|---|---|
| **Part III** | |
| Statistics III | **Prerequisites** Mathematics IIA & Mathematics IIC (including Topics CO, H & I) |

SCHEDULE B

**Subjects With a Substantial Mathematical Content**

| | |
|---|---|
| **Part I** | |
| Engineering I | It is assumed that students have studied Higher School Certificate Mathematics at the two-unit level or higher together with **either** Multistrand Science at the four-unit level **or** Physics at the two-unit level and Chemistry at the two-unit level |
| **Part II** | |
| Accounting IIC | **Prerequisites** Accounting I & Mathematics I |
| Civil Engineering IIM | **Prerequisites** Engineering I & Mathematics I |
| Psychology IIC | **Prerequisites** Mathematics I, Psychology I. A candidate counting Psychology IIC shall not be entitled to count Psychology IIA or Psychology IIB |
| **Part III** | |
| Accounting IIIC | **Prerequisites** Mathematics IIA, Mathematics IIC & Accounting IIC |
| Biology IIIB | **Prerequisites** Mathematics IIA & Mathematics IIC & either Biology IIA or Biology IIB |
| Civil Engineering IIIM | **Prerequisites** Civil Engineering IIM, Mathematics IIA & Mathematics IIC |
| Communications & Automatic Control | **Prerequisites** Mathematics IIA & Mathematics IIC (including Topics CO, D) |
| Digital Computers & Automatic Control | **Prerequisites** Mathematics IIA & Mathematics IIC (including Topics CO, D) |
| Economics IIIC | **Prerequisites** Economics IIA, Mathematics IIA & Mathematics IIC |

| | |
|---|---|
| Geology IIIC | **Prerequisites** Physics IA, Mathematics IIA, Mathematics IIC & Geology IIA |
| Industrial Engineering I | **Prerequisites** Mathematics IIA & Mathematics IIC |
| Mechanical Engineering IIIC | **Prerequisites** Mathematics IIA & Mathematics IIC (including Topics F & H) |
| Physics IIIA | **Prerequisites** Physics II, Mathematics IIA & Mathematics IIC |
| Psychology IIIC | **Prerequisites** Mathematics IIA, Mathematics IIC and either Psychology IIC or Psychology IIA and Psychology IIB. |

SCHEDULE C

**Combined Honours Subjects**

**Part IV**

| | |
|---|---|
| Mathematics/Geology IV | **Prerequisites** Mathematics IIIA & Geology IIIC |
| Mathematics/Physics IV | **Prerequisites** Mathematics IIIA & Physics IIIA |
| Mathematics/Psychology IV | **Prerequisites** Mathematics IIIA & Psychology IIIC |

*NOTES ON COMBINED DEGREE COURSES*

*ARTS/MATHEMATICS*

The details for the combined course follow simply from the Requirements for each degree. Each degree requires nine subjects so the combined degree requires 18 subjects less four subjects for which standing may be given, thus the combined degree should contain 14 subjects. The Bachelor of Mathematics requires Mathematics I, Mathematics IIA, Mathematics IIC, Mathematics IIIA and either Mathematics IIIB, Computer Science III, Statistics III or a Part III subject from Schedule B of the Schedule of Subjects approved for the degree of Bachelor of Mathematics. This leaves nine subjects which must clearly satisfy the Requirements for the Arts degree.

The course could be pursued in the following manner:

**Year I** Mathematics I and three other Part I subjects,

**Year II** three Part II subjects including Mathematics IIA and Mathematics IIC and another subject which should be a Part I or Part II subject approved for the degree of Bachelor of Arts,

**Year III** Mathematics IIIA plus two other subjects which must include at least one Part III subject,

**Year IV** either Mathematics IIIB, Computer Science III, Statistics III or a Schedule B subject from the Requirements for Bachelor of Mathematics plus two other subjects which will complete the Requirements for the Arts degree.

*COMMERCE/MATHEMATICS*

The details of the combined course in Commerce and Mathematics follow from the Requirements for each degree. The combined course should contain Mathematics I, Mathematics IIA, Mathematics IIC, Mathematics IIIA and either Mathematics IIIB, Computer Science III, Statistics III or a Part III subject from Schedule B of the Schedule of Subjects approved for the degree of Bachelor of Mathematics. This leaves twelve subjects which must clearly satisfy the Requirements for the Commerce degree. The course could be pursued in the following manner:

**Year I** Mathematics I
Introductory Quantitative Methods
Economics I
Accounting I



**Year II** Mathematics IIA
Mathematics IIC
One B.Com. subject

**Year III** Mathematics IIIA
Three B.Com. subjects

**Year IV** Mathematics IIIB, Computer Science III, Statistics III or a Part III Schedule B subject from the Requirements for Bachelor of Mathematics
Two B.Com. subjects

**Year V** Three B.Com. subjects

*ECONOMICS/MATHEMATICS*

The details of the combined course in Mathematics and Economics follow simply from the Requirements for each degree. The combined course should contain Mathematics I, Mathematics IIA, Mathematics IIC, Mathematics IIIA and one of Mathematics IIIB, Computer Science III, Statistics III or a Part III subject from Schedule B of the Schedule of Subjects approved for the degree of Bachelor of Mathematics, and all the subjects satisfying the Requirements for the degree of Bachelor of Economics.

The course could be pursued in the following manner:

**Year I** Mathematics I
Introductory Quantitative Methods
Economics I
One B.Ec. subject

**Year II** Mathematics IIA
Mathematics IIC
One B.Ec. subject

**Year III** Mathematics IIIA
Economics II
Two B.Ec. subjects

**Year IV** Mathematics IIIB, Computer Science III, Statistics III or a Part III Schedule B subject from the Requirements for B.Math.
Two B.Ec. subjects

**Year V** Three B.Ec. subjects

*ENGINEERING/MATHEMATICS*

The details of the combined course in Mathematics and Engineering follow simply from the Requirements for each degree. The combined degree course should contain Mathematics I, Mathematics IIA, Mathematics IIC, Mathematics IIIA and one of Mathematics IIIB, Computer Science III, Statistics III or a Part III subject from Schedule B of the Schedule approved for the degree of Bachelor of Mathematics, and all subjects satisfying the Requirements for the degree of Bachelor of Engineering.

The course could be pursued in the following manner:

**(i) B.E./B.Math. in Chemical Engineering**

**Year I** ChE141 Industrial Process Principles
ChE151 Industrial Chemical Process & Equipment
ChE152 Industrial Process Design I
GE151 Introduction to Materials Science
Chemistry I
Mathematics I
Physics IA

**Year II** Mathematics IIA
Mathematics IIC

ChE261 Separation Processes I
GE204 Engineering Computations I
GE205 Engineering Computations II
ChE241 Process Analysis I
Chemistry IIC

**Year III**
Mathematics IIIA
ChE251 Structures & Pressure Vessel Design
ChE271 Fuels & Combustion
ChE272 Fluid Mechanics
ChE291 Laboratory
ChE361 Separation Processes II

**Year IV**
ChE371 Kinetics & Thermodynamics
ChE391 Laboratory
ChE362 Solids Handling & Minerals Processing
ChE354 Electrochemistry & Corrosion
ChE351 Equipment Design
ChE342 Process Analysis II
ChE381 Computations
ChE382 Process Dynamics
ChE352 Process Engineering
ChE353 Process Economics
Part III Subject from B.Math. Schedule of Subjects

**Year V**
ChE462 Environmental Control
ChE471 Industrial Safety
ChE472 Transport Phenomena
ChE482 Process Control
ChE483 Reaction Engineering
ChE497 Design Project
ChE491 Seminar
ChE496 Research Project
Electives — 2 units

### (ii) B.E./B.Math. in Civil Engineering

**Year I**
CE111 Statics
ME111 Graphics & Engineering Drawing
GE112 Introduction to Engineering Design
ME131 Dynamics
GE151 Introduction to Materials Science
EE131 Circuit Fundamentals
Mathematics I
Physics IA
CE171 Engineering Surveying I

**Year II**
Mathematics IIA
Chemistry IS
CE212 Mechanics of Solids I
CE213 Mechanics of Solids II
CE224 Civil Engineering Materials
CE231 Fluid Mechanics I
CE232 Fluid Mechanics II
CE223J Engineering Geology
GE204 Engineering Computations I
GE205 Engineering Computations II
ME121 Workshop Practice



**Year III**
Mathematics IIC
CE314 Structural Analysis I
CE315 Structural Design I
CE324 Soil Mechanics
CE333 Fluid Mechanics III
CE334 Fluid Mechanics IV
CE342 Water Resources Engineering II
GE350 Seminar
EE211 Energy Conversion

**Year IV**
Mathematics IIIA
CE351 Civil Engineering Systems I
CE372 Transport Engineering
CE425 Earth & Rock Engineering
CE452 Engineering Construction
Structures Elective

**Year V**
Mathematics IIIB or a Part III subject from the Schedules of Subjects for B.Math.
CE453 Project
Departmental Elective

### (iii) B.E./B.Math. in Computer Engineering

**Year I**
Year I is similar for all combined course involving the Computer Engineering speciality and consists of the following subjects:
CE111 Statics
EE131 Circuit Fundamentals
GE112 Introduction to Engineering Design
ME111 Graphics and Engineering Drawing
ME131 Dynamics
Mathematics I
Physics IA
Chemistry IS

**Year II**
EE211 Energy Conversion
EE221 Semiconductor Devices
EE232 Electrical Circuits
EE262 Systematic Programming
EE264 Introduction to Computer Architecture & Assembly Language
PH221 Electromagnetics & Quantum Mechanics
Mathematics IIA
Mathematics IIC

**Year III**
Mathematics IIIA
Part III Subject from B.Math. Schedule of Subjects

**Year IV**
EE263 Introduction to Structuring of Info.
EE323 Linear Electronics
EE324L Electronics Laboratory
EE325 Introduction to Digital Tech.
EE333 Advanced Circuit Analysis
EE341 Automatic Control
EE344 Communications
EE345 Digital Switching Proc.
EE362 Switching Theory and Logic Design
GE350 Seminar
4 Units of electives

**Year V**
EE421 Electronic Design A
EE422 Electronic Design B

EE426 Advanced Digital Systems
EE463 Computer Operating Systems
EE464 Compiler Construction
EE480 Project
EE481 Project **OR** 2 EE300/400/500 Units
EE491 Seminar
4 Units from List I
1 Unit or Elective

### (iv) B.E./B.Math. in Electrical Engineering

**Year I**
Mathematics I
Physics IA
Chemistry IS
CE111 Statics
EE131 Circuit Fundamentals
GE112 Introduction to Engineering Design
ME111 Graphics & Engineering Drawing
ME131 Dynamics

**Year II**
EE211 Energy Conversion
EE221 Semiconductor Devices
EE232 Electrical Circuits
EE262 Systematic Programming
EE264 Introduction to Computer Architecture & Assembly Language
Ph221 Electromagnetics & Quantum Mechanics
Mathematics IIA
Mathematics IIC

**Year III**
Mathematics IIIA
Mathematics IIIB or a Part III subject from the Schedule of Subjects for B.Math.

**Year IV**
EE313 Power Systems
EE314 Electrical Machines
EE315 Power Electronics
EE323 Linear Electronics
EE324L Electronics Laboratory
EE325 Introduction to Digital Technology
EE333 Advanced Circuit Analysis
EE341 Automatic Control
EE344 Communications
EE362 Switching Theory & Logic Design
GE350 Seminar
4 units of electives

**Year V**
EE421 Electronics Design A
EE451 Electromagnetic Propagation & Antennas
EE480 Project
EE481 Project or 2 units from EE300, 400 subjects
EE491 Seminar
7 units from EE300, 400 subjects

### (v) B.E./B.Math. in Industrial Engineering

**Year I**
Mathematics I
Physics IA
Chemistry IS
CE111 Statics
GE151 Introduction to Materials Science



GE112 Introduction to Engineering Design
ME111 Graphics & Engineering Drawing
ME131 Dynamics
ME223 Engineering Technology

**Year II**
Mathematics IIA
Mathematics IIC
EE131 Circuit Fundamentals
ME201 Experimental Methods I
ME202 Dynamics of Engineering Systems
ME203 Experimental Methods II
ME214 Mechanics of Solids I
ME241 Properties of Materials I
ME251 Fluid Mechanics I
ME271 Thermodynamics I

**Year III**
Mathematics IIIA
EE211 Energy Conversion
ME121 Workshop Practice
ME212 Engineering Design I
ME232 Dynamics of Machines I
GE204 Engineering Computations I
GE205 Engineering Computations II
ME343 Mechanics of Solids II
ME361 Automatic Control

**Year IV**
Mathematics IIIB or a Part III subject from Schedule of Subjects for B.Math.
ME312 Engineering Design II
ME313 Engineering Design III
ME333 Dynamics of Machines II
ME381 Methods Engineering
ME383 Quality Engineering
ME483 Production Engineering

**Year V**
ME482 Engineering Economics I
ME484 Engineering Economics II
ME487 O.R. — Deterministic Models
ME488 O.R. — Probabilistic Models
ME496 Project/Seminar
GE301 Technology & Human Values I
GE302 Technology & Human Values II
4 units Departmental Technical Electives

### (vi) B.E./B.Math. in Mechanical Engineering

**Year I**
Mathematics I
Physics IA
Chemistry IS
CE111 Statics
GE151 Introduction to Materials Science
GE112 Introduction to Engineering Design
ME223 Engineering Technology
ME131 Dynamics
ME111 Graphics & Engineering Drawing

**Year II**
Mathematics IIA
Mathematics IIC
EE131 Circuit Fundamentals
ME201 Experimental Methods I

| | | |
|---|---|---|
| | ME202 | Dynamics of Engineering Systems |
| | ME203 | Experimental Methods II |
| | ME214 | Mechanics of Solids I |
| | ME241 | Properties of Materials I |
| | ME251 | Fluid Mechanics I |
| | ME271 | Thermodynamics I |
| **Year III** | Mathematics IIIA | |
| | EE211 | Energy Conversion |
| | ME121 | Workshop Practice |
| | GE204 | Engineering Computations I |
| | GE205 | Engineering Computations II |
| | ME212 | Engineering Design I |
| | ME232 | Dynamics of Machines I |
| | ME342 | Properties of Materials II |
| | ME343 | Mechanics of Solids II |
| | ME361 | Automatic Control |
| **Year IV** | Mathematics IIIB or a Part III subject from Schedule of Subjects for B.Math. | |
| | ME302 | Experimental Methods III |
| | ME312 | Engineering Design II |
| | ME313 | Engineering Design III |
| | ME352 | Fluid Mechanics II |
| | ME372 | Heat Transfer |
| | ME373 | Thermodynamics II |
| | GE301 | Technology & Human Values I |
| **Year V** | CE315 | Structural Design I |
| | ME333 | Dynamics of Machines II |
| | ME496 | Project/Seminar |
| | 4 units Departmental Technical Electives | |
| | ME481 | Engineering Administration |
| | ME482 | Engineering Economics I |
| | GE302 | Technology & Human Values II |

*MATHEMATICS/SCIENCE*

The details for the combined course follow simply from the Requirements for each degree. Each degree requires nine subjects so the combined degree requires 18 subjects less four subjects for which standing may be given, thus the combined degree should contain 14 subjects. The Bachelor of Mathematics requires Mathematics I, Mathematics IIA, Mathematics IIC, Mathematics IIIA and one of Mathematics IIIB, Computer Science III, Statistics III or a Part III subject from Schedule B of the Requirements. This leaves nine subjects which must clearly satisfy the Requirements for the Science degree.

The course could be pursued in the following manner:

**Year I** Mathematics I and three other Part I subjects,

**Year II** three Part II subjects including Mathematics IIA and Mathematics IIC and another Part I subject.

**Year III** Mathematics IIIA plus two other subjects which must include at least one Part III subject.

**Year IV** one of Mathematics IIIB, Computer Science III, Statistics III or a Schedule B subject from the Requirements for Bachelor of Mathematics, plus two other subjects which will complete the Requirements for the Science degree.

*MATHEMATICS/METALLURGY*

A combined course leading to admission to the degrees of Bachelor of Metallurgy and Bachelor of Mathematics as approved by the Faculty Boards of Mathematics and Engineering



shall include Mathematics I, Mathematics IIA, Mathematics IIC, Mathematics IIIA and one of Mathematics IIIB, Computer Science III, Statistics III or a Part III subject chosen from Schedule B of the Schedule of Subjects approved for the degree of Bachelor of Mathematics and other subjects taken from the Schedule of Subjects approved for the degree of Bachelor of Metallurgy.

| | | **Subject** |
|---|---|---|
| **Year I** | | Mathematics I |
| | | Physics IA |
| | | Chemistry I |
| | ChE141 | Industrial Process Principles |
| | GE151 | Introduction to Materials Science |
| | ChE151 | Industrial Chemical Process & Equipment |
| | ChE152 | Industrial Process Design I |
| **Year II** | | Mathematics IIA |
| | | Mathematics IIC |
| | GE204 | Engineering Computations I |
| | GE205 | Engineering Computations II |
| | Met214 | Theory of Metallurgy Processes I |
| | Met261 | Extraction Metallurgy |
| | Met251 | Metallography |
| | Met241 | Microplasticity |
| | Met271 | Fabrication Metallurgy |
| | Met281 | Electronic & Atomic Structure |
| **Year III** | | Mathematics IIIA |
| | Met301 | Communication Skills |
| | ChE353 | Process Economics |
| | Met314 | Theory of Metallurgical Processes II |
| | Met355 | Physical Metallurgy |
| | Met375 | Industrial Metallurgy |
| **Year IV** | | Part III Subject from B.Math. Schedule of Subjects |
| | | 2 units from Met300 subjects |
| | Met391 | Physical Metallurgy Laboratory |
| | | OR |
| | Met392 | Chemical Metallurgy Laboratory |
| | | 2 units of Elective |
| **Year V** | Met401 | Directed Reading |
| | Met402 | Seminar |
| | Met491 | Laboratory Project |
| | | 8 units from Met400 Subjects |

*REQUIREMENTS FOR THE DIPLOMA IN COMPUTER SCIENCE*

1. In these Requirements, unless the context or subject matter otherwise indicates or requires "the Faculty Board" means the Faculty Board of the Faculty of Mathematics and "the Board" means the Board of Studies in Computer Science.

2. An application for admission to candidature for the Diploma shall be made on the prescribed form and lodged with the Secretary to the University by the prescribed date.

3. The Diploma shall be awarded in two grades, namely:
   Diploma in Computer Science with merit,
   Diploma in Computer Science

4. An applicant for admission to candidature for the Diploma shall:
   (a) have satisfied all the requirements for admission to a degree of the University of Newcastle, or to a degree of any other tertiary institution approved for this purpose by the Board, or
   (b) have other qualifications approved for this purpose by the Senate on the recommendations of the Board and the Faculty Board.

5. (1) Notwithstanding the provision of Section 4, a student who is required to complete not more than the equivalent of one year of full-time studies to qualify for a degree may be admitted as a part-time student to the course for the Diploma with such programme as the Dean recommends, provided that the student is not enrolled in any subject for which he has not satisfied the prerequisite. Before making such recommendation, the Dean will obtain the agreement of the Heads of the Departments and Deans of other Faculties concerned.
   (2) In no case will a Diploma be awarded until the Requirements for the degree have been satisfied.

6. The Board may require a candidate to complete additional work and/or examinations if, in its opinion, he has not reaching the assumed standard of attainment on which the content of any of the subjects is based.

7. Admission to candidature shall require the approval of the Board.

8. (1) In order to qualify for the Diploma, a candidate shall, in not less than two years of part-time or one year of full-time enrolment, complete to the satisfaction of the Board a programme of subjects approved by the Board totalling not less than 11 units.
   (2) The programme referred to in subsection (1) of this section shall consist of:
      (a) the core programme set out in the Schedule; and
      (b) units chosen from subjects approved by the Board designated either Group A subjects or Group B subjects. A candidate's programme may not include more than two Group B subjects.
   (3) The Board may approve a project for inclusion in the candidate's programme. Such a project shall count as a Group B subject with a unit value of not more than 2.
   (4) Notwithstanding the provision of subsection (2) of this section a candidate shall not enrol in a subject the content of which, in the opinion of the Board, is substantially equivalent to work already completed towards another degree or Diploma. In such a case the Board shall prescribe an alternative subject to any listed in the Schedule.

9. A candidate may be granted standing by the Board for work completed in this University, or in another tertiary institution approved for this purpose by the Board. Such standing shall not be given for more than half of the course and shall not be given for work on the basis of which a degree or Diploma has already been conferred or awarded or approved for conferment or award.

10. (1) To complete a subject a candidate shall attend such lectures, tutorials, seminars and laboratory classes, and submit such written work as the Board may require.
   (2) To pass a subject, a candidate shall complete the subject and pass such examinations as the Board may require.
   (3) The result of a successful candidate in a subject shall be classified: Pass, Credit, Distinction or High Distinction.



11. (1) A candidate may withdraw from a subject or the course only by notifying the Secretary to the University in writing and the withdrawal shall take effect from the date of receipt of such notification.
   (2) A candidate who withdraws from any subject after the relevant date shall be deemed to have failed in that subject unless granted permission by the Dean of the Faculty of Mathematics to withdraw without penalty. The relevant date shall be:
      (a) in the case of any subject offered in the first half of the academic year — the eighth Monday in first term;
      (b) in the case of any subject offered in the second half of the academic year — the second Monday in third term;
      (c) in the case of any other subject — the sixth Monday in second term.

12. In order to provide for exceptional circumstances arising in particular cases, the Senate, on the recommendation of the Faculty Board, may relax any provision of these Requirements.

SCHEDULE OF SUBJECTS

Core Subjects

| *Subject*[2] | *Department Offering Subject* | *Assumed Standard of Attainment*[1] | *No. of Units* |
|---|---|---|---|
| CS—Commercial Programming | Commerce | Mathematics I, Topic SC, or Commercial Electronic Data Processing | 1 |
| CS—Introduction to Computer Architecture & Assembly Language | Electrical Engineering | Mathematics I or suitable alternative preparation | 1 |
| CS—Switching Theory & Logical Design | Electrical Engineering | Mathematics I or suitable alternative preparation | 1 |
| CS—Programming & Algorithms | Mathematics | Mathematics I or suitable alternative preparation | 1 |
| CS—Data Structures & Programming | Mathematics | CS—Prog. & Algor. | 1 |
| CS—Numerical Analysis | Mathematics | Mathematics I or suitable alternative preparation | 1 |
| Systems Analysis | Mathematics | — | 1 |

1 The lecturer in the subject will assume that all students have a good understanding of the content of items in this column.

2 Subjects with a prefix CS are subjects offered in the Faculty of Mathematics specifically for the Diploma in Computer Science.

REQUIREMENTS FOR THE DIPLOMA IN MATHEMATICAL STUDIES

1. In these Requirements, unless the context or subject matter otherwise indicates or requires, "the Faculty Board" means the Faculty Board of the Faculty of Mathematics and "the Dean" means the Dean of the Faculty of Mathematics.

2. An applicant for registration as a candidate for the Diploma shall:
   (a) have satisfied all the Requirements for admission to a degree in the University of Newcastle or another institution approved for this purpose by the Faculty Board, OR
   (b) in exceptional circumstances produce evidence of possessing such other qualifications as may be approved by the Faculty Board.

3. The Faculty Board will appoint an adviser for each candidate.

4. In order to qualify for the Diploma, a candidate shall, in not less than three terms in the case of a full-time student or not less than six terms in the case of a part-time student, complete a course of studies comprising 12 units of advanced work offered by the Department of Mathematics or another department offering courses with considerable mathematical content. Two units of this advanced work may be a project approved by the Faculty Board. Each unit will require attendance at lectures, seminars and tutorials, reading exercises, laboratory work and examinations as may be prescribed by the Faculty Board.

5. A candidate may be granted standing by the Faculty Board for work completed in this University, or in another tertiary institution approved for this purpose by the Faculty Board. Such standing shall not be given for more than half of the course and shall not be given for work on the basis of which a degree or diploma has already been conferred or awarded or approved for conferment or award.

6. (a) To complete a unit qualifying towards the Diploma, a candidate shall attend such lectures, tutorials, seminars and laboratory classes, and submit such written work as the Faculty Board may require.
   (b) To pass a unit, a candidate shall complete the unit and pass such examinations as the Faculty Board may require.

7. (a) A candidate may withdraw from a unit or units only by notifying the Secretary to the University in writing and the withdrawal shall take effect from the date of receipt of such notification in writing.
   (b) A candidate who after:—
   the eighth Monday in First Term, in the case of a unit lasting only the first half-year,
   the sixth Monday in Second Term, in the case of a unit lasting the whole year,
   the second Monday in Third Term, in the case of a unit lasting only the second half-year,
   withdraws from a unit in which he has enrolled, shall be deemed to have failed in that unit, unless granted permission by the Dean to withdraw without penalty.

8. In exceptional circumstances the Senate may, on the recommendation of the Faculty Board, relax any of the above requirements.

## REGULATIONS RELATING TO THE DIPLOMA IN MEDICAL STATISTICS

1. These Regulations prescribe the requirements for the Diploma in Medical Statistics of the University of Newcastle and are made in accordance with the powers vested in the Council under By-law 5.2.1.

2. In these Regulations, unless the context or subject matter otherwise indicates or requires:
"the Board" means the Board of Studies in Medical Statistics;
"the diploma" means the Diploma in Medical Statistics.



3. Admission to candidature shall be governed by the Regulations Governing Admission and Enrolment made by the Council from time to time.

4. An applicant for admission to candidature for the diploma shall:
   (a) have satisfied all the requirements for admission to a degree of the University of Newcastle, or to a degree of any other tertiary institution approved for this purpose by the Board, or
   (b) have other qualifications approved for this purpose by the Senate on the recommendation of the Board.

5. The Board may require a candidate to complete work and/or examinations additional to the programme referred to in Regulation 6 if, in its opinion, he has not reached the assumed standard of attainment on which the content of any of the subjects for the diploma is based.

6. (1) To qualify for the diploma a candidate shall, in not less than one year of full-time study or two years of part-time study, complete to the satisfaction of the Board a programme approved by the Board totalling not less than ten units.

   (2) The programme shall consist of:
      (a) a thesis which shall count as 2, 3 or 4 units as determined by the Board;
      (b) Seminar of Population Research Group which shall count as 1 unit;
      (c) units chosen from the Schedule of Subjects or other units of advanced work approved by the Board.
   (3) A candidate shall not enrol in a subject the content of which, in the opinion of the Board, is substantially equivalent to work already completed towards another degree or diploma. In such a case the Board shall prescribe an alternative subject to any listed in the Schedule.

7. A candidate may be granted standing by the Board for work completed in this University, or in another tertiary institution approved for this purpose by the Board. Such standing shall not be given for more than half the unit total of the programme nor for work on the basis of which a degree or diploma has already been conferred or awarded or approved for conferment or award.

8. (1) To complete a subject a candidate shall attend such lectures, tutorials, seminars and laboratory classes, and submit such written and other work as the Board may require.
   (2) To pass a subject, a candidate shall complete it and pass such examinations as the Board may require.
   (3) The result of a successful candidate in a subject shall be: Ungraded Pass, Pass, Credit, Distinction or High Distinction.

9. The examining of candidates for the diploma shall be carried out in accordance with the Examination Regulations approved by the Council from time to time.

10. The Regulations Governing Unsatisfactory Progress shall apply where a candidate fails to maintain a rate of progress considered satisfactory by the Board.

11. (1) A candidate may withdraw from a subject or the course only by notifying the Secretary to the University in writing and the withdrawal shall take effect from the date of receipt of such notification.

(2) A candidate who withdraws from any subject after the relevant date shall be deemed to have failed in that subject unless granted permission by the Chairman of the Board to withdraw without penalty. The relevant date shall be:

(a) in the case of any subject offered in the first half of the academic year - the eighth Monday in first term;

(b) in the case of any subject offered in the second half of the academic year - the second Monday in third term;

(c) in the case of any other subject - the sixth Monday in second term.

12. In order to provide for exceptional circumstances arising in particular cases, the Senate, on the recommendation of the Board, may relax any provision of these Regulations.

SCHEDULE OF SUBJECTS

| *Subject* | *Offered by* | *No. of Units* |
|---|---|---|
| MS—Seminar of Population Research Group | | |
| MS—Scientific Method and Critical Thinking | Faculty of Medicine | 1 |
| MS—Epidemiology and Study Design | Faculty of Medicine | 1 |
| MS—Theory of Statistics | Department of Mathematics | 1 |
| MS—Regression, design, and analysis of experiments | Department of Mathematics | 1 |
| MS—Demography and survival analysis | Department of Mathematics | 1 |
| MS—Generalised linear statistical modelling | Department of Mathematics | 1 |
| CS—Programming and Algorithms | Department of Mathematics | 1 |
| CS—Data Structures and Programming | Department of Mathematics | 1 |
| MS—Survey Sampling Methods | Department of Mathematics | 1 |

## REGULATIONS GOVERNING MASTERS DEGREES

PART I — GENERAL

1. (1) These Regulations, including the Schedules thereto, prescribe the conditions and requirements relating to the degrees of Master of Architecture, Master of Arts, Master of Commerce, Master of Education, Master of Educational Studies, Master of Engineering, Master of Engineering Science, Master of Mathematics, Master of Psychology (Clinical), Master of Psychology (Educational) and Master of Science.

(2) In these Regulations and the Schedules thereto, unless the context or subject matter otherwise indicates or requires:
"Faculty Board" means the Faculty Board of the Faculty responsible for the course in which a person is enrolled or is proposing to enrol;
"programme" means the programme of research and study prescribed in the Schedule;
"Schedule" means the Schedule of these Regulations pertaining to the course in which a person is enrolled or is proposing to enrol; and
"thesis" means any thesis of dissertation submitted by a candidate.

(3) These Regulations shall not apply to degrees conferred *honoris causa*.

(4) A degree of Master shall be conferred in one grade only.

2. An application for admission to candidature for a degree of Master shall be made on the prescribed form and lodged with the Secretary to the University by the prescribed date.



3. (1) To be eligible for admission to candidature an applicant shall:

(a) (i) have satisfied the requirements for admission to a degree of Bachelor in the University of Newcastle as specified in the Schedule; or

(ii) have satisfied the requirements for admission to a degree or equivalent qualification, approved for the purpose by the Faculty Board, in another tertiary institution; or

(iii) have such other qualifications and experience as may be approved by the Senate on the recommendation of the Faculty Board or otherwise as may be specified in the Schedule; and

(b) have satisfied such other requirements as may be specified in the Schedule.

(2) Unless otherwise specified in the Schedule, applications for admission to candidature shall be considered by the Faculty Board which may approve or reject any application.

(3) An applicant shall not be admitted to candidature unless adequate supervision and facilities are available. Whether these are available shall be determined by the Faculty Board unless the Schedule otherwise provides.

4. To qualify for admission to a degree of Master a candidate shall enrol and satisfy the requirements of these Regulations including the Schedule.

5. The programme shall be carried out:—

(a) under the guidance of a supervisor or supervisors either appointed by the Faculty Board or as otherwise prescribed in the Schedule; or

(b) as the Faculty Board may otherwise determine.

6. Upon request by a candidate the Faculty Board may grant leave of absence from the course. Such leave shall not be taken into account in calculating the period for the programme prescribed in the Schedule.

7. (1) A candidate may withdraw from a subject or course only by informing the Secretary to the University in writing and such withdrawal shall take effect from the date of receipt of such notification.

(2) A candidate who withdraws from any subject after the relevant date shall be deemed to have failed in that subject unless granted permission by the Dean to withdraw without penalty.

The relevant date shall be:

(a) in the case of a subject offered in the first half of the academic year — the eighth Monday in first term;

(b) in the case of a subject offered in the second half of the academic year — the second Monday in third term;

(c) in the case of any other subject — the sixth Monday in second term.

8. (1) If the Faculty Board is of the opinion that the candidate is not making satisfactory progress towards the degree then it may terminate the candidature or place such conditions on its continuation as it deems fit.

(2) For the purpose of assessing a candidate's progress, the Faculty Board may require any candidate to submit a report or reports on his progress.

(3) A candidate against whom a decision of the Faculty Board has been made under Regulation 8(1) of these Regulations may request that the Faculty Board cause his case to be reviewed. Such request shall be made to the Dean of the Faculty within seven days from the date of posting to the candidate the advice of the Faculty Board's decision or such further period as the Dean may accept.

(4) A candidate may appeal to the Vice-Chancellor against any decision made following the review under Regulation 8(3) of these Regulations.

9. In exceptional circumstances arising in a particular case, the Senate, on the recommendation of the Faculty Board, may relax any provision of these Regulations.

PART II — EXAMINATION AND RESULTS

10. The Examination Regulations approved from time to time by the Council shall apply to all examinations with respect to a degree of Master with the exception of the examination of a thesis which shall be conducted in accordance with the provisions of Regulations 12 to 16 inclusive of these Regulations.

11. The Faculty Board shall consider the results in subjects, the reports of examiners and any other recommendations prescribed in the Schedule and shall decide:
(a) to recommend to the Council that the candidate be admitted to the degree; or
(b) in a case where a thesis has been submitted, to permit the candidate to resubmit an amended theses within twelve months of the date on which the candidate is advised of the result of the first examination or within such longer period of time as the Faculty Board may prescribe; or
(c) to require the candidate to undertake such further oral, written or practical examinations as the Faculty Board may prescribe; or
(d) not to recommend that the candidate be admitted to the degree, in which case the candidature shall be terminated.

PART III — PROVISIONS RELATING TO THESES

12. (1) The subject of a thesis shall be approved by the Faculty Board on the recommendation of the Head of the Department in which the candidate is carrying out his research.
(2) The thesis shall not contain as its main content any work or material which has previously been submitted by the candidate for a degree in any tertiary institution unless the Faculty Board otherwise permits.

13. The candidate shall give to the Secretary to the University three months' written notice of the date he expects to submit a thesis and such notice shall be accompanied by any prescribed fee.[1]

14. (1) The candidate shall comply with the following provisions concerning the presentation of a thesis:
(a) the thesis shall contain an abstract of approximately 200 words describing its content;
(b) the thesis shall be typed and bound in a manner prescribed by the University;
(c) three copies of the thesis shall be submitted together with:
(i) a certificate signed by the candidate that the main content of the thesis has not been submitted by the candidate for a degree of any other tertiary institution; and
(ii) a certificate signed by the supervisor indicating whether the candidate has completed the programme and whether the thesis is of sufficient academic merit to warrant examination; and

1 At present there is no fee payable.



(iii) if the candidate so desires, any documents or published work of the candidate whether bearing on the subject of the thesis or not.
(2) The Faculty Board shall determine the course of action to be taken should the certificate of the supervisor indicate that in the opinion of the supervisor the thesis is not of sufficient academic merit to warrant examination.

15. The University shall be entitled to retain the submitted copies of the thesis, accompanying documents and published work. The University shall be free to allow the thesis to be consulted or borrowed and, subject to the provisions of the Copyright Act, 1968 (Com), may issue it in whole or any part in photocopy or microfilm or other copying medium.

16. (1) For each candidate two examiners, at least one of whom shall be an external examiner (being a person who is not a member of the staff of the University) shall be appointed either by the Faculty Board or otherwise as prescribed in the Schedule.
(2) If the examiners' reports are such that the Faculty Board is unable to make any decision pursuant to Regulation 11 of these Regulations, a third examiner shall be appointed either by the Faculty Board or otherwise as prescribed in the Schedule.

## SCHEDULE 8 — MASTER OF MATHEMATICS

1. The Faculty of Mathematics shall be responsible for the course leading to the degree of Mathematics.

2. To be eligible for admission to candidature an applicant shall:
(a) have satisfied all the requirements for admission to a degree of Bachelor of the University of Newcastle with honours in the area of study in which he proposes to carry out his research or to an honours degree, approved for this purpose by the Faculty Board, of another University; OR
(b) have satisfied all the requirements for admission to a degree of the University of Newcastle or to a degree, approved for this purpose by the Faculty Board, of another tertiary institution and have completed such work and sat for such examinations as the Faculty Board may have determined and have achieved a standard at least equivalent to that required for admission to a degree of bachelor with second class honours in an appropriate subject; OR
(c) in exceptional cases produce evidence of possessing such academic and professional qualifications as may be approved by the Faculty Board.

3. To qualify for admission to the degree a candidate shall complete to the satisfaction of the Faculty Board a programme consisting of:
(a) such examinations and such other work as may be prescribed by the Faculty Board; and
(b) a thesis embodying the results of an original investigation or design.

4. The programme shall be completed in not less than two years except that, in the case of a candidate who has completed the requirements for a degree of Bachelor with honours or for a qualification deemed by the Faculty Board to be equivalent or who has had previous research experience, the Faculty Board may reduce this period by up to one year.

5. A part-time candidate shall, except with the permission of the Faculty Board, which shall be given only in special circumstances:

(a) conduct the major proportion of the research or design work in the University; and

(b) take part in research seminars within the Department in which he is working.

6. Any third examiner shall be an external examiner.

## DESCRIPTION OF SUBJECTS

### NOTE ON SUBJECT ENTRIES

Subject outlines and reading lists are set our in a standard format to facilitate easy reference. An explanation is given below of some of the technical terms used in this Handbook.

(a) *Prerequisites* are subjects which must be passed before a candidate enrols in a particular subject. The only prerequisites noted for *topics* are any topics or subjects which must be taken before enrolling in the particular topic. To enrol in any subject which the topic may be part of, the prerequisites for that subject must still be satisfied.
Where a prerequisite is marked "(advisory)", lectures will be given on the assumption that the subject or topic has been completed as indicated.

(b) *Corequisites* for subjects are those which the candidate must pass before enrolment, or be taking concurrently.
Corequisites for topics are those which the candidate must take before enrolment or be taking concurrently.

(c) *Examination* — Under examination Regulations "examination" includes mid-year examinations, assignments, tests or any other work by which the final grade of a candidate in a subject is assessed. Some attempt has been made to indicate for each subject how assessment is determined. See particularly the general statement below headed Progressive Assessment referring to Mathematics subjects.

(d) *Texts* are essential books recommended for purchase.

(e) *References* are books relevant to the subject or topic which, however, need not be purchased.

## DEGREE OF BACHELOR OF MATHEMATICS

### SCHEDULE A

*Preliminary Notes*

The Department of Mathematics offers and examines subjects. Each subject is composed of topics each single-unit topic consisting of about 27 lectures and 13 tutorials throughout the year. Each of the Part I, Part II and Part III Mathematics subjects consists of the equivalent of four single-unit topics. For **Mathematics I**, there is no choice of topics; for **Mathematics IIA, IIB, IIC** there is some choice available to students; for **Mathematics IIIA** and **IIIB** there is a wider choice. No topic may be counted twice in making up distinct subjects. (Students who passed some mathematics subjects before this arrangement of subjects was introduced should consult the "transition arrangements" set out on p. 155 of the 1970 Faculty of Arts handbook, and p. 76 of the 1973 Faculty of Mathematics handbook. Note that the "code letters" for the topics may vary slightly from year to year.)

The subjects Computer Science II and III are taught and examined jointly by the Departments of Electrical Engineering, Commerce and Mathematics. In Computer Science II, there is no choice of topics.

*Progressive Assessment*

From time to time during the year students will be given assignments, tests, etc. Where a student's performance during the year has been better than his performance in the final examination, then the former will be taken into account in determining his final result. On



the other hand, when a student's performance during the year has been worse than his performance in the final examination, then his performance during the year will be ignored in determining his final result.

### (i) MATHEMATICS SUBJECTS

#### PART I SUBJECT

**661100 Mathematics I**

*Prerequisites* Nil

*Hours* 4 lecture hours and 2 tutorial hours per week

*Examination* Two 3-hour papers

*Content*

Topics AL — Algebra
AN — Real Analysis
CA — Calculus
SC — Statistics and Computing

#### PART I TOPICS

**Algebra (Topic AL)** — W. Brisley

*Prerequisites* Nil

*Hours* 1 lecture hour and ½ tutorial hour per week

*Content*

Introduction to basic algebraic objects and ideas. Induction. Matrices, solution of systems of linear equations. Determinants. Permutations. Vector geometry in two and three dimensions. Vector spaces, basis and dimension, subspaces. Linear maps, matrix representation, rank and nullity. Eigenvectors and eigenvalues. Applications are illustrated throughout the course.

*Text*

Brisley, W. — *A Basis for Linear Algebra* (Wiley 1973)

*References*

Anton, H. — *Elementary Linear Algebra* 2nd edn (Wiley 1977)
Kolman, B. — *Elementary Linear Algebra* (Macmillan 1977)
Liebeck, H. — *Algebra for Scientists and Engineers* (Wiley 1971)
Lipschutz, S. — *Linear Algebra* (Schaum 1974)

**Real Analysis (Topic AN)** — J. G. Couper

*Prerequisites* Nil

*Hours* 1 lecture hour and ½ tutorial hour per week

*Content*

Real numbers. Sequences and series. Functions of one real variable, continuity, differentiability, integrability. Power series, Taylor Series.

*Text* Nil

*References*

Apostol, T. — *Calculus* Vol. 1 2nd edn (Blaisdell 1967)
Spivak, M. — *Calculus* (Benjamin 1967)

**Calculus (Topic CA)** — W. P. Wood

*Prerequisites* Nil

*Hours* 1 lecture hour and ½ tutorial hour per week

*Content*
Binomial Theoreom. Revision of differentiation and integration of polynomials and trigonometric functions. Differentiation of rational functions and of implicit and parametrically defined functions. Definition and properties of logarithmic, exponential and hyperbolic functions. Integration by parts and by substitution techniques. Integration of rational functions. First order separable and linear differential equations. Second order linear differential equations with constant coefficients. Conic sections and simple three-dimensional geometry of curves and surfaces. Partial differentiation. Tangency. Complex numbers.

*Text*

Ayres, F. — *Calculus* (Schaum 1974)

*References*

Apostol, T. — *Calculus* Vol. 1 2nd edn (Blaisdell 1967)
Hille, E. & Salas, S. — *First Year Calculus* Internat. Textbook Series (Blaisdell 1968)
Kaplan, W. & Lewis, D. J. — *Calculus and Linear Algebra* Vol. 1 (Wiley 1970)
Spivak, M. — *Calculus* (Benjamin 1967)

**Statistics & Computing (Topic SC)** — R. W. Gibberd

*Prerequisites* — Nil

*Hours* — 1 lecture hour and ½ tutorial hour per week

*Content*
Introduction to computers. Programming in PASCAL. Calculating the zeros of functions. Numerical integration. Descriptive statistics, mean and variance. Probability. Random variables. Probability distributions. Statistical inference. A requirement is the writing of successful computer programmes to solve problems in statistical and numerical analysis.

*Texts*

University of Newcastle Computing Centre — *DEAMON Handbook*
University of Newcastle — *Statistical Tables*
*Either*
Grogono, P. — *Programming in PASCAL* 2nd edn (Addison-Wesley 1980) (Recommended for those continuing in computer science)
*or*
Moore, L. — *Foundations of Programming with PASCAL* (Ellis Horwood 1980)

*References*

Conte, S. D. & de Boor, C. — *Elementary Numerical Analysis* (McGraw-Hill 1972)
Hine, J. & Wetherill, G. B. — *A Programmed Text in Statistics* Vols 1, 2, 3 (Chapman & Hall 1975)
Hoel, P. G. — *Introduction to Mathematical Statistics* (Wiley 1971)

## PART II SUBJECTS

The Department of Mathematics offers three **Part II Mathematics** subjects. Students whose course restricts them to one subject must study **Mathematics IIA** or **Mathematics IIB**. The subject **Mathematics IIA** is a pre-or corequisite for **Mathematics IIC**, and **IIA** and **IIC** together a prerequisite for any **Part III** subject, so students wishing to take two **Part II** subjects would normally choose **Mathematics IIA** and **IIC**. (It should be noted that Computer Science III is regarded as a part III subject in the Faculty of Mathematics). Students taking all three of the Part II subjects would study all of the topics listed below and an additional topic.

Summaries and booklists for these topics are given on page 37 et seq. of this handbook.

The Department of Mathematics also offers jointly with the Department of Electrical Engineering the subject Computer Science II. No student taking this subject may choose the



Mathematics Topic F as a component of another Part II subject. A description and course outline of Computer Science II will be found on page 69 et seq.

When selecting topics for Part II subjects, students are advised to consider the prerequisites needed for the various Part III subjects offered in the Faculty of Mathematics (Mathematics IIIA, Mathematics IIIB, Statistics III and Computer Science III). All Mathematics III topics are offered with the assumption of Topics CO, D, K, L as background.

### List of Topics for Part II Mathematics Subjects

All Part II Topics have Mathematics I as pre-requisite

| Topic | | Corequisite or Prerequisite Topic | Part III Topic having this Part II Topic as pre-requisite |
|---|---|---|---|
| A | Mathematical Models | CO | — |
| B | Complex Analysis | CO | — |
| CO | Vector Calculus & Differential Equations (Double topic) | — | M, N, P, PD, Q, QRS, TC, Y, Z |
| D | Linear Algebra | — | P, T, X, Z, GT |
| E | Topic in Applied Mathematics e.g. Mechanics, Potential Theory and Fluid Dynamics | CO | — |
| F | Numerical Analysis & Computing | — | TC |
| H | Probability & Statistics | CO | R, ST, U, Y |
| I | Applied Probability and Statistics | H | — |
| K | Topic in Pure Mathematics e.g. Group Theory | — | FM, O, T, X |
| L | Analysis of Metric Spaces | — | FM, O, P, V, W |

The selection rules and definitions of the **Part II** subjects follow.

**662100 Mathematics IIA**

*Prerequisite* — Mathematics I

*Hours* — 4 lecture hours and 2 tutorial hours per week

*Examination* — Each topic is examined separately

*Content*
Topics B, CO and D. In exceptional circumstances *and with the consent of the Head of the Department*, one other topic may be substituted for B. Additional substitutions may be allowed in the case of candidates who have passed the subject Mathematics IIB.

**662200 Mathematics IIB**

*Prerequisite* — Mathematics I

*Hours* — 4 lecture hours and 2 tutorial hours per week

*Examination* — Each topic is examined separately

*Content*
Four topics chosen from A to H, where CO counts as two topics, *and approved by the Head of the Department*. In exceptional circumstances *and with the consent of the Head of the Department* one or more of the topics SP, I, K or L may be included. Students in the Faculty of Mathematics may, with the consent of the Dean, take Mathematics IIB in two parts, each consisting of two topics.

**662300 Mathematics IIC**

| | |
|---|---|
| *Prerequisite* | Mathematics I |
| *Pre-or Corequisite* | Mathematics IIA |
| *Hours* | 4 lecture hours and 2 tutorial hours per week |
| *Examination* | Each topic is examined separately |

*Content*

The topics H, I, K, L, or A, H, K, L or A, E, K, L. Students who may wish to proceed to Statistics III as a Part III subject should select topic I. Under exceptional circumstances, *and with the consent of the Head of the Department,* some substitution may be allowed.

*Notes*

1. Students whose course includes a Schedule B subject may have their choice of topics specified further than is set out in the rules above.
2. Students whose course includes Physics IIIA are advised to include topics CO, B and one of D, F and H in their Mathematics Part II subjects: this may require the use of the substitution rules.
3. Students who take all three subjects Mathematics IIA, IIB, IIC will be required to take the ten topics above together with *either* Topic SP of Computer Science II *or* Topic S (Geometry) or some other suitable topic. Such students should consult the Head of the Department concerning the appropriate choice.

## PART II TOPICS

**662101 Topic A — Mathematical Models** — D. L. S. McElwain

| | |
|---|---|
| *Prerequisite or Corequisite* | Topic CO |
| *Hours* | 1 lecture hour per week and 1 tutorial hour per fortnight |
| *Examination* | One 2-hour paper |

*Content*

This topic is designed to introduce students to the idea of a mathematical model. Four or five realistic situations will be treated beginning with an analysis of the non-mathematical origin of the problem, the formulation of the mathematical model, solution of the mathematical problem and interpretation of the theoretical results.

| | |
|---|---|
| *Text* | Nil |

*References*

| | |
|---|---|
| Andrews, J. G. & McClone, R. R. | *Mathematical Modelling* (Butterworth 1976) |
| Haberman, R. | *Mathematical Models* (Prentice-Hall 1977) |
| Kemeny, J. G. & Snell, J. L. | *Mathematical Models in Social Sciences* (Blaisdell 1963) |
| Noble, B. | *Applications of Undergraduate Mathematics in Engineering* (M.A.A./Collier-Macmillan 1967) |
| Rapoport, A. & Chammah, A. M. | *Prisoner's Dilemma* (Michigan 1965) |
| Smith, J. M. | *Mathematical Ideas in Biology* (Cambridge 1971) |

**662102 Topic B — Complex Analysis** — M. J. Hayes and R. F. Berghout

| | |
|---|---|
| *Prerequisite or Corequisite* | Topic CO |
| *Hours* | 1 lecture hour per week and 1 tutorial hour per fortnight |
| *Examination* | One 2-hour paper |

*Content*

Complex numbers, cartesian and exponential forms, solution of polynomial equations. Functions of a complex variable, mapping from one set of complex numbers to another.



Continuity. Differentiation, Cauchy-Riemann equations. Integration, Cauchy's theorem and integral formulae. Taylor and Laurent series. Analytic continuation. Residue Theory, evaluation of some real integrals and series. More conformal mapping and applications to fluid flow. Inverse Laplace transforms. Argument Theorem - applications to Rouché, Fundamental Theorem of Algebra, Inverse Mapping Theorem.

*Text*

| | |
|---|---|
| Spiegel, M. R. | *Theory and Problems of Complex Variables* (McGraw-Hill 1964) |

*References*

| | |
|---|---|
| Churchill, R. V. | *Complex Variables and Applications* (McGraw-Hill 1960) |
| Greenberg, M. D. | *Foundations of Applied Mathematics* (Prentice-Hall 1978) |
| Kreyszig, E. | *Advanced Engineering Mathematics* 4th edn (Wiley 1979) |
| Polya, G. & Latta, G. E. | *Complex Variables* (Wiley 1974) |

**662109 Topic CO — Vector Calculus & Differential Equations** — W. Summerfield

| | |
|---|---|
| *Prerequisites* | Nil |
| *Hours* | 2 lecture hours per week and 1 tutorial hour per week |
| *Examination* | One 3-hour paper |

*Content*

Differential and integral calculus of functions of several variables: partial derivatives, chain rule, Jacobians, multiple integrals, Green's, Gauss' and Stokes' theorems, gradient, divergence and curl.

Taylor's polynomial; Fourier series.

First and second order linear differential equations: general solution, initial and boundary value problems, solution by Laplace transform. A little on Sturm-Liouville systems if time permits.

Second order linear partial differential equations: Laplace, Wave and Diffusion equations.

*Text*

*Either*

| | |
|---|---|
| Kreyszig, E. | *Advanced Engineering Mathematics* 4th edn (Paperback) (Wiley 1979) (4th edn is preferable but 3rd edn will suffice) |

*or*

| | |
|---|---|
| Greenberg, M. D. | *Foundations of Applied Mathematics* (Prentice-Hall 1978) |

*References*

| | |
|---|---|
| Boyce, W. E. & Di Prima, R. C. | *Elementary Differential Equations and Boundary Value Problems* (Wiley 1969) |
| Courant, R. | *Differential and Integral Calculus* Vol. II (Wiley 1968) |
| Greenspan, H. D. & Benney, D. J. | *Calculus — an Introduction to Applied Mathematics* (McGraw-Hill 1973) |
| Powers, D. L. | *Boundary Value Problems* (Academic 1972) |
| Sneddon, I. N. | *Fourier Series* (Routledge 1961) |
| Spiegel, M. R. | *Theory and Problems of Advanced Calculus* (Schaum 1974) |
| Stephenson, G. | *An Introduction to Partial Differential Equations for Science Students* 2nd edn (Longman 1974) |

**662104 Topic D — Linear Algebra** — P. K. Smrz

| | |
|---|---|
| *Prerequisites* | Nil |
| *Hours* | 1 lecture hour per week and 1 tutorial hour per fortnight |
| *Examination* | One 2-hour paper |

*Content*

The first half of the year: A brief review of some material in the algebra section of Mathematics I. Linear maps, matrix representations. Diagonalisation, eigenvalues and eigenvectors. Inner product spaces, orthogonalisation. Orthogonal, unitary, hermitian and normal matrices. Difference equations. Quadratic forms. Linear programming.

The second half of the year: Spectral theorem. Characteristic and minimum polynomials. Cayley-Hamilton theorem. Duality. Jordan form. Some Euclidean geometry, isometries. Three-dimensional rotations.

*Text*

Lipschutz, S. — *Linear Algebra* (Schaum 1974)

*References*

Anton, H. — *Elementary Linear Algebra* 2nd edn (Wiley 1977)
Bloom, D. M. — *Linear Algebra and Geometry* (Cambridge 1979)
Brisley, W. — *A Basis for Linear Algebra* (Wiley 1973)
Nering, E. D. — *Linear Algebra and Matrix Theory* (Wiley 1964)
Reza, F. — *Linear Spaces in Engineering* (Ginn 1971)
Rorres, C. & Anton, H. — *Applications of Linear Algebra* (Wiley 1979)

**662201 Topic E — Topic in Applied Mathematics e.g. Mechanics, Potential Theory and Fluid Dynamics** — W. T. F. Lau

*Prerequisites or Corequisite* — Topic CO

*Hours* — 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* — One 2-hour paper

*Content*

Summary of vector algebra. Velocity and accelerations. Kinematics of a particle. Newton's Law of Motion. Damped and forced oscillations. Projectiles. Central forces. Inverse square law. The energy equation. Motion of a particle system. Conservation of linear momentum and of angular momentum. Motion with variable mass. If time permits, three-dimensional motion and Lagrange's equations. An introduction to fluid mechanics and potential theory will be given.

*Text* — Nil

*References*

Chorlton, F. — *Textbook of Dynamics* (Van Nostrand 1963)
Goodman, L. E. — *Dynamics* (Blackie 1963)
Marion, J. B. — *Classical Dynamics* (Academic 1970)
Meirovitch, L. — *Methods of Analytical Dynamics* (McGraw-Hill 1970)

**662202 Topic F — Numerical Analysis & Computing** — R. J. Vaughan

*Prerequisites* — Nil

*Hours* — 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* — One 2-hour paper

*Content*

FORTRAN. Sources of error in computation. Solution of a single nonlinear equation. Interpolation and the Lagrange interpolating polynomial. Finite differences and applications to interpolation. Numerical differentiation and integration including the trapezoidal rule, Simpson's rule and Gaussian integration formulae. Numerical solution of ordinary differential equations — Runge-Kutta and predictor-corrector methods. Numerical solution of linear systems of algebraic equations. Applications of numerical methods to applied mathematics, engineering and the sciences will be made throughout the course.

*Text* — Nil



*References*

Balfour, A. & Beveridge, W. T. — *Basic Numerical Analysis with Fortran* (Heinemann 1973)
Carnahan, B. et al. — *Applied Numerical Methods* (Wiley 1969)
Conte, S. D. & de Boor, C. — *Elementary Numerical Analysis* 3rd edn (McGraw-Hill 1980)
Hartree, D. R. — *Numerical Analysis* (Oxford 1958)
Kreitzberg, C. B. & Shneiderman, B. — *The Elements of Fortran Style* (Harcourt, Brace & Jovanovich 1972)
Ralston, A. — *A First Course in Numerical Analysis* (McGraw-Hill 1965)

**662204 Topic H — Probability & Statistics** — R. G. Keats

*Prerequisites* — Nil

*Hours* — 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* — One 2-hour paper

*Content*

This topic is an introduction to the theory of probability and statistics. The lectures will include the following topics. Probability space, basic probability theorems, conditional probability, independence of events. Discrete and continuous random variables, probability density functions, distribution function. Expectation, mean, variance, moment generating function. Joint distribution, covariance, correlation, independence. Error propagation. Chebyshev inequality and the weak law of large numbers. Binomial and Poisson probability distributions. Normal distribution. Classification of experimental data, histograms. Random samples, sampling distributions for mean and variance. Statistical inference, hypothesis testing types of error, power functions. Point and interval estimation. Application of the $x^2$, T, F and normal random variables to hypothesis testing.

*Text*

Hoel, P. G. — *Introduction to Mathematicel Statistics* 4th edn (Wiley 1971)

*References*

Allendoerfer, C. B. & Oakley, C. O. — *Principles of Mathematics* Chapter 12 (McGraw-Hill 1955)
Feller, W. — *An Introduction to Probability Theory and its Applications* Vol. I 3rd edn (Wiley 1968)
Freund, J. E. — *Mathematical Statistics* 2nd edn (Prentice-Hall 1971)
Gnedenko, B. V. — *The Theory of Probability* Chapters I & II (Chelsea 1962)
Hine, J. & Wetherill, G. B. — *A Programmed Text in Statistics* Vol. 1—Summarising Data; Vol. 2—Basic Theory; Vol. 3—The t-test and $x^2$ Goodness of Fit; Vol. 4—Tests on Variance and Regression (Chapman & Hall 1975)
Kolmogorov, A. N. — *Foundations of the Theory of Probability* (Chelsea 1950)
Lipschutz, S. — *Theory and Problems of Probability* (Schaum 1968)
Loeve, M. — *Probability Theory* pp. 1-18 (Van Nostrand 1960)
Mendenhall, W. & Scheaffer, R. L. — *Mathematical Statistics with Applications* (Duxbury 1973)
Moran, P. A. P. — *An Introduction to Probability Theory* (Oxford U.P. 1968)

**662301 Topic I — Applied Probability and Statistics** — W. P. Wood

*Prerequisite or Corequisite* — Topic H

*Hours* — 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* — One 2-hour paper

*Content*

Applied Probability — generating functions, regenerative events, random walk and ruin problems; Markov chains, applications.

Applied Statistics — nonparametric statistics, chi-square test, contingency tables.

*Text*

Feller, W. — *An Introduction to Probability Theory and its Applications* Vol. 1, 2nd edn (Wiley 1965)

Hoel, P. G. — *Introduction to Mathematical Statistics* 4th edn (Wiley 1971)

*References*

Kemeny, J. G. & Snell, J. L. — *Finite Markov Chains* (Van Nostrand 1967)

Noether, G. E. — *Introduction to Statistics: A Nonparametric Approach* 2nd edn (Houghton/Mifflin 1976)

### 662303 Topic K — Topic in Pure Mathematics e.g. Group Theory — R. F. Berghout

*Prerequisites* — Nil

*Hours* — 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* — One 2-hour paper

*Content*

Groups, subgroups, isomorphism. Permutation groups, groups of linear transformations and matrices, isometries, symmetry groups of regular polygons and polyhedra. Cosets, Lagrange's theorem, normal subgroups, isomorphism theorems, correspondence theorem. Orbits, stabilisers, and their applications to the Burnside-Polya counting procedure and classification of finite groups of isometries in $R^2$ or $R^3$.

*Text* — Nil

*References*

Budden, F. J. — *The Fascination of Groups* (Cambridge 1972)

Coxeter, H. S. M. — *Introduction to Geometry* (Wiley 1961)

Herstein, I. N. — *Topics in Algebra* 2nd edn (Wiley 1975)

Rotman, J. J. — *The Theory of Groups: an Introduction* (Allyn & Bacon 1966)

Weyl, H. — *Symmetry* (Princeton 1952)

### 662304 Topic L — Analysis of Metric Spaces — J. R. Giles

*Prerequisites* — Nil

*Hours* — 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* — One 2-hour paper

*Content*

Examples of metric and normed linear spaces, convergence of sequences and completeness, contraction mappings. Cluster points and closed sets, interior points and open sets. Continuity of mappings and of linear mappings on normed linear spaces. Compactness and finite dimensional normed linear spaces. Uniform continuity. Uniform convergence of sequences and series of real functions, differentiation and integration of sequences and series of real functions, power series.

*Text*

Giles, J. R. — *Analysis of Metric Spaces* (University of Newcastle 1974)

*References*

Dieudonne, J. — *Foundations of Modern Analysis* (Academic 1960)

Giles, J. R. — *Real Analysis–an Introductory Course* (Wiley 1973)

Goldberg, R. R. — *Methods of Real Analysis* (Ginn Blaisdell 1964)

Mendelson, B. — *Introduction to Topology* (Blackie 1963)

Simmons, G. F. — *Introduction to Topology and Modern Analysis* (McGraw-Hill 1963)

White, A. J. — *Real Analysis* (Addison-Wesley 1968)





The Mathematics Department offers two **Part III Mathematics** subjects, each comprising four topics chosen from the list below. It also offers Part III subjects in Statistics, described on page 44 et seq., and Computer Science, described on page 71 et seq.

Students wishing to proceed to Honours in Mathematics are required to take Mathematics IIIA and at least one of Mathematics IIIB, Computer Science III or Statistics III. Students wishing to proceed to Combined Honours are required to take **Mathematics IIIA** together with the appropriate subject from Schedule B. Students proceeding to Honours will also be required to study additional topics as prescribed by the Heads of the Departments concerned. Students proceeding to Honours are required to prepare under supervision, and deliver in a half-hour session, a seminar paper and may submit this paper as their essay requirement for Mathematics IIIA.

Passes in both **Mathematics IIA** and **IIC** are prerequisite for entry to **Mathematics IIIA**, and **Mathematics IIIA** is pre- or corequisite for **Mathematics IIIB**. It will be assumed that students taking third-year topics in 1982 have already studied topics CO, D, K and L in 1981 (or C, D, E, K and L if passed prior to 1978) in their Part II subjects.

Students from other faculties who wish to enrol in particular **Part III** topics, according to the course schedules of those Faculties, should consult the particulars of the list below, and should consult the lecturer concerned. In particular, the prerequisites for subjects may not all apply to isolated topics.

Students wishing to enrol in Statistics III should avoid taking topics R, U and Y as Mathematics IIIA topics, and students wishing to enrol in Computer Science III should note that topics O, TC and Z may be chosen as topics in either Mathematics IIIA or Computer Science III, but not both.

Summaries of these topics, together with texts and references, appear on page 44 et seq. of this handbook.

### List of Topics for Part III Mathematics

| Topic | | Prerequisite(s) |
|---|---|---|
| FM | Foundations of Mathematics | K, L |
| M | General Tensors and Relativity | CO |
| N | Variational Methods and Integral Equations | CO |
| O | Mathematical Logic and Set Theory | K, L |
| P | Ordinary Differential Equations | CO, D, L |
| PD | Partial Differential Equations | CO |
| PL | Programming Languages and Systems | — |
| Q | Fluid Mechanics | CO |
| QRS | Quantum, Relativistic and Statistical Mechanics (not offered in 82, but offered in 83) | CO |
| R | Theory of Statistics | H |
| S | Geometry | — |
| ST | Sampling Theory | H |
| T | Group Theory | D, K |
| TC | Theory of Computing | CO, F |
| U | Regression, Design & Analysis of Experiments | H |
| V | Measure Theory & Integration | L |
| W | Functional Analysis | B, CO, D, K, L |
| X | Rings & Fields | D, K |
| Y | Theory of Probability | CO, H |
| Z | Mathematical Principles of Numerical Analysis | CO, D |
| GT | Applied Graph Theory | D |

Some topics may be offered in alternate years, and, in particular, some may be available as Mathematics IV topics.

The selection rules and definitions of the **Part III** subjects follow.

**663100 Mathematics IIIA**

*Prerequisites* Mathematics IIA & IIC

*Hours* 4 lecture hours and 2 tutorial hours per week

*Examination* Each topic is examined separately

*Content*

A subject comprising Topic O, together with three other topics, at least one of which should be from the set (M, Q, QRS, ST, U, R), and at least one from the set (S, X, T, V, W). The final choice of topics must be approved by the Head of the Department. The topic PL will not normally be included in this subject. In addition, students taking this subject will be required to complete an essay on a topic chosen from the history or philosophy of Mathematics. Students should consult members of academic staff regarding their choice of topics.

**663200 Mathematics IIIB**

*Prerequisite or Corequisite* Mathematics IIIA

*Hours* 4 lecture hours and 2 tutorial hours per week

*Examination* Each topic is examined separately

*Content*

A subject comprising four topics chosen from the topics listed above. Students should consult members of academic staff regarding their choice of topics. The final choice of topics must be approved by the Head of the Department.

*Notes*

1. In order to take both Mathematics IIIA and Mathematics IIIB, a student must study eight topics from the above with due regard to the composition of Mathematics IIIA mentioned above.
2. Students whose course includes a subject from Schedule B may have their choice of topics further restricted.
3. Students aiming to take Mathematics IV may be required to undertake study of more topics than the eight comprising the two Part III subjects.

## STATISTICS SUBJECT

**663300 Statistics III**

*Prerequisites* Mathematics IIA and IIC (including topics CO, H & I)

*Hours* 4 lecture hours and 2 tutorial hours per week

*Examination* Each topic is examined separately

*Content*

A subject comprising four topics: Topics R, U, ST, Y.

## PART III TOPICS

**663210 Topic FM — Foundations of Mathematics** — R. F. Berghout

*Prerequisites* Topics K & L

*Hours* 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* One 2-hour paper plus several assignments and short tests



*Content*

First and second year topics have introduced the real numbers axiomatically. But what reasons do we have for assuming the existence of a unique real number system? Where do the axioms come from? Why stop with the real, or complex, numbers? This topic is aimed at answering such questions. The second half of the topic will deal with Euclidean geometry: first as done by the Greeks, to find its strengths and flaws; second as "tidied-up" by modern mathematicians.

*Text*

Enderton, H. B. *Elements of Set Theory* (Academic 1977)

*References*

Birkhoff, G. & MacLane, S. *A Survey of Modern Algebra* 3rd edn (Macmillan 1965)
Burrill, C. W. *Foundations of Real Numbers* (McGraw-Hill 1967)
Cohen, L. & Ehrlich, G. *The Structure of the Real Number System* (Van Nostrand 1963)
Courant, R. & Robbins, H. *What is Mathematics?* (Oxford 1961)
Halmos, P. *Naive Set Theory* (Van Nostrand 1960)
Landau, E. *Foundations of Analysis* (Chelsea 1951)
MacLane, S. & Birkoff, G. *Algebra* 2nd edn (Macmillan 1979)
Wilder, R. *Introduction to the Foundation of Mathematics* (Wiley 1965)

**663101 Topic M — General Tensors and Relativity** — P. K. Smrz

*Prerequisites* Topic CO

*Hours* 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* One 2-hour paper

*Content*

Covariant and contravariant vectors, general systems of coordinates. Covariant differentiation, differential operators in general coordinates. Riemannian geometry, metric, curvature, geodesics. Applications of the tensor calculus to the theory of elasticity, dynamics, electromagnetic field theory, and Einstein's theory of gravitation.

*Text* Nil

*References*

Abram, J. *Tensor Calculus through Differential Geometry* (Butterworths 1965)
Landau, L. D. & Lifshitz, E. M. *The Classical Theory of Fields* (Pergamon 1962)
Lichnerowicz, A. *Elements of Tensor Calculus* (Methuen 1962)
Tyldesley, J. R. *An Introduction to Tensor Analysis* (Longman 1975)
Willmore, T. J. *An Introduction to Differential Geometry* (Oxford 1972)

**663102 Topic N — Variational Methods and Integral Equations** — T. K. Sheng

*Prerequisite* Topic CO

*Hours* 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* One 2-hour paper

*Content*

Fixed end point problems. Weak, strong, global, minima. Moveable boundaries, corner conditions. Isoperimetric problems. Direct methods of solving variational problems, Rayleigh-Ritz method, Galerkin method. Sturm-Liouville eigenvalue-eigenfunction problems.

Fredholm equations. Volterra equations. Finite difference method. Contraction mapping principle. Successive approximation method. Integral transforms.

*Text* Nil

*References*


| | |
|---|---|
| Arthurs, A. M. | *Complementary Variational Principles* (Pergamon 1964) |
| Elsgolc, L. E. | *Calculus of Variations* (Peragom 1963) |
| Hochstadt, H. | *Integral Equations* (Wiley-Interscience 1973) |
| Kanwal, R. P. | *Linear Integral Equations* (Academic 1971) |
| Weinstock, R. | *Calculus of Variations* (McGraw-Hill 1952) |


**663103 Topic O — Mathematical Logic and Set Theory** — W. Brisley/R. W. Robinson

*Prerequisites* Topics K & L

*Hours* 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* One 2-hour paper

*Content*

Formalisation of deductive processes as inference rules. Sentential calculus, predicate calculus, and predicate calculus with equality. First order theories; consistency, independence, and completeness. (Examples will be taken from the usual mathematical systems). Godel's Theorem. Set Theory: questions of cardinality and of ordering. The continuum hypothesis. Zorn's Lemma and the Axiom of Choice. The place of the paradoxes, and their consequences.

*Texts* Notes available from the Mathematics Department

*References*


| | |
|---|---|
| Crossley, J. et al. | *What is Mathematical Logic?* (Oxford 1972) |
| Enderton, H. B. | *A Mathematical Introduction to Logic* (Academic 1972) |
| Halmos, P. R. | *Naive Set Theory* (Springer 1974 and Van Nostrand 1960) |
| Hayden, G. E. & Kennison, J. F. | *Zermelo-Fraenkel Set Theory* (Merrill 1968) |
| Hofstadter, D. R. | *Godel, Escher, Bach: an Eternal Golden Braid* (Harvester Press 1979) |
| Kleene, S. C. | *Mathematical Logic* (Wiley 1967) |
| Lipschutz, S. | *Set Theory and Related Topics* (Schaum 1964) |
| Margaris, A. | *First Order Mathematical Logic* (Blaisdell 1967) |
| Mendelson, E. | *Introduction to Mathematical Logic* 2nd edn (Van Nostrand 1979, paperback) |


**663104 Topic P — Ordinary Differential Equations** — J. G. Couper

*Prerequisites* Topics CO, D & L

*Hours* 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* One 2-hour paper

*Content*

Stability for linear systems with constant coefficients. Existence, uniqueness and properties of solutions for non-linear systems. Stability of equilibria, Liapunov's method.

*Text* Nil

*References*


| | |
|---|---|
| Coppel, W. A. | *Stability and Asymptotic Behaviour of Differential Equations* (Heath 1965) |
| Hale, J. K. | *Ordinary Differential Equations* (Wiley 1969) |
| Hirsch, M. W. & Smale, S. | *Differential Equations, Dynamical Systems and Linear Algebra* (Academic 1974) |
| Jordan, D. W. & Smith, P. | *Nonlinear Ordinary Differential Equations* (Oxford 1977) |




**663108 Topic PD — Partial Differential Equations** — W. T. F. Lau

*Prerequisite* Topic CO

*Hours* 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* One 2-hour paper

*Content*

First order equations and higher order equations. The Laplace equation, the wave equation and the diffusion equation. Integral transforms, Green's function and other methods. Applications in dynamics, fluid mechanics, heat flow, potential theory, etc.

*Text* Nil

*References*


| | |
|---|---|
| Courant, R. & Hilbert, D. | *Methods of Mathematical Physics* Vol. II *Partial Differential Equations* (Interscience 1966) |
| Epstein, B. | *Partial Differential Equations—an Introduction* (McGraw-Hill 1962) |
| Haack, W. & Wendland, W. | *Lectures on Partial and Phaffian Differential Equations* (Pergamon 1972) |
| Smith, M. G. | *Introduction to the Theory of Partial Differential Equations* (Van Nostrand 1967) |
| Sneddon, I. N. | *Elements of Partial Differential Equations* (McGraw-Hill 1957) |


**663211 Topic PL — Programming Languages & Systems** — W. D. Wallis and D. W. E. Blatt

*Prerequisite* Knowledge of FORTRAN and PASCAL

*Hours* 1½ lecture and tutorial hours per week

*Examination* One 2-hour paper

*Content*

Survey and detailed comparisons of the properties of representative languages of various types with special consideration of some of LISP, SNOBOL, APL, C, ALGOL 68. Review of the mutual influences between the design of languages and the nature of the applications for which the languages have originally been intended.

*Text* Nil

*References*


| | |
|---|---|
| Elson, M. | *Concepts of Programming Languages* (Science Research Associates 1973) |
| Gimpel, J. F. | *Algorithms in SNOBOL4* (Wiley 1976) |
| Griswold, R. E. et al. | *The SNOBOL4 Programming Language* 2nd edn (Prentice-Hall 1971) |
| Pratt, T. W. | *Programming Languages: Design and Implementation* (Prentice-Hall 1975) |
| Sammet, J. E. | *Programming Languages: History and Fundamentals* (Prentice-Hall 1969) |
| Siklossy, L. | *Let's Talk LISP* (Prentice-Hall 1975) |
| Tucker, A. B. | *Programming Languages* (McGraw-Hill 1977) |


**663105 Topic Q — Fluid Mechanics** — W. Summerfield

*Prerequisite* Topic CO

*Hours* 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* One 2-hour paper

*Content*

Basic concepts: continuum, pressure, viscosity. Derivation of the equations of motion for a real incompressible fluid; Poiseuille and Stokes' boundary layer flow. Dynamical similarity and the Reynolds number. Flow at high Reynolds number; ideal (non-viscous) fluid;

simplification of the equations of motion: Bernoulli equations; the case of irrotational flow; Kelvin's circulation theorem. Investigation of simple irrotational inviscid flows; two-dimensional flows; circulation; axisymmetric flow around sphere; virtual mass. Generation of vorticity at solid boundaries; boundary layers and their growth in flows which are initially irrotational.

*Text* Nil

*References*


Batchelor, G. K. *An Introduction to Fluid Dynamics* (Cambridge 1967)
Chirgwin, B. H. & Plumpton, C. *Elementary Classical Hydrodynamics* (Pergamon 1967)
Curle, N. & Davies, H. J. *Modern Fluid Dynamics* Vols I & II (Van Nostrand 1968, 1971)
Goldstein, S. (ed) *Modern Developments in Fluid Dynamics* Vols I & II (Dover 1965)
Milne-Thompson, L. M. *Theoretical Hydrodynamics* (Macmillan 1962)


**663212 Topic QRS — Quantum, Relativistic and Statistical Mechanics** — C. A. Croxton (not offered in 1982)

*Prerequisite* Topic CO

*Hours* 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* One 2-hour paper

*Content*

Classical Lagrangian and Hamiltonian mechanics, Liouville theorem.

Statistical Mechanics: basic postulate; microcanonical ensemble; equipartition; classical ideal gas; canonical ensemble; energy fluctuations; grand canonical ensemble; density fluctuation; quantum statistical mechanics; density matrix; ideal Bose gas; ideal Fermi gas; white dwarf stars; Bose-Einstein condensation; superconductivity.

Relativity: Galilean and Lorentz transformations; simultaneity; Fitzgerald-Lorentz contraction; apparent volume of a moving body; time dilation; the clock paradox.

Quantum mechanics; the wave-particle duality; concept of probability; development, solution and interpretation of Schrodinger's equations in one, two and three dimensions; degeneracy; Heisenberg uncertainty; molecular structure.

*Text* Nil

*References*


Croxton, C. A. *Introductory Eigenphysics* (Wiley 1975)
Fong, P. *Elementary Quantum Mechanics* (Addison-Wesley 1968)
Huang, K. *Statistical Mechanics* (Wiley 1963)
Landau, L. D. & Lifshitz, E. M. *Statistical Physics* (Pergamon 1968)
Resnick, R. *Introduction to Special Relativity* (Wiley 1968)


**663106 Topic R — Theory of Statistics** — A. J. Dobson

*Prerequisite* Topic H

*Hours* 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* One 2-hour paper

*Content*

Sampling distributions. Random vectors and multivariate distributions. Methods of estimation: moments, maximum likelihood. Properties of estimators: bias, sufficiency, minimum variance, etc. Hypothesis testing: Neyman-Pearson lemma, likelihood ratios. Bayesian methods. Non-parametric statistics.

*Text* Nil



*References*


Cox, D. R. & Hinkley, D. V. *Theory of Statistics* (Chapman & Hall)
Hogg, R. V. & Craig, A. J. *Introduction to Mathematical Statistics* 4th edn (Collier Macmillan 1978)
Silvey, S. D. *Statistical Inference* (Chapman & Hall 1975)


**663107 Topic S — Geometry** — T. K. Sheng

*Prerequisites* Nil

*Hours* 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* One 2-hour paper

*Content*

Euclidean geometry: axiomatic and analytic approach, transformations, isometries, decomposition into plane reflections, inversions, quadratic geometry.

Geometry of incidence: the real projective plane, invariance, projective transformation, conics, finite projective spaces.

*Text* Nil

*References*


Blumenthal, L. M. *Studies in Geometry* (Freeman 1970)
Coxeter, H. S. M. *Introduction to Geometry* (Wiley 1969)
Fishback, W. T. *Projective and Euclidean Geometry* (Wiley 1962)
Meschkowski, H. *Unsolved and Unsolvable Problems in Geometry* (Oliver & Boyd 1966)
Tuller, A. *A Modern Introduction to Geometries* (Van Nostrand 1967)


**663129 Topic ST — Sampling Theory** — R. W. Gibberd

*Prerequisite* Topic H

*Hours* 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* One 2-hour paper

*Content*

This course covers the statistical principles that are used to construct and assess methods for collecting and analysing data from finite populations. Some consideration of the practical problems will also be given. Topics covered include: simple random sampling, ratio and regression estimators, stratified sampling and cluster sampling.

*Text*


Barnett, V. *Elements of Sampling Theory* (E.U.P. 1974)


*References*


Cochran, W. G. *Sampling Techniques* 2nd edn (Wiley 1963)
Kish, L. *Survey Sampling* (Wiley 1965)


**663201 Topic T — Group Theory** — R. B. Eggleton

*Prerequisites* Topics D and K

*Hours* 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* One 2-hour paper

*Content*

Permutation groups, regular permutations, regular representations, alternating groups, Galois' Theorem, graphs and permutation groups, transitive and multiply transitive groups. External and internal direct products of groups; quotient groups. Normalizers, conjugate subgroups, centre, derived or commutator subgroup; lattice of subgroups, modular lattice of normal subgroups. Sylow theorems, groups of order $p^2$, pq or $p^3$, finite p-groups. Finitely generated abelian groups. Free groups, homomorphisms of free groups, free abelian groups.

*Text*

Ledermann, W. — *Introduction to Group Theory* (Longman 1976)

*References*

Baumslag, B. & Chandler, B. — *Group Theory* (Schaum 1968)
Carmichael, R. D. — *Introduction to the Theory of Groups of Finite Order* (Dover 1956)
Macdonald, I. D. — *The Theory of Groups* (Oxford 1975)
Rotman, J. J. — *The Theory of Groups: An Introduction* (Allyn and Bacon 1965)

**663209 Topic TC — Theory of Computing** — R. W. Robinson

*Prerequisites* — Topics CO & F

*Hours* — 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* — One 2-hour paper and assignments throughout the course

*Content*

This course will attract science, mathematics and engineering students who are interested in the theoretical foundations of computer science. Topics studied include the following:

Mathematical Models of Computers: Finite Automata are introduced as a first approximation to a model of a computer and some of their properties are studied. Three equivalent models of computation are then introduced and compared. These models are Turing machines, counter machines, and recursive functions. Some of the limits of models of computation (unsolvability) are also discussed.

Algorithmic Aspects of Computation: How "good" an algorithm do we have for performing some computation? Is there any way in which we can say that some algorithm is the "best" for accomplishing some task?

Program Correctness: Methods of program verification are introduced and discussed.

Formal Languages and Parsing: Methods of systematically and formally specifying the syntax of programming languages are discussed. Some parsing methods are introduced.

*Text* — Nil

*References*

Aho, A. V., Hopcroft, J. E. & Ullman, J. D. — *The Design and Analysis of Computer Algorithms* (Addison-Wesley 1974)
Garey, M. R. & Johnson, D. S. — *Computers and Intractability* (Freeman 1979)
Hopcroft, J. E. & Ullman, J. D. — *Formal Languages and Their Relation to Automata* (Addison-Wesley 1969)

**663202 Topic U — Regression, Design and Analysis of Experiments** — R. J. Vaughan

*Prerequisite* — Topic H

*Hours* — 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* — One 2-hour paper

*Content*

The purpose of the course is to familiarise the student with tools for the interpretation of data. Minitab — use of the PDP 11/70 and RSTS operating system. General concept of regression. General linear model: point estimation, sample distribution of estimators, tests of hypothesis including analysis of variance, tests of subhypotheses. Simple and multiple linear regression. Polynominal regression. Design of Experiments: philosophy, randomisation, randomised blocks including interactions, Latin squares, factorial experiments.

*Text* — Nil

*References*

Cochran, W. G. & Cox, G. M. — *Experimental Designs* (Wiley 1964)
Fisher, R. A. — *The Design of Experiments* Any edn (Oliver & Boyd)
Graybill, F. A. — *An Introduction to Linear Statistical Models* Vol. I (McGraw-Hill 1961)



Hoel, P. G. — *Introduction to Mathematical Statistics* 4th edn (Wiley 1971)
Kendall, M. G. & Stuart, A. — *The Advanced Theory of Statistics* (Griffin 1966)
Peng, K. C. — *The Design and Analysis of Scientific Experiments* (Addison-Wesley 1967)

**663203 Topic V — Measure Theory & Integration** — V. Ficker

*Prerequisite* — Topic L

*Hours* — 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* — One 2-hour paper

*Content*

Algebras of sets, Borel sets. Measures, outer measures, measurable sets, extension of measures, Lebesgue measure. Measurable functions, sequences of measurable functions, simple functions. Integration, monotone convergence theorem, the relation between Riemann and Lebesgue integrals. Lp-spaces, completeness. Modes of convergence. Product spaces, Fubini's theorem. Signed measures, Hahn decomposition, Radon-Nikodym theorem.

*Text* — Nil

*References*

Bartle, R. G. — *The Elements of Integration* (Wiley 1966)
de Barra, G. — *Introduction to Measure Theory* (Van Nostrand 1974)
Halmos, P. R. — *Measure Theory* (Van Nostrand 1950)
Kolmogorov, A. N. & Fomin, S. V. — *Introductory Real Analysis* (Prentice-Hall 1970)
Munroe, M. E. — *Introduction to Measure and Integration* (Addison Wesley 1953)

**663204 Topic W — Functional Analysis** — J. R. Giles

*Prerequisites* — Topics B, CO, D, K, L

*Hours* — 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* — One 2-hour paper

*Content*

Hilbert space, the geometry of the space and the representation of continuous linear functionals. Operators on Hilbert space, adjoint, self-adjoint and projection operators. Complete orthonormal sets and Fourier analysis on Hilbert space.

Banach spaces, topological and isometric isomorphisms, finite dimensional spaces and their properties. Dual spaces, the Hahn-Banach Theorem and reflexivity. Spaces of operators, conjugate operators.

*Text*

Giles, J. R. — *Analysis of Normed Linear Spaces* (University of Newcastle 1976)

*References*

Banach, S. — *Theorié des Opérations Linéaires* 2nd edn (Chelsea)
Brown, A. L. & Page, A. — *Elements of Functional Analysis* (Van Nostrand 1970)
Giles, J. R. — *Analysis of Metric Spaces* (University of Newcastle 1975)
Kolmogorov, A. N. & Fomin, S. V. — *Elements of the Theory of Functions and Functional Analysis* Vol. I (Grayloch 1957)
Kreysig, E. — *Introductory Functional Analysis with Applications* (Wiley 1978)
Liusternik, L. A. & Sobolev, U. J. — *Elements of Functional Analysis* (Frederick Unger 1961)
Simmons, G. F. — *Introduction to Topology and Modern Analysis* (McGraw-Hill 1963)
Taylor, A. E. — *Introduction to Functional Analysis* (Wiley 1958)
Wilansky, A. — *Functional Analysis* (Blaisdell 1964)

**663205 Topic X — Rings and Fields** — M. J. Hayes

*Prerequisites* Topics D & K

*Hours* 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* One 2-hour paper

*Content*

Rings and fields, ideals. Euclidean rings, unique factorisation domains, factorisation of polynomials. Extension fields. Algebraic and transcendental numbers. Trisection of angle, duplication of cube, squaring of circle. Finite fields. Galois theory, solvability by radicals, unsolvability of general quintic by radicals, construction of regular n-gons.

*Text* Nil

*References*

Birkhoff, G. D. & MacLane, S. — *A Survey of Modern Algebra* (Macmillan 1953)

Herstein, I. N. — *Topics in Algebra* (Wiley 1975)

Kaplansky, I. — *Fields and Rings* (Chicago 1969)

Stewart, I. — *Galois Theory* (Chapman & Hall 1973)

**663206 Topic Y — Theory of Probability** — V. Ficker

*Prerequisites* Topics CO & H

*Hours* 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* One 2-hour paper

*Content*

Probability spaces, random variables, integration of random variables, various types of convergence of random variables, conditional expectations, independence of random variables and products of probability spaces. Introduction to stochastic processes.

*Text* Nil

*References*

Burrill, C. W. — *Measure, Integration and Probability* (McGraw-Hill 1972)

Cox, D. R. & Miller, H. D. — *The Theory of Stochastic Processes* (Chapman and Hall 1967)

Feller, W. — *An Introduction to Probability Theory and its Applications* Vol. I & II (Wiley 1968)

Kingman, J. F. C. & Taylor, S. J. — *Introduction to Measure and Probability* (Cambridge 1966)

Laha, R. G. & Rohatgi, V. K. — *Probability Theory* (Wiley 1979)

Loeve, M. — *Probability Theory* (Van Nostrand 1960)

**663207 Topic Z — Mathematical Principles of Numerical Analysis** — D. L. S. McElwain

*Prerequisites* Topics CO and D; some experience in programming computers is assumed

*Hours* 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* One 2-hour paper

*Content*

Solution of linear systems of algebraic equations by direct and linear iterative methods; particular attention will be given to the influence of various types of errors on the numerical result, to the general theory of convergence of the latter class of methods and to the concept of "condition" of a system. Solution by both one step and multistep methods of initial value problems involving ordinary differential equations. Investigation of stability of linear marching schemes. Boundary value problems. Finite-difference and finite-element methods of solution of partial differential equations.

*Text* Nil



*References*

Ames, W. F. — *Numerical Methods for Partial Differential Equations* (Nelson 1969)

Cohen, A. M. et al. — *Numerical Analysis* (McGraw-Hill 1973)

Conte, S. D. & de Boor, C. — *Elementary Numerical Analysis* 3rd edn (McGraw-Hill 1980)

Forsythe, G. E., Malcolm, M. A. & Moler, C. B. — *Computer Methods for Mathematical Computations* (Prentice-Hall 1977)

Isaacson, E. & Keller, H. M. — *Analysis of Numerical Methods* (Wiley 1966)

Lambert, J. D. & Wait, R. — *Computational Methods in Ordinary Differential Equations* (Wiley 1973)

Mitchell, A. R. & Wait, R. — *The Finite Element Method in Partial Differential Equations* (Wiley 1977)

Smith, G. D. — *Numerical Solution of Partial Differential Equations: Finite Difference Methods* (Oxford 1978)

**663134 Topic GT — Applied Graph Theory** — W. D. Wallis

*Prerequisite* Topic D

*Hours* 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* One 2-hour paper

*Content*

Introductory concepts of graph theory: graphs, digraphs, walks, paths, cycles, matchings, colourings, planarity. Euler and Hamilton walks and applications. Personnel assignment and timetabling. Storage allocation.

Trees. The minimal spanning tree. Distance; communication networks and organisational structure. Tree counting. The vector spaces associated with a graph.

Graphs and networks. Electrical application - Kirchhoff's law, squaring the square. Commodity networks, the max flow-min cut theorem, feasible flows, supply and demand problems.

Critical path analysis. The shortest route problem and dynamic programming.

Various applications in the social sciences.

*Text* Nil

*References*

Bondy, J. A. & Murty, U. S. R. — *Graph Theory with Applications* (Macmillan 1977)

Street, A. P. & Wallis, W. D. — *Combinational Theory: An Introduction* (Charles Babbage Research Centre 1977)

Wilson, R. J. — *Introduction to Graph Theory* (Longman 1972)

Wilson, R. J. & Beineke, L. W. — *Applications of Graph Theory* (Academic 1979)

## PART IV SUBJECT

**664100 Mathematics IV**

*Prerequisites* Mathematics IIIA and at least one of Mathematics IIIB, Computer Science III or Statistics III and additional work as prescribed by the Head of the Department of Mathematics.

A student desiring admission to this subject should apply in writing to the Head of the Department before 20th December of the preceding year.

Students who have passed Computer Science III may, with the permission of the Head of the Department of Mathematics, select not more than half of their topics of study from a supplementary list of courses related to computer science and given in other departments. This list is printed on page 68.

*Hours* — At least 8 lecture hours per week over one full-time year or 4 lecture hours per week over two part-time years.

*Examination* — At least eight 2-hour final papers.
A thesis, i.e. a study under direction of a special topic using relevant published material and presented in written form. The topics offered may be from any branch of Mathematics including Pure Mathematics, Applied Mathematics, Statistics, Computer Science and Operations Research as exemplified in the publication *Mathematical Reviews*.Work on this thesis normally starts early in February.

*Content*
A selection of at least eight Part IV topics. Summaries of topics which may be offered follow.

## PART IV TOPICS

### 664137 Introduction to Category Theory — R. F. Berghout

*Prerequisites* — Topics FM, T or X

*Hours* — About 27 lecture hours

*Examination* — One 2-hour paper

*Content*
This course is geared to an examination of the concept of "naturality" in mathematics. Categories and functors will be introduced as unifying concepts underlying much of mathematics. Adjoint functors will be discussed in some depth and illustrated by applications to various branches of mathematics, particularly group theory. The existence of adjoint functors under certain conditions and a monadic approach to universal algebra will end the course.

*Text*
MacLane, S. — *Categories for the Working Mathematician* (Springer 1971)

*References*
Arbib, M. & Manes, E. G. — *Arrows, Structures and Functors: The Categorical Imperative* (Academic 1975)
Dickson, S. — *An Introduction to Categorical Algebra* (Obtainable from Mathematics Department)

### 664151 Radicals & Annihilators — R. F. Berghout

*Prerequisites* — Topics FM, T or X

*Hours* — About 27 lecture hours

*Examination* — One 2-hour paper

*Content*
This topic will briefly outline the classical theory of finite dimensional algebras and the emergence of the concepts of radical, idempotence, ring, chain conditions, etc. Hopefully thus set in perspective, the next part will deal with the Artin-Hopkins-Jacobson ring theory and the significance of other radicals when finiteness conditions are dropped. The relations between various radicals, noetherian rings, left and right annihilators and the Goldie-Small theorems will end the topic.

Text — Nil

*References*
Cohn, P. — *Algebra Vol. 2* (Wiley 1977)
Divinsky, N. — *Rings and Radicals* (Allen-Unwin 1964)
Herstein, I. N. — *Non-commutative Rings* (Wiley 1968)
Kaplansky, I. — *Fields and Rings* (Chicago 1969)



McCoy, N. — *The Theory of Rings* (McMillan 1965)
Tolkien, J. R. R. — *The Fellowship of the Ring* (Allen-Unwin 1974)
Wagner, R. — *The Ring of the Nibelungen* (Philips 1973)

### 664157 Concurrent Programming Techniques — D. W. E. Blatt

*Prerequisite* — Topic TC or Computer Operating Systems

*Hours* — About 27 lecture hours

*Examination* — One 2-hour paper

*Content*
Methods of controlling concurrent activities in a computer or a multiprocessor system. Time dependent errors, functional systems, the deadlock problem. Semaphores, simple and conditional critical regions, message buffers, event queues, Hoare's monitor construct, path expressions. Theory of communicating sequential processes. Languages used for structured concurrent programming: Concurrent Pascal, C, Modula, Ada. Hardware architectures to support concurrent processing, e.g. matrix multiplication with processor arrays. Practical work in C (modifying Unix internals) and Concurrent Pascal (writing a small concurrent system).

*Text* — Nil

*References*
Kernighan, B. W. & Ritchie, D. M. — *The C Programming Language* (Prentice-Hall 1978)
Mead, C. & Conway, L. — *Introduction to VLSI Systems* (Addison-Wesley 1980)
Wegner, P. — *Programming with Ada: An Introduction by Means of Graduated Examples* (Prentice-Hall 1980)

### 664166 Symmetry — W. Brisley

*Prerequisites* — Topics D and K

*Hours* — About 27 lecture hours

*Examination* — One 2-hour paper

*Content*
A course dealing with various aspects of symmetry. Matters discussed will include: invariance of lattices, crystals and associated functions and equations; permutation groups; finite geometries; regular and strongly-regular graphs; designs; tactical configurations; "classical" simple groups, Mathieu groups.

*Text* — Nil

*References*
Biggs, N. — *Finite Groups of Automorphisms* (Cambridge 1971)
Carmichael, R. D. — *Groups of Finite Order* (Dover reprint)
Harary, F. — *Graph Theory* (Addison-Wesley 1969)
Lomont, J. S. — *Applications of Finite Groups* (Academic 1959)
White, A. T. — *Graphs, Groups and Surfaces* (North-Holland 1973)
Wielandt, H. — *Finite Permutation Groups* (Academic 1964 et seq)
Wilson, R. J. — *Introduction to Graph Theory* (Longman 1972)

### 664169 Nonlinear Oscillations — J. G. Couper

*Prerequisite* — Topic P

*Hours* — About 27 lecture hours

*Examination* — One 2-hour paper

*Content*
Physical problems often give rise to ordinary differential equations which have oscillatory solutions. This course will be concerned with the existence and stability of periodic solutions

of such differential equations, and will cover the following subjects: Two-dimensional autonomous systems, limit sets, and the Poincare-Bendixson theorem. Brouwer's fixed point theorem and its use in finding periodic solutions. Non-critical linear systems and their perturbations. The method of averaging. Frequency locking, jump phenomenon, and subharmonics. Bifurcation of periodic solutions. Attention will be paid to applications throughout the course.

*Text* Nil

*References*

Hale, J. K. — *Ordinary Differential Equations* (Wiley 1969)

Hirsch, M. W. & Smale, S. — *Differential Equations, Dynamical Systems and Linear Algebra* (Academic 1974)

Marsden, J. E. & McCracken, M. — *The Hopf Bifurcation and its Applications* (Springer-Verlag 1976)

Nayfeh, A. H. & Mook, D. T. — *Nonlinear Oscillations* (Wiley 1979)

Stoker, J. J. — *Nonlinear Vibrations* (Wiley 1950)

**664170 Many-body Theory** — Not offered in 1982

*Prerequisites* Nil

*Hours* About 27 lecture hours

*Examination* One 2-hour paper

*Content*

Cluster-diagrammatic expansions—low density solutions; integrodifferential equations (BGY, HNC, PY)— high density solutions; quantum liquids—Wu-Feenburg fermion extension; numerical solution of integral equations; phase transitions—diagrammatic approach; critical phenomena; the liquid surface; liquid metals; liquid crystals; molecular dynamics and Monte Carlo computer simulation; irreversibility; transport phenomena.

*Text*

Croxton, C. A. — *Introduction to Liquid State Physics* (Wiley 1975)

*Reference*

Croxton, C. A. — *Liquid State Physics—A Statistical Mechanical Introduction* (Cambridge 1974)

**664120 Quantum Mechanics** — Not offered in 1982

*Prerequisites* Nil

*Hours* About 27 lecture hours

*Examination* One 2-hour paper

*Content*

Operators; Schrodinger equation; one dimensional motion; parity; harmonic oscillator; angular momentum; central potential; eigenfunction; spin and statistics; Rutherford scattering; scattering theory phase shift analysis; nucleon-nucleon interaction; spin-dependent interaction; operators and state vectors; Schrodinger equations of motion; Heisenberg equation of motion. Quantum molecular orbitals; hybridization; LCAO theory; MO theory.

*Texts*

Croxton, C. A. — *Introductory Eigenphysics* (Wiley 1974)

Matthews, P. T. — *Introduction to Quantum Mechanics* (McGraw-Hill 1968)

**664171 Algebraic Number Theory** — R. B. Eggleton

*Prerequisites* Topic T or X

*Hours* About 27 lecture hours

*Examination* One 2-hour paper



*Content*

A genetic approach to algebraic number theory as it arose out of the study of Fermat's Last Theorem. The course, closely following the prescribed text, covers the following topics: Selected diophantine equations, method of infinite descent, sums of two squares, sums of two cubes, sums of two fifth powers, cyclotomic integers, ideal factors and divisibility theory, equivalent divisors, class number, regular primes, Euler's product formula, characters, units, the class number formula, divisibility for quadratic integers, the divisor class group, genera, binary quadratic forms.

*Text*

Edwards, H. M. — *Fermat's Last Theorem: A Genetic Introduction to Number Theory*, Graduate Texts in Mathematics 50 (Springer 1977)

**664172 Generalised Linear Statistical Modelling** — J. R. Landis and A. J. Dobson

*Prerequisites* Topics R and U

*Hours* About 27 lecture hours

*Examination* One 2-hour paper

*Content*

The first part of this course covers the general linear models approach to the analysis of multivariate categorical data. Topics include the multi-factor, multi-response framework for multidimensional contingency tables; product multinomial distribution; multivariate Taylor series approximations; weighted least squares; hypothesis formulation, estimation and testing within linear models; parameterization and analysis of factorial and repeated measurement designs including symmetry, agreement and growth curve models; methods for the analysis of ordinal variables. Each of these procedures will be illustrated with actual research data involving multidimensional contingency tables.

The second part covers the theory of generalised linear models and illustrates how many methods for analysing continuous, binary and multiple category data fit into this framework. Topics include the exponential family of distributions; maximum likelihood estimation; sampling distributions for goodness-of-fit statistics; linear models for continuous data (regression and analysis of variance); logistic regression; contingency tables.

Students will implement these methods using various computer packages which form an integral part of the course.

*Text* Lecture notes to be distributed

*References* A bibliography of research papers will be available

**664153 Algebraic Graph Theory** — R. B. Eggleton

*Prerequisite* Topic D

*Hours* About 27 lecture hours

*Examination* One 2-hour paper

*Content*

The adjacency matrix of a graph. Path lengths, shortest paths in a graph. Spectrum of a graph. Regular graphs and line graphs. Homology of graphs. Spanning trees. Complexity of a graph. The determinant of the adjacency matrix. Automorphisms of graphs. Vertex transitive graphs Symmetric graphs, with attention to the trivalent case. Covering graph of a graph. Distance-transitive graphs. Realisability of intersection arrays. Primitivity and imprimitivity. Minimal regular graphs of given girth. The course will finish with a selection of topics related to vertex colourings and the chromatic polynomial, as time permits.

*Text*

Biggs, N. — *Algebraic Graph Theory* (Cambridge 1974)

*References*


Bondy, J. A. & Murty, U. Š. R. — *Graph Theory with Applications* corrected edn (Macmillan 1977)

Harary, F. — *Graph Theory* (Addison-Wesley 1969)

Lancaster, P. — *Theory of Matrices* (Academic 1969)

Wilson, R. J. — *Introduction to Graph Theory* (Longman 1972)


**664173 Mathematical Problem Solving** — R. B. Eggleton

*Prerequisites* Topic FM or O

*Hours* About 27 class hours

*Examination* One 2-hour paper

*Content*

The class will be conducted by a team of several staff members with interests across a wide spectrum of mathematics. The course will contain a series of mathematical problems, presented for solution. Participants in the class will be expected to contribute to initial discussion of the problems, then to attempt individual solutions, and subsequently to present their full or partial solutions.

In the case of problems solved only partially by individuals, subsequent class discussion would be aimed at producing a full solution on a team basis. Finally participants in the class will be expected to write up a polished version of the statement and solution of each problem. The intention of the class is to build up participants' experience in skills appropriate for mathematical research. The final examination will be mainly concerned with problems actually solved during the year.

*References*

References will be suggested during the course.

**664142 Topological Graph Theory** — R. B. Eggleton

*Prerequisite* Topic CO

*Hours* About 27 lecture hours

*Examination* One 2-hour paper

*Content*

This topic deals with drawings of graphs on various surfaces. It will begin with a brief introduction to the theory of graphs, to be followed by a fairly detailed introduction to the topology of surfaces, with particular attention to the classification of surfaces.

The main graph-theoretic areas to be treated are: Kuratowski's Theorem characterising graphs which can be embedded in the plane; genus, thickness, coarseness and crossing numbers of graphs; chromatic number of a surface and the proof of the Four Colour Theorem by Appel and Hakin.

*Text* Nil

*References*


Blackett, D. W. — *Elementary Toplogy: Combinational and Algebraic Approach* (Academic 1967)

Bondy, J. A. & Murty, U. S. R. — *Graph Theory with Applications* corrected edn (Macmillan 1977)

Harary, F. — *Graph Theory* (Addison-Wesley 1969)

Ore, O. — *The Four Colour Problem* (Academic 1967)

Ringel, G. — *Map Colour Theorem* (Springer 1974)

White, A. T. — *Graphs, Groups and Surfaces* (North/Holland American Elsevier 1973)

Wilson, R. J. — *Introduction to Graph Theory* (Oliver & Boyd 1972)




**664167 Measure Theory** — V. Ficker

*Prerequisite* Topic V

*Hours* About 27 lecture hours

*Examination* One 2-hour paper

*Content*

Different spaces will be considered and methods of construction of measures on these spaces will be discussed. Some properties of the measures involved will be given.

*Text* Nil

*References*


Berberian, S. K. — *Measure and Integration* (Macmillan 1965)

Burrill, C. W. — *Measure, Integration and Probability* (McGraw-Hill 1972)

Halmos, P. R. — *Measure Theory* (Van Nostrand 1950)

Kingman, J. F. C. & Taylor, S. J. — *Measure and Probability* (Cambridge 1966)

Munroe, M. E. — *Measure and Integration* (Addison-Wesley 1952)

Parthasarathy, K. R. — *Probability Measures on Metric Spaces* (Academic 1967)

Rogers, C. A. — *Hausdorff Measures* (Cambridge 1970)


**664174 Mathematical Demography and Survival Models** — R. W. Gibberd

*Prerequisite* Topic H

*Hours* About 27 lecture hours

*Examination* One 2-hour paper

*Content*

This course presents a mathematical treatment of the techniques used in population projections, manpower studies, urban modelling and the survival models used in demography and bio-statistics.

*Text* Nil

*References*


Elandt-Johnson, R. C. & Johnson, N. L. — *Survival Models and Data Analysis* (Wiley 1980)

Gross, A. J. & Clark, V. A. — *Survival Distributions* (Wiley 1975)

Kalbfleisch, J. D. & Prentice, R. L. — *The Statistical Analysis of Failure Time Data* (Wiley 1980)

Keyfitz, N. — *Applied Mathematical Demography* (Wiley 1977)

Keyfitz, N. — *Introduction to the Mathematics of Population* (Addison-Wesley 1968)


**664103 Banach Algebra** — J. R. Giles

*Pre- or Corequisite* Topic W

*Hours* About 27 lecture hours

*Examination* One 2-hour paper

*Content*

A Banach Algebra is a mathematical structure where the two main strands of pure mathematical study—the topological and the algebraic—are united in fruitful contact. The course will cover the following subject matter. Normed algebras; regular and singular elements; the spectrum of an element and its properties; the Gelfand-Mazur theorem; topological divisors of zero; the spectral radius and spectral mapping theorem for polynominals; ideals and maximal ideals.

Commutative Banach algebras; the Gelfand theory and the Gelfand representation theorem.

Weak topologies, the Banach-Alaoglu theorem, the Gelfand topology. Involutions in Banach algebras; hermitian involutions; the Gelfand-Naimark representation theorem for commutive B* algebras. Numerical range of an element in a normed algebra; relation of the numerical range to the spectrum; B* algebras are symmetric, discussion of the Gelfand-Naimark representation theorem for B* algebras.

Applications of Banach algebra theory.

*Text*

Bonsall, F. F. & Duncan, J. — *Complete Normed Algebras* (Springer 1973)

*References*

Bachman, G. & Narici, L. — *Functional Analysis* (Academic 1966)

Bonsall, F. F. & Duncan, J. — *Numerical Ranges of Operators on Normed Spaces and Elements of Normed Algebras* (Cambridge 1970)

Gelfand, I. M., Raikov, D. A. & Shilov, G. E. — *Commutative Normed Rings* (Chelsea 1964)

Naimark, M. A. — *Normed Rings* (Noordhoff 1959)

Rickart, C. E. — *General Theory of Banach Algebras* (Van Nostrand 1960)

Simmons, G. F. — *Introduction to Topology and Modern Analysis* (McGraw-Hill 1963)

Wilansky, A. — *Functional Analysis* (Blaisdell 1964)

**664158 Convex Analysis** — J. R. Giles

*Pre- or Corequisite* — Topic W

*Hours* — About 27 lecture hours

*Examination* — One 2-hour paper

*Content*

Convexity has become an increasingly important concept in analysis: much of current research in functional analysis concerns generalising to convex functions, properties previously studied for the norm; much of interest in convexity has arisen from areas of applied mathematics related to fixed point theory and optimisation problems.

We begin with a study of convex sets and functions defined on linear spaces: gauges of convex sets, separation properties. We then study topology on linear spaces generated by convex sets: metrisability, normability and finite dimensional cases. We examine continuity and separation for locally convex spaces, continuity for convex functions. We study weak and weak * topologies on normed linear spaces: convexity properties and Banach-Alaoglu Theorem. We study extreme points of convex sets, the Krein-Milman theorem. We give particular attention to the study of differentiation of convex functions on normed linear spaces: Gateaux and Fréchet derivative, Mazur's and Asplund's theorems.

*Text*

Giles, J. R. — *Convex Analysis with Application in the Differentiation of Convex Functions* (Pitman 1982)

*References*

Day, M. M. — *Normed Linear Spaces* (Springer 1973)

Diestel, J. — *Geometry of Banach Spaces—Selected Topics* (Springer 1975)

Ekeland, I. & Teman, R. — *Convex Analysis and Variational Problems* (North Holland 1976)

Giles, J. R. — *Analysis of Normed Linear Spaces* (University of Newcastle 1978)

Holmes, R. B. — *Geometric Functional Analysis and its Applications* (Springer 1975)

Roberts, A. W. & Varberg, D. E. — *Convex Functions* (Academic 1970)

Rockafellar, R. T. — *Convex Analysis* (Princeton 1970)

Rudin, W. — *Functional Analysis* (McGraw-Hill 1973)

Valentine, F. A. — *Convex Sets* (McGraw-Hill 1964)

Wilansky, A. — *Functional Analysis* (Blaisdell 1964)



# GENERAL INFORMATION

The University of Newcastle Calendar consists of the following volumes:

Volume 1 — Legislation: *The Act, By-laws and Regulations*

Volume 2 — University Bodies and Staff:
Part 1 — *Principal Officers, Council, Senate, Boards and Committees.*
Part 2 — *The Professors and Staff.*

Volume 3 — Handbook, *Faculty of Architecture*

Volume 4 — Handbook, *Faculty of Arts*

Volume 5 — Handbook, *Faculty of Economics and Commerce*

Volume 6 — Handbook, *Faculty of Education*

Volume 7 — Handbook, *Faculty of Engineering*

Volume 8 — Handbook, *Faculty of Mathematics*

Volume 9 — Handbook, *Faculty of Medicine*

Volume 10 — Handbook, *Faculty of Science*

Volume 11 — *Annual Report*

All volumes except Volume 1 — Legislation, are published annually.

Volume 1 — Legislation is published irregularly the last issue being 1980.

All volumes except Volumes 2 Staff and 11 Annual Report are available on microfiche.

*Other Publications*
Undergraduate Prospectus
Postgraduate Prospectus
An ABC for New Students
University News
Gazette



CONTENTS

# I PRINCIPAL DATES 1982

*January*

| | | |
|---|---|---|
| 1 | Friday | Public Holiday — New Year's Day |
| 8 | Friday | Last day for return of Re-Enrolment Forms — Continuing Students |
| 18 | Monday | Deferred Examinations begin |
| 29 | Friday | Deferred Examinations end |
| 31 | Sunday | Closing date for applications for residence in Edwards Hall |

*February*

| | | |
|---|---|---|
| 1 | Monday | Public Holiday — Australia Day |
| 10<br>11 | Wednesday<br>Thursday | New students attend in person to enrol and pay charges |
| 22 | Monday | Late enrolment session for new students |

*March*

| | | |
|---|---|---|
| 1 | Monday | *First Term* begins |

*April*

| | | |
|---|---|---|
| 9 | Friday | Good Friday — Easter Recess commences |
| 13 | Wednesday | Lectures resume |
| 21 | Wednesday | Last day for withdrawal without academic penalty from first half year subjects (See page (viii) for Dean's discretion) |
| 26 | Monday | Public Holiday — Anzac Day — 25 April |

*May*

| | | |
|---|---|---|
| 1 | Saturday | *First Term* ends |
| 17 | Monday | Examinations begin |
| 21 | Friday | Examinations end |
| 24 | Monday | *Second term* begins |

*June*

| | | |
|---|---|---|
| 11 | Friday | Last day for return of *Confirmation of Enrolment* forms |
| 14 | Monday | Public Holiday — Queen's Birthday |
| 30 | Wednesday | Closing date for Applications for Admission to the Bachelor of Medicine course in 1983 |

*July*

| | | |
|---|---|---|
| 5 | Monday | Last day for withdrawal without academic penalty from full year subjects (See page (viii) for Dean's discretion) |
| 5 | Monday | Examinations begin |
| 9 | Friday | Examinations end |



*August*

| | | |
|---|---|---|
| 7 | Saturday | *Second Term* ends |
| 9 | Monday | Examinations begin |
| 13 | Friday | Examinations end |
| 30 | Monday | *Third Term* begins |

*September*

| | | |
|---|---|---|
| 6 | Monday | Last day for withdrawal without academic penalty from second half year subjects (See page (viii) for Dean's discretion) |

*October*

| | | |
|---|---|---|
| 1 | Friday | Closing date for Applications for Admission 1983 (Undergraduate courses other than Medicine) |
| 4 | Monday | Public Holiday — Eight Hour Day |
| 30 | Saturday | *Third Term* ends |

*November*

| | | |
|---|---|---|
| 1 | Monday | Annual Examinations begin |
| 19 | Friday | Annual Examinations end |

Note: Term dates for students in the Bachelor of Medicine course are printed in Calendar Volume 9 — Medicine Handbook.

1983

*January*

| | | |
|---|---|---|
| 17 | Monday | Deferred Examinations begin |
| 28 | Friday | Deferred Examinations end |

*February*

| | | |
|---|---|---|
| 28 | Monday | *First Term* begins |

# II GENERAL INFORMATION

*Enrolment of New Students*

Persons offered admission are required to attend in person at the Great Hall in mid February to enrol and pay charges. Detailed instructions are given in the Offer of Admission.

*Enrolment of Continuing Students*

The University makes arrangements for continuing students to enrol by mail. There are two steps involved:

— Lodging the *Enrolment form* with details of your proposed programme.
— Completing enrolment by lodging the *Authority to Complete* Enrolment form with the cashier with charges payable.

*1. Lodging Enrolment Forms*

Re-enrolment materials will be mailed to all undergraduate students in mid-December. Those who wish to enrol in 1982 and *who are eligible to do so* (see Regulations Governing Unsatisfactory Progress) should complete the enrolment form as soon as possible after the release of the 1981 annual examination results, and forward it to The Secretary, University of Newcastle, N.S.W. 2308.

*Enrolment forms from continuing students are due by 8 January 1982* except in the case of a student who is required to take a special or deferred examination in which case the enrolment form must be submitted within seven days of the release of those examination results.

Submission of enrolment forms after the due date will render the student liable to a late lodgement charge of $14.00.

Students who, for good reason, are unable to submit their enrolment forms by the due date, may apply for an extension of time. The request, with details of the reason for the extension must reach the Secretary by the due date if the late lodgement charge is to be avoided. The By-laws provide that no enrolment will be accepted after 31 March without the approval of the Secretary.

*2. Completing Enrolment*

When the proposed programme has been approved, an *Authority to Complete Enrolment* form will be mailed to the student showing charges payable. Students are required to complete enrolment by lodging the form with the Cashier with the charges payable. This can be done by mail or in person. The Cashier's office is open 10 am to 12 noon and 2 pm to 4 pm Monday to Friday. At least 14 days notice is allowed from the date of posting to the date by which charges must be paid if a late charge is to be avoided.

*Student Cards*

The Authority to Complete Enrolment form incorporates the student's identification card which is returned to him after payment of charges. It should be carried by students when at the University. It serves as evidence that the student is enrolled and must be presented when applying for travel concessions, a parking permit or to confirm membership of the University Union.

If a student loses his Student Card he should pay the replacement charge of 50 cents to the Cashier and present the receipt at the Student Administration Office when seeking a replacement card.

A student who withdraws completely from studies should return the Student Card to the Student Administration Office.



*Library Cards*

Students should present their Student Card to the Library desk to be issued with their Library Borrowers Card. This card, which has machine readable lettering, must be presented when borrowing books from the Library.

*Re-admission after Absence*

A person who has been enrolled previously at the University of Newcastle, *but not enrolled in 1981*, is required to lodge an *Application for Admission* if further undergraduate enrolment is desired. Applications are available from the Student Administration Office and should preferably be lodged by 1 October 1981.

*Attendance Status*

A candidate for any qualification other than a postgraduate qualification who is enrolled in three quarters or more of a normal full-time programme shall be deemed to be a full-time student whereas a candidate enrolled in either a part-time course or less than three-quarters of a full-time programme shall be deemed to be a part-time student.

A candidate for a postgraduate qualification shall enrol as either a full-time or a part-time student as determined by the Faculty Board.

*Change of Address*

Students are responsible for notifying the Student Administration Office in writing of any change in their address. A *Change of Address* form should be used and is available from the Student Administration Office.

Failure to notify changes could lead to important correspondence or course information not reaching the student. The University cannot accept responsibility if official communications fail to reach a student who has not notified the Student Administration Office of a change of address.

It should be noted that examination results, re-enrolment and other correspondence will be mailed to students in December and January. Students who will be away during the long vacation from the address given to the University for correspondence should make arrangements to have mail forwarded to them.

*Change of Name*

Students who change their name should advise the Student Administration Office. Marriage, deed poll or naturalisation etc. certificates should be presented for sighting in order that the change can be noted on University records.

*Change of Programme*

Approval must be sought for any changes to the programme for which a student has enrolled. This includes adding or withdrawing subjects, changing attendance status (for example from full-time to part-time) or transferring to a different degree or faculty.

All proposed changes should be entered on the *Variation of Programme* form available at the Student Administration Office. Reasons for changes and where appropriate documentary evidence in the form of medical or other appropriate certificates must be submitted.

*Withdrawal*

Application to withdraw from a subject should be made on a Variation of Programme form and lodged at the Student Administration Office or mailed to the Secretary.

Applications received by the appropriate date listed below will be approved for withdrawal without a failure being recorded against the subject or subjects in question.

Withdrawal Dates

| *Full Year Subjects* | *First Half-year Subjects* | *Second Half-year Subjects* |
|---|---|---|
| Monday 2 August 1982 | Monday 19 April 1982 | Monday 6 September 1982 |

Withdrawal *after* the above dates will normally lead to a failure being recorded against the subject or subjects unless the Dean of the Faculty grants permission for the student to withdraw without penalty.

If a student believes that a failure should not be recorded because of the circumstances leading to his withdrawal, it is important that full details of these circumstances be provided with the application to withdraw.

*Confirmation of Enrolment*

In May each year the University mails to all students a *Confirmation of Enrolment* form which also serves as the application to sit for examinations. This form must be checked carefully, signed and returned by all students (including non-degree students and postgraduate students not taking formal subjects) to confirm that they are actively pursuing subjects for which they are enrolled and that the information on University records is correct and complete.

*Indebtedness*

The Council of the University has directed that students who are indebted to the University because of unpaid charges, library fines or parking fines may not

- complete enrolment in a following year;
- receive a transcript of academic record; or
- graduate or be awarded a Diploma.

Students are requested to pay any debts incurred without delay.

*Leave of Absence*

A student who does not wish to re-enrol for any period up to *three years* should apply for leave of absence. Leave of absence is normally granted only to those students who are in good standing. Applications should be submitted before the end of first term in the first year for which leave of absence is sought. Leave of absence will not be granted for more than three years and will not be granted retrospectively.

Any student who does not enrol for a period of two years and does not obtain leave of absence, must apply for re-admission to the University when he wishes to resume his studies.

*Attendance at Classes*

Where a student's attendance or progress has not been satisfactory, action may be taken under the Regulations Governing Unsatisfactory Progress.

In the case of illness or absence for some other unavoidable cause, a student may be excused for non attendance at classes.

All applications for exemption from attendance at classes must be made in writing to the Head of the Department offering the subject. Where tests or term examinations have been missed, this fact should be noted in the application.

The granting of an exemption from attendance at classes does not carry with it any waiver of the General Services Charge.

*General Conduct*

In accepting membership of the University, students undertake to observe the by-laws and other requirements of the University.



Students are expected to conduct themselves at all times in a seemly fashion. Smoking is not permitted during lectures, in examination rooms or in the University Library. Gambling is forbidden.

Members of the academic staff of the University, senior administrative officers, and other persons authorised for the purpose have authority to report on disorderly or improper conduct occurring in the University.

*Notices*

Official University notices are displayed on the notice boards and students are expected to be acquainted with the contents of those announcements which concern them.

A notice board on the wall opposite the entrance to Lecture Theatre B01 is used for the specific purpose of displaying examination time-tables and other notices about examinations.

*Student Matters Generally*

The main notice board is the display point for notices concerning enrolment matters, scholarships, University rules and travel concessions, etc. This notice board is located on the path between the Union and the Library.

# III EXAMINATIONS

Tests and assessments may be held in any subject from time to time. In the assessment of a student's progress in a university course, consideration will be given to laboratory work, tutorials and assignments and to any term or other tests conducted throughout the year. The results of such assessments and class work may be incorporated with those of formal written examinations.

*Examination Periods*

Formal written examinations take place on prescribed dates within the following periods:

| | |
|---|---|
| End of First Term: | 17 to 21 May, 1982 |
| Mid Year: | 5 to 9 July, 1982 |
| End of Second Term: | 9 to 13 August, 1982 |
| End of Year: | 1 to 19 November, 1982 |

Timetables showing the time and place at which individual examinations will be held will be posted on the examinations notice board near Lecture Theatre B01.

**Misreading of the timetable will not under any circumstances be accepted as an excuse for failure to attend an examination.**

*Sitting for Examinations*

Formal examinations, where prescribed, are compulsory. Students should consult the final timetable in advance to find out the date, time and place of their examinations and should allow themselves plenty of time to get to the examination room so that they can take advantage of the 10 minutes reading time that is allowed before the examination commences. Formal examinations are usually held in the Great Hall area and (in November) the Auchmuty Sports Centre. The seat allocation list for each examination will be on a noticeboard outside the room.

Students can take into any examination any writing instrument, drawing instrument or calculating instrument. Logarithmic tables may not be taken in: they will be available from the supervisor if needed.

Calculators may be used, if permitted by the examiner in any examination. They must be hand held, battery operated and non-programmable* and students should note that no concession will be granted:

(a) to a student who is prevented from bringing into a room a programmable calculator;
(b) to a student who uses a calculator incorrectly; or
(c) because of battery failure.

*Rules for Formal Examinations*

Regulation 15 of the Examination Regulations sets down the rules for formal examinations, as follows:

(a) candidates shall comply with any instructions given by a supervisor relating to the conduct of the examination;
(b) before the examination begins candidates shall not read the examination paper until granted permission by the supervisor which shall be given ten minutes before the start of the examination;
(c) no candidate shall enter the examination room after thirty minutes from the time the examination has begun;
(d) no candidate shall leave the examination room during the first thirty minutes or the last ten minutes of the examination;
(e) no candidate shall re-enter the examination room after he has left it unless during the full period of his absence he has been under approved supervision;
(f) a candidate shall not bring into the examination room any bag, paper, book, written material, device or aid whatsoever, other than such as may be specified for the particular examination;
(g) a candidate shall not by any means obtain or endeavour to obtain improper assistance in his work, give or endeavour to give assistance to any other candidate, or commit any breach of good order;
(h) a candidate shall not take from the examination room any examination answer book, graph paper, drawing paper or other material issued to him for use during the examination;
(i) no candidate may smoke in the examination room.

Any infringement of these rules constitutes an offence against discipline.

*Examination Results*

Each student will be advised in December by mail of his annual examination results.

**No result will be given by telephone.**

After the release of the annual examination results a student may apply to have a result reviewed. There is a charge of $8.00 per subject, which is refundable in the event of an error being discovered. Applications for review must be submitted on the appropriate form together with the prescribed review charge by 14 January 1983.

However, it should be noted that examination results are released only after careful assessment of students' performances and that, amongst other things, marginal failures are reviewed before results are released.

*Special Examinations*

When considering the examination results Faculty Boards take into consideration any circumstances such as illness or personal problems which may have seriously affected a

* A programmable calculator will be permitted provided program cards and devices are not taken into the examination room.



student's work during the year or during the examinations. Any student who considers that his work has been affected in this way or who is unable to attend for any examination and who wishes to apply for special consideration should write to the Secretary explaining the circumstances and, in the case of illness, enclosing a medical certificate (see Regulation 12 (2) of the Examination Regulations, Calendar Volume 1).

If a student is affected by illness during an examination, and wishes to ask for a Special Examination he must report to the supervisor in charge of the examination and then make written application to the Secretary as soon as possible after the examination (see Regulation 12 (3) of the Examination Regulations, Calendar Volume 1).

*Deferred Examinations*

The Boards of the Faculties of Architecture, Engineering, and Mathematics may grant deferred examinations. Such examinations, if granted, will be held in January-February and candidates will be advised by mail of the times and results of the examinations.

# IV UNSATISFACTORY PROGRESS

The University has adopted Regulations Governing Unsatisfactory Progress which are set out below.

Students who become liable for action under the Regulations will be informed accordingly by mail after the release of the End of Year examination results and will be informed of the procedure to be followed if they wish to 'show cause'.

Appeals against exclusion must be lodged together with re-enrolment forms by Friday 8 January 1982.

The Faculty's progress requirements are set out elsewhere in this volume.

**Regulations Governing Unsatisfactory Progress**

1. (1) These Regulations are made in accordance with the powers vested in the Council under By-law 5.1.2.

(2) These Regulations shall apply to all students of the University except those who are candidates for a degree of Master or Doctor.

(3) In these Regulations, unless the context or subject matter otherwise indicates or requires:
"**Admissions Committee**" means the Admissions Committee of the Senate constituted under By-law 2.3.5;
"**Dean**" means the Dean of a Faculty in which a student is enrolled.
"**Faculty Board**" means the Faculty Board of a Faculty in which a student is enrolled.

2. (1) A student's enrolment in a subject may be terminated by the Head of the Department offering that subject if that student does not maintain a rate of progress considered satisfactory by the Head of the Department. In determining whether a student is failing to maintain a satisfactory progress the Head of the Department may take into consideration such factors as:
(a) unsatisfactory attendance at lectures, tutorials, seminars, laboratory classes or field work;
(b) failure to complete laboratory work;
(c) failure to complete written work or other assignments; and
(d) failure to complete field work.

(2) The enrolment of a student in a subject shall not be terminated pursuant to regulation 2 (1) of these Regulations unless he has been given prior written notice of the intention to consider the matter with brief particulars of the grounds for so

doing and has also been given a reasonable opportunity to make representations either in person or in writing or both.

(3) A student whose enrolment in a subject is terminated under regulation 2 (1) of these regulations may appeal to the Faculty Board which shall determine the matter.

(4) A student whose enrolment in a subject is terminated under this Regulation shall be deemed to have failed the subject.

3. (1) A Faculty Board may review the academic performance of a student who does not maintain a rate of progress considered satisfactory by the Faculty Board and may determine:
   (a) that the student be permitted to continue the course;
   (b) that the student be permitted to continue the course subject to such conditions as the Faculty Board may decide;
   (c) that the student be excluded from further enrolment;
      (i) in the course; or
      (ii) in the course and any other course offered in the Faculty; or
      (iii) in the Faculty; or
   (d) if the Faculty Board considers its powers to deal with the case are inadequate, that the case be referred to the Admissions Committee together with a recommendation for such action as the Faculty Board considers appropriate.

(2) Before a decision is made under regulation 3 (1) (b) (c) or (d) of these Regulations the student shall be given an opportunity to make representations with respect to the matter, either in person or in writing or both.

(3) A student may appeal against any decision made under regulation 3 (1) (b) or (c) of these Regulations to the Admissions Committee which shall determine the matter.

4. Where the progress of a student who is enrolled in a combined course or who has previously been excluded from enrolment in another course or Faculty is considered by the Faculty Board to be unsatisfactory, the Faculty Board shall refer the matter to the Admissions Committee together with a recommendation for such action as the Faculty Board considers appropriate.

5. (1) An appeal made by a student to the Admissions Committee pursuant to Regulation 3 (3) of these Regulations shall be in such form as may be prescribed by the Admissions Committee and shall be made within fourteen (14) days from the date of posting to the student of the notification of the decision or such further period as the Admissions Committee may accept.

(2) In hearing an appeal the Admissions Committee may take into consideration any circumstances whatsoever including matters not previously raised and may seek such information as it thinks fit concerning the academic record of the appellant and the making of the determination by the Faculty Board. Neither the Dean nor the sub-Dean shall act as a member of the Admission Committee on the hearing of any such appeal.

(3) The appellant and the Dean or his nominee shall have the right to be heard in person by the Admissions Committee.

(4) The Admissions Committee may confirm the decision made by a Faculty Board or may substitute for it any other decision which the Faculty Board is empowered to make pursuant to these Regulations.

6. (1) The Admissions Committee shall consider any case referred to it by a Faculty Board and may:
   (a) make any decision which the Faculty Board itself could have made pursuant to regulation 3 (1) (a) (b) or (c) of these Regulations; or
   (b) exclude the student from enrolment in such other subjects, courses, or Faculties as it thinks fit; or



   (c) exclude the student from the University.

(2) The Committee shall not make any decision pursuant to regulation 6 (1) (b) or (c) of these Regulations unless it has first given to the student the opportunity to be heard in person by the Committee.

(3) A student may appeal to the Vice-Chancellor against any decision made by the Admissions Committee under this Regulation.

7. Where there is an appeal against any decision of the Admission Committee made under Regulation 6 of these Regulations, the Vice-Chancellor may refer the matter back to the Admissions Committee with a recommendation or shall arrange for the appeal to be heard by the Council. The Council may confirm the decision of the Admissions Committee or may substitute for it any other decision which the Admissions Committee is empowered to make pursuant to these Regulations.

8. (1) A student who has been excluded from further enrolment in a Faculty may enrol in a course in another Faculty only with the permission of the Faculty Board of that Faculty and on such conditions as it may determine after considering any advice from the Dean of the Faculty from which the student was excluded.

(2) A student who has been excluded from further enrolment in any course, Faculty or from the University under these regulations may apply for permission to enrol therein again provided that in no case shall such re-enrolment commence before the expiration of two academic years from the date of the exclusion. A decision on such application shall be made:
   (a) by the Faculty Board, where the student has been excluded from a single course or a single Faculty; or
   (b) by the Admissions Committee, in any other case.

9. (1) A student whose application to enrol pursuant to Regulation 8 (1) or 8 (2) (a) of these Regulations is rejected by a Faculty Board may appeal to the Admissions Committee.

(2) A student whose application to enrol pursuant to Regulation 8 (2) (b) of these Regulations is rejected by the Admissions Committee may appeal to the Vice-Chancellor.

# V CHARGES

Enrolment is completed by lodging with the Cashier the approved *Authority to Complete Enrolment* form with a remittance to cover all charges due or evidence that a sponsor will meet these charges.

New students are required to pay charges when they attend to enrol.

For re-enrolling students at least 14 days notice is allowed from the date of mailing the Authority to Complete Enrolment form to the date by which charges must be paid. The actual date, which will not be before mid February, will be printed on the form. A later date will be set if approval of the proposed programme has been delayed or if the student has taken Special or Deferred examinations.

*Charges*

1. *General Services Charge*
   (a) *Students Proceeding to a Degree or Diploma*

| | |
|---|---|
| Full-time students | $120.50 Per annum |
| Part-time students | $115.50 Per annum |
| *Plus* Students joining Newcastle University Union for the first time | $10 |

(b) *Non-Degree Students*
Union charge ..... $56 Per annum

The above charges must be paid in full by the prescribed date.

2. *Late Charges*

(a) *Late Lodgement of Enrolment Form*
— Where a continuing student does not lodge application by Friday, 8 January 1982 ..... $14
— where a candidate for a special or deferred examination in January does not lodge re-enrolment application by Monday, 15 February 1982 ..... $14

(b) *Late Lodgement of Authority to Complete Enrolment Form with Cashier*
Where the Authority to Complete Enrolment Form together with
(i) General Services Charge payable; or
(ii) evidence of sponsorship (e.g. scholarship voucher or letter from Sponsor); or
(iii) an Extension of Time to Pay Charges form
is not lodged with the Cashier by the Due Date prescribed by the Secretary on the *Authority to Complete Enrolment* form ..... $14

(c) *Late Payment of Charges*
Where all charges have not been paid by the Due Date
(i) if not more than 14 days overdue ..... $8
(ii) if more than 14 days overdue ..... $14

3. *Other Charges*

(a) Examination under special supervision ..... $15 per paper
(b) Review of examination results ..... $8 per subject
(c) Statement of matriculation status for non-members of the University ..... $8
(d) Academic statements in excess of six per annum ..... 15c per copy
(e) Replacement of student cards ..... 50c each

*Payment of Charges*

Enrolment is completed by lodging with the Cashier the approved Authority to Complete Enrolment Form with a remittance to cover all charges due or evidence that a sponsor will meet these charges. Payment by mail is encouraged. Money Orders should be made payable at the Newcastle University Post Office, N.S.W. 2308. The Cashier's Office is located on the First Floor of the McMullin Building, and is open from 10 am to 12 noon, and 2 pm to 4 pm.

Students are urged to pay charges by mail and a pre-addressed envelope will be forwarded with the Authority to Complete Enrolment form.

*Scholarship Holders and Sponsored Students*

Students holding scholarships or receiving other forms of financial assistance must lodge with the Cashier their Authority to Complete Enrolment Form together with warrants or other evidence that charges will be paid by sponsors. Sponsors must provide a separate voucher, warrant or letter for each student sponsored.

*Extension of Time to Pay Charges*

Students who have finalised their programme and been isssued with their Authority to Complete Enrolment form but who, due to circumstances beyond their control, are unable to pay the charges due, may apply for an extension of time to pay charges. The Extension of Time form should be completed and presented in person at the Student Administration Office where arrangements will be made for the student to be interviewed.



*Refund of Charges*

Students who notify the Student Administration Office of a complete withdrawal from their courses should also lodge a claim form for a refund of charges. A refund cheque will be mailed to the student or, if applicable, to the sponsor.

The refund will be based on the date of notification of withdrawl, as follows:

Notification on or before Monday, 1 March, 1982 ..... 100%
Notification on or before Friday, 26 March, 1982 ..... 90%
Notification on or before Friday, 25 June, 1982 ..... 50%

*No refund will be made before 31 March 1982.*

*Higher Degree Candidates*

Higher degree candidates are required to pay the General Services charge and Union Entrance charge, if applicable. Where the enrolment is effective from First or Second Term, the General Services charge covers the period from the first day of the term to the Friday immediately preceding the first day of First Term in the following academic year. Where enrolment is on or after the first day of Third Term, the General Services charge paid will cover liability to the end of the long vacation following the next academic year.

*Tuition Fees*

The Commonwealth Government has announced its intention that tuition fees be payable in some circumstances from 1982. At the time of printing, the necessary legislation was still to be passed. If tuition fees are introduced a statement will be sent to those students who are affected.

# VI CAMPUS TRAFFIC AND PARKING

Persons wishing to bring motor vehicles (including motor cycles) on to the campus are required to obtain and display on the vehicle a valid permit to do so. Permits may be obtained from the Attendant (Patrol) Office which is located off the foyer of the Great Hall. Permit holders must comply with the University's *Traffic and Parking Regulations* including parking in approved parking areas, complying with road signs and not exceeding 35 k.p.h. on the campus.

If the Vice-Principal, after affording the person a period of seven days in which to submit a written statement is satisfied that any person is in breach of Regulations, he may:

(a) warn the person against committing any further breach; or
(b) impose a fine; or
(c) refer the matter to the Vice-Chancellor.

The range of fines which may be imposed in respect of various categories of breach include:

Parking in areas not set aside for parking ..... $4
Parking in special service areas, e.g. loading bays, by fire hydrants etc. ..... $10
Failing to display a valid permit ..... $4
Driving offences — including speeding and dangerous driving ..... up to $25
Failing to stop when signalled to do so by an Attendant (Patrol) ..... up to $25
Refusing to give information to an Attendant (Patrol) ..... up to $25
Failing to obey the directions of an Attendant (Patrol) ..... up to $25

The Traffic and Parking Regulations are stated in full in the Calendar, Volume 1.

**664144 High Level Software Development** — D. W. E. Blatt and J. A. Lambert

*Prerequisite* — Programming experience in a high-level language is assumed

*Hours* — About 27 lecture hours concentrated into the first two terms

*Examination* — One 2-hour paper and assignments throughout the course

*Content*

This course covers the writing of medium to large scale software projects. The course covers: software tools and packages, data base management systems and involves a series of review seminars on current software engineering literature. Parts of the course are run as a seminar series with all participants contributing. The writing of successful programs is integral to the course, and in the data base section a small online multiuser data base is developed as a class project.

*Text*

Kernighan, B. W. & Plauger, P. J. — *Software Tools in Pascal* (Addison-Wesley 1981)

*References*

Date, C. J. — *An Introduction to Data Base Systems* 2nd edn (Addison-Wesley 1977)

Kerninghan, B. W. & Plauger, P. J. — *Software Tools* (Addison-Wesley 1976)

Kerninghan, B. W. & Ritchie, D. M. — *The C Programming Language* (Prentice-Hall 1978)

Martin, J. — *Computer Data Base Organisation* 2nd edn (Prentice-Hall 1977)

Wasserman, A. I. & Freeman, P. (eds) — *Software Engineering, Education, Needs and Objectives* (Springer-Verlag 1976)

**664116 Mathematical Models of Phase Transitions** — A. J. Guttmann
(May be offered in second half year only if there is sufficient demand)

*Prerequisites* — Nil

*Hours* — About 27 lecture hours

*Examination* — One 2-hour paper

*Content*

Review of thermodynamics and statistical mechanics. Some rigorous results in statistical mechanics. Survey of critical phenomena and analogies. Classical theories of phase transitions. Exact solution of two dimensional Ising model. Approximate results in three dimensions. Generation and analysis of exact series expansions. Anisotropic Heisenberg model and symmetry of ground state. Critical exponent inequalities and scaling laws. Asymptotic degeneracy as a mechanism of phase transitions. Kac models in one dimension. Heisenberg and Planar Classical Heisenberg model. Phase transitions for some models of biological systems. Renormalization group theory.

*Text*

Thompson, C. J. — *Mathematical Statistical Mechanics* (Princeton 1979)

*References*

Brout, R. H. — *Phase Transitions* (Academic 1972)

Domb, C. & Green, M. S. (eds) — *Phase Transitions and Critical Phenomena* Vols. I—VI (Academic 1972, 1973, 1974, 1976, 1977)

Fisher, M. E. — *The Theory of Equilibrium Critical Phenomena* (Rep. Prog. Phys. 30 (615) 1967)

Huang, K. — *Statistical Mechanics* (Wiley 1963)

Stanley, H. E. — *Introduction to Phase Transitions and Critical Phenomena* (Oxford 1971)

**664150 General & Algebraic Topology** — M. J. Hayes

*Prerequisite* Topic L

*Hours* About 27 lecture hours

*Examination* One 2-hour paper

*Content*

Topological spaces are sets with enough properties on which to study continuity. These lectures will concentrate on the geometric aspects of these spaces, and will include the following topics: separation, relative and product topologies, compactness, connectedness, homeomorphisms, quotient spaces, homotopy and the fundamental group, deformation retracts. Seifert-Van Kempen Theorem. Covering spaces.

*Text* Nil

*References*


Cairns, S. S. — *Introductory Topology* (Ronald 1961)

Lefshetz, S. — *Introduction to Topology* (Princeton 1949)

Massey, W. S. — *Algebraic Topology* (Harcourt, Brace & World 1967)

Simmons, G. F. — *Introduction to Topology and Modern Analysis* (McGraw-Hill 1963)

Wallace, A. H. — *An Introduction to Algebraic Topology* (Pergamon 1961)


**664124 Signal Detection** — R. G. Keats

*Prerequisite* Topic H

*Hours* About 27 lecture hours

*Examination* One 2-hour paper

*Content*

This topic will cover the detection and processing of signals with applications. The topic will discuss the application of likelihood ratio, Bayes and other tests to signal detection and processing in a variety of situations including known signals in white Gaussian noise, and known signals in coloured Gaussian noise. The Shannon sampling theorem, Karhunen-Loeve expansion, sequential detection and the effect of clipping will also be discussed.

*Text* Nil

*References*


Cramer, H. — *Mathematical Methods of Statistics* (Princeton 1946)

Davenport, W. B. & Root, W. L. — *Introduction to the Theory of Random Signals and Noise* (McGraw-Hill 1958)

Franks, L. E. — *Signal Theory* (Prentice-Hall 1969)

Hancock, J. C. — *An Introduction to the Principles of Communication Theory* (McGraw-Hill 1961)

Hancock, J. C. & Wintz, P. A. — *Signal Detection Theory* (McGraw-Hill 1966)

Helstrom, C. W. — *Statistical Theory of Signal Detection* (Permagon 1960)

Middleton, D. — *Introduction to Statistical Communication Theory* (McGraw-Hill 1960)

Middleton, D. — *Topics in Communication Theory* (McGraw-Hill 1965)

Papoulis, A. — *Probability, Random Variables and Signal Processes* (McGraw-Hill 1965)

Rowe, H. E. — *Signals and Noise in Communication Systems* (Van Nostrand 1965)

Selin, I. — *Detection Theory* (Princeton 1965)

Thomas, J. B. — *Introduction to Statistical Communication Theory* (Wiley 1969)

Van Trees, H. L. — *Detection, Estimation & Modulation Theory* (Wiley 1967)

Wax, N. (ed.) — *Selected Papers on Noise and Stochastic Processes* (Dover 1954)





Wong, E. — *Stochastic Processes in Information and Dynamical Systems* (McGraw-Hill 1971)

Woodward, P. M. — *Probability and Information Theory with Application to Radar* (Pergamon 1960)


**664145 Viscous Flow Theory** — W. T. F. Lau

*Prerequisite* Topic Q

*Hours* About 27 lecture hours

*Examination* One 2-hour paper

*Content*

Basic equations. Some exact solutions of the Navier-Stokes equations. Approximate solutions: theory of very slow motion, boundary layer theory, etc.

*Text* Nil

*References*


Batchelor, G. K. — *An Introduction to Fluid Dynamics* (Cambridge 1967)

Landau, L. D. & Lifshitz, E. M. — *Fluid Mechanics* (Pergamon 1959)

Langlois, W. E. — *Slow Viscous Flow* (Macmillan 1964)

Pai, S. I. — *Viscous Flow Theory* Vol. 1 (Van Nostrand 1956)

Rosenhead, L. (ed.) — *Laminar Boundary Layers* (Oxford 1963)

Schlichting, H. — *Boundary Layer Theory* (McGraw-Hill 1968)

Teman, R. — *Navier-Stokes Equations — Theory and Numerical Analysis* (North Holland 1976)


**664118 Perturbation Theory** — D. L. S. McElwain

*Prerequisite* Topic CO

*Hours* About 27 lecture hours

*Examination* One 2-hour paper

*Content*

An introduction to regular perturbation methods, including parameter and coordinate perturbations. A discussion of the sources of nonuniformity in perturbation expansions. The method of strained coordinates and the methods of matched and composite asymptotic expansions. The method of multiple scales.

*Text* Nil

*References*


Cole, J. D. — *Perturbation Methods in Applied Mathematics* (Blaisdell 1968)

Nayfeh, A. H. — *Perturbation Methods* (Wiley 1973)

Van Dyke, M. — *Perturbation Methods in Fluid Mechanics* (Parabolic 1975)


**664175 Artificial Intelligence** — A. Narayanan

*Prerequisites* Nil

*Hours* About 27 lecture hours in second term and part of third term

*Examination* One 2-hour paper

*Content*

History: theorem-proving, chess-playing, general problem solving, simulation. Problem solving methods: state-space representations, problem-reduction representations, search methods, frame descriptions. Memory representations of knowledge and inferences: problems of accessibility and refinement, multi-program approach, production system languages, networks. Natural language processing: computational linguistics, machine translation, PROGRAMMER, PLANNER. Formal considerations and constraints: Church, Turing, Tarski, Godel. Implications and applications: humanism and mechanism, mind and mechanism, intelligent systems and society, cybernetics and intelligence.

*References*
To be advised.

**664106 Combinatorics** — R. W. Robinson

*Prerequisite* Topic K
*Hours* About 27 lecture hours
*Examination* One 2-hour paper

*Content*
Permutations and combinations, inclusion-exclusion and generating functions. Polya's theorem and its application to counting various kinds of structures and graphs will be discussed. Also asymptotic analysis of many of the exact results.

*Text* Nil

*References*

Beckenbach, E. F. (ed) — *Applied Combinational Mathematics* (Wiley 1964)
Hall, M. — *Combinational Theory* (Blaisdell 1967)
Harary, F. & Palmer, E. M. — *Graphical Enumeration* (Academic 1974)
Liu, C. L. — *Introduction to Combinational Mathematics* (McGraw-Hill 1968)
Riordan, J. — *Combinational Analysis* (Wiley 1958)


**664134 Recursion Theory** — R. W. Robinson

*Prerequisite* Topic TC
*Hours* About 27 lecture hours
*Examination* One 2-hour paper

*Content*
Recursive functions and Turing reducibility are discussed, along with various more special reducibilities. The structure of the degrees of unsolvability is investigated using priority method constructions.

*Text* Nil

*References*

Kleene, S. C. — *Introduction to Metamathematics* (Van Nostrand 1952)
Rogers, H. — *Theory of Recursive Functions and Effective Computability* (McGraw-Hill 1967)
Sacks, G. E. — *Degrees of Unsolvability* (Princeton 1963)
Shoenfield, J. R. — *Degrees of Unsolvability* (North-Holland 1971)


**664164 Number Theory** — T. K. Sheng

*Prerequisites* Nil
*Hours* About 27 lecture hours
*Examination* One 2-hour paper

*Content*
Divisibility. Congruences. Quadratic residues, the Legendre symbol, quadratic reciprocity, the Gaussian reciprocity law, the Jacobi symbol. Multiplicative functions, Mobius inversion formula, recurrence functions. Simple continued fractions. Pell's equation. Distribution of primes. Partitions. Asymptotic density. Dispersive and explosive mappings.

*Text* Nil

*References*

Andrews, G. E. — *Number Theory* (Saunders 1971)
Hardy, G. & Wright, E. M. — *Introduction to Number Theory* (Oxford 1960)
Niven, I. & Auckerman, H. S. — *An Introduction to the Theory of Numbers* (Wiley 1968)




**664159 Foundations of Modern Differential Geometry** — P. K. Smrz

*Prerequisite* Topic CO
*Hours* About 27 lecture hours
*Examination* One 2-hour paper

*Content*
This topic will introduce basic concepts of the local theory of differentiable manifolds.

Vector fields, differential forms, and their mapping. Frobenius' theorem. Fundamental properties of Lie groups and Lie algebras. General linear group. Principle and associated fibre bundles. Connections. Bundle of linear frames, affine connections. Curvature and torsion. Metric, geodesics. Riemannian manifolds.

*Text* Nil

*References*

Auslander, L. — *Differential Geometry* (Harper & Row 1967)
Chevalley, C. — *Theory of Lie Groups.* Vol. 1 (Princeton 1946)
Kobayashi, S. & Nomizu, K. — *Foundations of Differential Geometry,* Vol. 1 (Interscience 1963)


**664155 Advanced Numerical Analysis** — W. Summerfield

*Prerequisite* Topic Z
*Hours* About 27 lecture hours
*Examination* One 2-hour paper

*Content*
Often, one has to resort to a numerical method to "solve" a mathematical problem; before the resultant numbers can be interpreted in terms of the latter problem, one must analyse how their generation has been biased by the numerical method. The three major problem areas of numerical analysis involve rounding error, discretisation error and convergence (in iterative methods) error. The effect of each of these types of error is often masked by "ill-conditioning" (instability) either in the numerical method or in the mathematical problem itself. This course concentrates on the basic theoretical results pertaining to these areas, especially as they apply to methods of solution of either linear systems of equations, eigenvalue problems or differential equations.

*Text* Nil

*References*

Ames, W. F. — *Numerical Methods for Partial Differential Equations* (Nelson 1969)
Forsythe, G. & Moler, C. B. — *Computer Solution of Linear Algebraic Systems* (Prentice-Hall 1967)
Gear, C. W. — *The Numerical Solution of Initial Value Problems in Ordinary Differential Equations* (Prentice-Hall 1971)
Isaacson, E. & Keller, H. M. — *Analysis of Numerical Methods* (Wiley 1966)
Lambert, J. D. — *Computational Methods in Ordinary Differential Equations* (Wiley 1973)
Mitchell, A. R. & Wait, R. — *The Finite Element Method in Partial Differential Equations* (Wiley 1977)
Ortega, J. M. — *Numerical Analysis—A Second Course* (Academic 1973)
Strang, G. & Fix, G. J. — *An Analysis of the Finite Element Method* (Prentice-Hall 1973)
Wilkinson, J. — *The Algebraic Eigenvalue Problem* (Oxford 1965)


**664165 Mathematical Physiology** — W. Summerfield

*Prerequisites* Nil
*Hours* About 27 lecture hours
*Examination* One 2-hour paper

*Content*

Physiology — the study of how the body works based on the knowledge of how it is constructed — essentially dates from early in the seventeenth century when the English physician Harvey showed that blood circulates constantly through the body. The intrusion of engineering into this field is well known through the wide publicity given to (for example) heart by-pass and kidney dialysis machines, cardiac assist pace-makers, and prosthetic devices such as hip and knee joints; the obviously beneficial union has led to the establishment of Bioengineering Departments within Universities and Hospitals. Perhaps the earliest demonstration of mathematics' useful application in (some areas of) physiology is the mid-nineteenth century derivation by Hagen, from the basic equations of continuum motion, of Poiseuille's empirical formula for flow through narrow straight tubes; detailed models of the cardiovascular circulatory system have recently been developed. Mathematical models have also been formulated for actions such as coughing, micturition and walking, as well as for the more vital processes involved in gas exchange in the lungs, mass transport between lungs and blood and blood and tissue, metabolic exchanges within tissues, enzyme kinetics, signal conduction along nerve fibres, sperm transport in the cervix, ..... Indeed, mathematical engineering might now be said to be part of the conspiracy to produce super humans (see "Fast Running Tracks" in Dec. 1978 issue of Scientific American).

This course will examine in some detail a few of the previously mentioned mathematical models; relevant physiological material will be introduced as required.

*Text* — Nil

*References*


Bergel, D. H. (ed.) — *Cardiovascular Fluid Dynamics* Vols I & II (Academic 1972)

Caro, C. G., Pedley, T. J., Schroter, R. D. & Seed, W. A. — *The Mechanics of the Circulation* (Oxford 1978)

Christensen, H. N. — *Biological Transport* (W. A. Benjamin 1975)

Fung, Y. C., Perrone, N. & Anliker, M. (eds.) — *Biomechanics Its Foundations and Objectives* (Prentice-Hall 1972)

Guyton, A. C. — *Textbook of Medical Physiology* (W. A. Saunders 1971)

Lightfoot, E. N. — *Transport Phenomena and Living Systems* (Wiley 1974)

Margaria, R. — *Biomechanics and Energetics of Muscular Exercise* (Clarendon 1976)

Murray, J. D. — *Lectures on Nonlinear-Differential-Equation Models in Biology* (Clarendon 1977)

Pedley, T. J. — *The Fluid Mechanics of Large Blood Vessels* (Cambridge 1980)

Riggs, D. S. — *The Mathematical Approach to Physiological Problems* (M.I.T. 1963)

Rubinow, S. I. — *Introduction to Mathematical Biology* (Wiley 1975)

West, J. B. (ed.) — *Bioengineering Aspects of the Lung* (Marcel Dekker 1977)


### 664148 Urban Spatial Traffic Patterns — R. J. Vaughan

*Prerequisites* — Topics CO and H

*Hours* — About 27 lecture hours

*Examination* — One 2-hour paper

*Content*

Discussion of transportation problems in cities. The advantages and disadvantages of the use of continuous and discrete models to describe traffic characteristics of urban areas. Distribution of homes and work places in urban areas. Mathematical properties of the distribution. Quadrivariate normal model. Structure of urban transportation networks. Routeing systems. Length of road per unit area and fraction of area occupied by roads related to the town centre. Intersection densities. Local traffic measures. Wardrop's principle. Travel intensity. Data on travel densities. Crossings intensity. Global traffic measures. Average



distance travelled in theoretical cities. Summary of known results. Data on average distances. Expected number of crossings. Use of traffic measures.

*Text* — Nil

*References*


Kendall, M. G. & Moran, P. A. P. — *Geometrical Probability* (Griffin 1963)

Mardia, K. V. — *Families of Bivariate Distributions* (Griffin 1970)


### 664149 Coding Theory — W. D. Wallis

*Prerequisites* — Topics D and K

*Hours* — About 27 lecture hours

*Examination* — One 2-hour paper

*Content*

Introduction to codes; Hamming distance; linear codes; the Slepian-Moore-Prange algorithm, Hamming codes; perfect codes; polynomial codes; BCH codes, comma-free codes.

*Text*

Street, A. P. & Wallis, W. D. — *Combinational Theory: An Introduction* (CBRC 1977)

*References*


Berlekamp, E. R. — *Algebraic Coding Theory* (McGraw-Hill 1968)

Berlekamp, E. R. — *A Survey of Algebraic Coding Theory* (Springer-Verlag 1970)

Blake, I. F. & Mullin, R. C. — *The Mathematical Theory of Coding* (Academic 1975)

Sloane, N. J. A. — *A Short Course on Error Correcting Codes* (Springer 1975)


### 664105 Combinatorial Designs — W. D. Wallis

*Prerequisites* — Topics D and K

*Hours* — About 27 lecture hours

*Examination* — One 2-hour paper

*Content*

An introduction to various types of designs and their properties. Pairwise balanced designs: the basic theory, some existence theorems, Wilson's theorems. Latin squares and balanced incomplete block designs; the existence theory using pairwise balanced designs, and various constructions. Partial balance. Room squares. Hadamard matrices. Block designs on graphs, such as handcuffed designs.

*Text*

Street, A. P. & Wallis, W. D. — *Combinatorial Theory: An Introduction* (CBRC 1977)

*References*


Denes, J. & Keedwell, A. D. — *Latin Squares and their Applications* (English and Akademiai Kiado 1974)

Hall, M. Jr. — *Combinatorial Theory* (Blaisdell 1967)

Mann, H. B. — *Addition Theorems. The Addition Theorems of Group Theory and Number Theory* (Interscience 1965)

Raghavarao, D. — *Constructions and Combinatorial Problems in Design of Experiments* (Wiley 1971)

Ryser, H. J. — *Combinatorial Mathematics* (Wiley 1963)

Wallis, W. D. et al. — *Combinatorics: Room Squares, Sum-Free Sets, Hadamard Matrices* (Springer 1972)

Wallis, W. D. — *Combinatorial Designs* (Univ. of Surrey 1977)


### 664176 Graph Theory and Applications — W. D. Wallis

*Prerequisite* — Topic D

*Hours* — About 27 lecture hours

*Examination* One 2-hour paper

*Content*

The course contains the content of the third year topic GT (Applied Graph Theory) together with some additional work on pure graph theory.

*Text* Nil

*References*

See Topic GT on page 53.

**664168 Astrophysical Applications of Magnetohydrodynamics** — W. P. Wood

*Prerequisites* Topics CO and PD

*Hours* About 27 lecture hours

*Examination* One 2-hour paper

*Content*

The normal state of matter in the universe is that of a plasma, or ionized gas, permeated by magnetic fields. Moreover, these fields (unlike that of the earth) may be dominant, or at least significant, in controlling the structure of the region. The aim of this course is to investigate the effects of astrophysical magnetic fields, ranging from $10^{-6}$ gauss in the galaxy to $10^{12}$ gauss in a neutron star.

*Text* Nil

*References*


Chandrasekhar, S. — *Hydrodynamic and Hydromagnetic Stability* (Oxford 1961)
Cowling, T. G. — *Magnetohydrodynamics* (Interscience 1957)
De Jong, T. & Maeder, A. (eds.) — *Star Formation* (D. Reidel 1977)
Mestel, L. — *Effects of Magentic Fields* (Mem.Sc.Roy.Sci. Liege (6) 879 1975)
Spiegel, E. A. & Zahn, J. P. (eds.) — *Problems of Stellar Convection* (Springer-Verlag 1976)


Other topics may be offered from time to time by visitors to the Department: intending students should consult the Department early in the year regarding them.

*SUPPLEMENTARY LIST*

(Courses available for choice as Part IV topics by students who have passed Mathematics IIIA, Computer Science III or Statistics III. Not all of these courses are necessarily offered in any one year).

**Department of Electrical Engineering**

| | | |
|---|---|---|
| EE443 | Optimization Techniques | — see page 84 |
| EE447 | Digital Communications | — see page 84 |

**Department of Mechanical Engineering**

| | | |
|---|---|---|
| ME404 | Mathematical Programming I | — see page 93 |
| ME487 | Operations Research — Deterministic Models | — see page 93 |
| ME488 | Operations Research — Probabilistic Models | — see page 93 |

Additionally, students permitted to select courses from this list should also select any of the following topics which they have not studied in Computer Science III:

Compiler Construction
Computer Operating Systems
Programming Languages and Systems





Students who obtain a B.Math. Degree including Computer Science II and Computer Science III, thereby satisfy all educational requirements for membership of the Australian Computer Society. Students should also read the footnotes below the entry Computer Science III.

PART II SUBJECT

**662400 Computer Science II**

*Prerequisite* Mathematics I

*Hours* 168 hours of lectures, tutorials and practical work as listed below

*Examination* See component descriptions below

*Content*

Topics

SI — Introduction to Structuring of Information
SP — Systematic Programming
ML — Introduction to Computer Architecture and Assembly Language
F — Numerical Analysis and Computing

PART II TOPICS

A statement concerning the relation between the Diploma in Computer Science and the undergraduate subjects Computer Science II and III can be found on page 10.

**662401 Topic SI — Introduction to Structuring of Information** — P. J. Moylan

*Prerequisite* Mathematics I

*Corequisite* Topic SP

*Hours* 1 lecture hour per week and 1 tutorial hour per fortnight

*Examination* One 2-hour paper

*Content*

Influence of structuring of information on design of programming languages.

Data structures: lists, trees, queues, deques and stacks. Examples of and methods for implementing these structures. Storage allocation for complex data items. Scatter storage and hash addressing. Elementary string processing, and list processing.

Searching and sorting. A description of several sorting algorithms and comparison of their efficiencies.

The course consists of mainly lectures supplemented by tutorials.

*Text*

Tenenbaum, A. M. & Augenstein, M. J. — *Data Structures Using Pascal* (Prentice-Hall 1981)

*References*


Dahl, O. J. et al. — *Structured Programming* (Academic 1972)
Elson, M. — *Data Structures* (Science Research Associates 1975)
Grogono, P. — *Programming in PASCAL* 2nd edn (Addison-Wesley 1980)
Holt, R. C. & Hulme, J. N. P. — *Programming Standard PASCAL* (Reston Publ. Co. 1980)
Horowitz, E. & Sahni, S. — *Fundamentals of Data Structures* (Pitman 1976, 1977)
Knuth, D. E. — *The Art of Computer Programming* Vols. I — Fundamental Algorithms, II — Semi-numerical Algorithms, III — Sorting and Searching (Addison-Wesley 1968, 1969, 1973)

Page, E. S. & Wilson, L. B. — *Information Representation and Manipulation in a Computer* 2nd edn (Cambridge 1978)
Wirth, N. — *Algorithms + Data Structures = Programs* (Prentice-Hall 1976)

**662402 Topic SP — Systematic Programming** — D. W. E. Blatt

*Prerequisite* Mathematics I

*Hours* 1 lecture hour and 1 tutorial hour per fortnight

*Examination* One 2-hour paper

*Content*

An introduction to Pascal.

The case for high level programming languages. The formal definition of the syntax of high level languages. An overview and comparison of several high level languages, including FORTRAN 77, COBOL, PL/I and Ada.

Structured programming: its objectives and the techniques used to achieve them. Modular design, top-down programming, good coding style. The role of 'goto' constructs, conditional statements, looping, 'case' statements.

Procedures, co-routines, re-entrancy. Recursive programming. Appropriate and inappropriate uses of recursion.

*Text*

Grogono, P. — *Programming in PASCAL* 2nd edn (Addison-Wesley 1980)

*References*

Bates, F. & Douglas, M. L. — *Programming Language/One* 3rd edn (Prentice-Hall 1975)
Balfour, A. & Marwick, D. H. — *Programming in Standard FORTRAN 77* (Heinemann 1979)
Dahl, O. J. et al. — *Structured Programming* (Academic 1972)
Elson, M. — *Concepts of Programming Languages* (Science Research Associates 1973)
Guttmann, A. J. — *Programming and Algorithms* (Heinemann 1977)
Holt, R. C. & Hulme, J. N. P. — *Programming Standard PASCAL* (Reston 1980)
Jensen, K. & Wirth, N. — *Pascal: User Manual and Report* 2nd edn (Springer-Verlag 1978)
Wegner, P. — *Programming with Ada: An Introduction by Means of Graduated Examples* (Prentice-Hall 1980)
Wirth, N. — *Systematic Programming* (Prentice-Hall 1973)
Yourdon, E. J. — *Techniques of Program Structure and Design* (Prentice-Hall 1975)

**662405 Topic ML — Introduction to Computer Architecture & Assembly Language** — K. K. Saluja

*Prerequisite* Mathematics I

*Hours* 2 lecture and practical work hours per week for first two terms

*Examination* Progressive assessment and final examination

*Content*

Number systems: representation and arithmetic.

Hardware components, processor structure, addressing modes. Assembly language. Instruction sets, pseudo ops, machine language programming, subroutines, co-routines, use of stacks, interrupts, macros, recursion, re-entry, linkers and loaders.

Lectures will be supplemented with practical assignments using PDP-11 computer.

*Text*

Eckhouse, R. H. & Morris, L. R. — *Minicomputer Systems: Organisation Programming and Applications (PDP-11)* 2nd edn (Prentice-Hall 1979)



*References*

Chu, Y. H. — *Computer Organization and Micro Programming* (Prentice-Hall 1972)
Donovan, J. J. — *Systems Programming* (McGraw-Hill 1972)
Friedman, A. D. — *Logical Design of Digital Systems* (Computer Science)
Stone, H. S. — *Introduction to Computer Organization and Data Structures* (McGraw-Hill 1972)

**662202 Topic F — Numerical Analysis and Computing** — see page 40.

## PART III SUBJECT

**663400 Computer Science III**

*Prerequisites* Computer Science II, Mathematics IIA and Mathematics IIC

*Hours* See individual topics

*Examination* See information given in descriptions of individual topics

*Content*

At least five topics from the list of topics given below, provided that at least two of the topics numbered 1, 3 and 7 are included. (It is recommended that a student should include all three of these topics in his programme).

*Topics*

1. Compiler Construction (*EE464)
†2. Commercial Programming & Systems Analysis (one topic composed of the combination of (i) Commercial Programming and (ii) Systems Analysis of the Diploma course)
3. Computer Operating Systems (*EE463)
4. Switching Theory & Logical Design (*EE362)
5. Mathematical Logic and Set Theory (**O)
6. Mathematical Principles of Numerical Analysis (***Z)
7. Programming Languages & Systems (*PL)
8. Theory of Computing (***TC)
†9. Systems Design (*CS — Diploma course)

Notes

* Not available for selection by students who have previously passed this course, or who are enrolled for it explicitly, extraneous to Computer Science III, in the year in which they are enrolled for Computer Science III.

** Not available for selection by students who have passed Mathematics IIIA including the topic or who are enrolled for Mathematics IIIA including the topic concurrently with Computer Science III, or who have passed (as an elective topic) the Part III Mathematics topic whose abbreviation is given following the asterisks.

*** Not available for selection by students who have passed or are concurrently enrolled for a Part III Mathematics subject which includes the topic whose abbreviation is given following the asterisks, or who have passed the topic previously as an elective topic.

† Students who are considering eventual careers as Computer Systems Officers in the Commonwealth Public Service are strongly advised to enrol for this topic.

## PART III TOPICS

**534137 Compiler Construction** — R. J. Evans

*Prerequisite* EE264 Introduction to Computer Architecture & Assembly Language or Topic ML

*Hours* 3 hours per week for the first half year

*Examination* Progressive assessment and final examination

*Content*

The design of assemblers. Introduction to the theory of grammars, parsing techniques, construction of compilers, object code generation. Construction of interpreters.

The course consists mainly of lectures and assignments on computers.

*Text*

Aho, A. V. & Ullman, J. D. — *Principles of Compiler Construction* (Addison-Wesley 1977)

*References*

Aho, A. V. & Ullman, J. D. — *The Theory of Parsing, Translation and Compiling* 2nd Vol. (Prentice-Hall)

Donovan, J. J. — *Systems Programming* (McGraw-Hill)

**410129 Commercial Programming & Systems Analysis**

*Prerequisite* — Mathematics I Topic SC or Commercial E.D.P.

*Hours* — 2 lecture hours per week and associated practical work

*Examination* — Examination at mid-year and end of year

*Content*

(i) Commercial Programming

Basic concepts of file handling and file maintenance, including file creation and processing.

Flow charting; file merging and updating of transactions; tape blocking and buffering.

General run types including editing, searching and sorting. Direct access versus serial; random or sequential organisation; re-run techniques; verifying programme accuracy; table lookup; programme documentation and use of test data.

DIBOL as a business data processing and file organisation language. Extensive practical work in DIBOL, including case studies.

*Texts*

D.E.C. — *DIBOL-11 Language Reference Manual*

Fiengold, C. — *Fundamentals of COBOL Programming* (W. C. Brown)

*References*

Chai, W. A. & H. W. — *Programming Standard COBOL* (Academic)

Clifton, H. D. — *Systems Analysis for Business Data Processing* (Business Books)

Davis, G. B. & Litecky, C. R. — *Elementary Cobol Programming* (McGraw-Hill)

DeRossi, C. J. — *Learning COBOL Fast* (Reston)

Kapur, G. K. — *Programming in Standard COBOL* (S.R.A.)

Laden, H. N. & Gildersleeve, T. R. — *Systems Design for Computer Applications* (Wiley)

McCracken, D. D. et al. — *Programming Business Computers* (Wiley)

Murach, M. — *Standard COBOL* (S.R.A.)

Sanders, D. H. — *Computers in Business* (McGraw-Hill)

Sprowls, R. C. — *Computing with COBOL* (Harper & Row)

Stern, N. B. & R. A. — *Cobol Programming* (Wiley)

Watters, J. L. — *Cobol Programming* (Heinemann)

(ii) Systems Analysis

This course is concerned with the early activities carried out in the development of computer-based information systems.

Topics covered include, the role of systems in modern business; the profession of systems analysis and design; management of the life cycle of a business information system; the tools of the systems analyst; the study phase, its associated documentation and its relationship to design, development and implementation. Students are also introduced to the concepts of structured analysis.



*Texts*

Gore, M. & Stubbe, J. — *Elements of Systems Analysis* (W. C. Brown)

Gore, M. & Stubbe, J. — *Elements of Systems Analysis Workbook* (William C. Brown)

Gane, C. & Sarson, T. — *Structured Systems Analysis: Tools and Techniques* (Prentice-Hall)

*References*

Davis, W. — *Information Processing Systems* (Addison-Wesley)

Davis, W. — *Information Processing Systems — Student Workbook* (Addison-Wesley)

Gildersleeve, T. — *Successful Data Processing Systems Analysis* (Prentice-Hall)

Semprevivo, P. C. — *Systems Analysis: Definitive Process and Design* (S.R.A.)

**534138 Computer Operating Systems** — P. J. Moylan

*Prerequisite* — EE264 Introduction to Computer Architecture & Assembly Language or Topic ML

*Hours* — Three hours per week for the second half of the year

*Examination* — Progressive assessment and final examination

*Content*

Views of an operating system. Multiprogramming, interacting concurrent processes, process control primitives. Processor management, memory management, name management. Protection.

The course consists mainly of lectures supplemented by tutorial sessions.

*Text*

Lister, A. M. — *Fundamentals of Operating Systems* 2nd edn (Macmillan 1979)

*References*

Coffman, E. G. & Denning, P. J. — *Operating Systems Theory* (Prentice-Hall)

Hansen, P. B. — *Operating Systems Principles* (Prentice-Hall)

Madnick, S. E. & Donovan, J. J. — *Operating Systems* (McGraw-Hill)

**533902 Switching Theory & Logical Design** — K. K. Saluja

*Prerequisites* — Mathematics I and Topic ML

*Hours* — 3 hours of lectures, tutorials and practical work per week for first half year

*Examination* — Progressive assessment and final examination

*Content*

Boolean algebra, combinational logic, logical circuits, minimization techniques, threshold logic. Data representation, binary arithmetic, codes, error checking and correcting. Sequential logic, flip-flops, state diagrams, state reduction, races and hazards. Logic subsystems: registers, adders, counters, converters, coders, etc. Basic architecture of digital computers.

Lectures will be supplemented by practical assignments on logic trainers and some tutorial sessions.

*Text*

Nagle, Carroll & Irwin — *An Introduction to Computer Logic* (Prentice-Hall)

**663406 Mathematical Logic and Set Theory** — see Topic O page 46.

**663402 Mathematical Principles of Numerical Analysis** — see Topic Z page 52.

**663405 Programming Languages & Systems** — see Topic PL page 47.

663404 **Theory of Computing** — see Topic TC page 50.

410128 **Systems Design**

| | |
|---|---|
| *Prerequisite* | Systems Analysis |
| *Corequisite* | Commercial Programming |
| *Hours* | 2 lecture hours per week for the second half year and associated practical work |
| *Examination* | An examination at end of year |

*Content*
This subject is a development of Systems Analysis and includes; data transmission; real time systems; information retrieval; file processing form design; management and the computer; file design; systems design and determination; operating systems; multi-programming.

*Texts* As for Systems Analysis

*SCHEDULE B*

**PART I**

541100 **Engineering I**

| | |
|---|---|
| *Prerequisites* | 3-unit Mathematics & multistrand Science at the 4-unit level (advisory) |
| *Corequisite* | Mathematics I |
| *Hours* | To be advised |
| *Examination* | To be advised |

*Content*
Four of the following units to be chosen.

**(i) CE111 Statics**
**(ii) ME131 Dynamics**
**(iii) ME111 Graphics and Engineering Drawing**
**(iv) GE112 Introduction to Engineering Design**
**(v) EE131 Circuit Fundamentals**
**(vi) ChE141 Industrial Process Principles**
**(vii) GE151 Introduction to Materials Science**

**(i) 521101 CE111 Statics**

*Content*
Two-dimensional force systems; equilibrium,funicular polygon, rigid bars, shear force, axial force, bending moment, pin-jointed frames, analytical and graphical treatment; equilibrium of three-dimensional force systems, cables.

*Text*
Hall, A. S. & Archer, F. — *Principles of Statics* (Uni. of N.S.W. Students Union 1966)

**(ii) 541103 ME131 Dynamics**

*Content*
Basic concepts for the study of motion: length, time, force and mass: Newton's laws of motion; law of friction; systems of units. Motion of point masses, rigid bodies and connected bodies in straight or curved paths and in simple rotation. Relative motion using translating reference frames. General plane motion of rigid bodies. Momentum and impulse, both linear and angular, related to point masses and rigid bodies.

Energy and the conservation principle applied to mechanical work, strain energy, kinetic energy, friction losses, for particles and rigid bodies.



In addition to lectures, the course includes weekly tutorials devoted to the solution of problems in Dynamics.

*Text*
Meriam, J. L. — *Engineering Mechanics, Vol 2 — Dynamics, SI Version* (Wiley International Student Edition 1980)

**(iii) 541104 ME111 Graphics and Engineering Drawing**

*Content*
A study in communication and analysis by pictorial means. Methods of projection covering orthogonal projection of points, lines, planes and solids; lengths of lines, angles and intersection between lines, planes and contoured surfaces; orthographic projection, dimensioning and sectioning; isometric projection; prospective projection.

*Texts*
Levens, A. S. — *Graphics, Analysis and Conceptual Design* (John Wiley & Sons)
— — *Australian Standard Engineering Drawing Practice* CZI 1976 (Inst. of Engineering, Australia)

*References*
Levens, A. S. — *Graphics* (Wiley)
Luzadder, W. J. — *Basic Graphics* (Prentice-Hall)

**(iv) 501101 GE112 Introduction to Engineering Design**

*Content*
Philosophy and fundamentals of engineering design.

*Texts*
— — *Australian Standard Engineering Drawing Practice* CZI 1976 (Inst. of Engineers, Australia)
Krick, E. V. — *An Introduction to Engineering and Engineering Design* (John Wiley & Sons)

**(v) 531203 EE131 Circuit Fundamentals**

*Content*
**Part 1 (Introduction)**
Introduction to Electrical Engineering, Model Theory, Units.

**Part 2 (Resistive Circuits)**
Ohms Law, Kirchoff's Law, Parallel and Series resistive circuits. Nodal and Mesh Analysis, Thevenins and Norton's Theorems.

**Part 3 (Transient Circuits)**
Inductance and Capacitance, Natural and Forced Response, Transients in RL, RC Circuits.

**Part 4 (Sinusoidal Analysis)**
The Phasor Concept, Complex Impedance and Admittance, Phasor diagrams.

**Part 5 (Power in AC Circuits)**
Power, Volt-Amps, Reactive Power, Power Factor.

The course will be evenly divided between lectures and laboratory work and will also be supplemented by tutorial sessions.

*Text*
Hayt, W. H. & Kemmerly, J. E. — *Engineering Circuit Analysis* 3rd edn. (McGraw-Hill)

**(vi) 511108 ChE141 Industrial Process Principles**

*Content*

Introduction to the process industries with reference to petrochemical and metallurgical processes. Calculation of energy and material balances. Properties of vapours and liquids. Equilibrium processes. Humidification, drying. Crystallisation.

*Texts*

| | |
|---|---|
| Wall, T. F. | *An outline of Industrial Process Principles* (Department of Chemical Engineering, University of Newcastle) |
| — | *Metric Conversion and the Use of S.I. Units* 2nd edn (University of Newcastle) |

**(vii) 501102 GE151 Introduction to Materials Science**

*Content*

The course provides a general introduction to materials of engineering significance and to the relationships which exist between structures, properties and applications. The detailed treatment of various aspects is left to the later stages of the degree programme.

The following sections are given approximately equal amounts of time and emphasis:

Atomic bonding; atomic arrangements in metals, glasses and polymers; the effects of stress and temperature on simple metals; the control of metallic structures by composition and thermal treatments; common metals of engineering importance; the structure and properties of ceramics and cement products.

Polymers, rubbers and woods; engineering applications for polymers; the mechanical testing of materials; composite material; the fundamentals of corrosion and practical considerations; the electrical, magnetic, optical and thermal properties of solid materials.

*Text*

| | |
|---|---|
| Flinn, R. A. & Trojan, P. K. | *Engineering Materials and their Applications* (Houghton Mifflin 1975) |

## PART II

**412700 Accounting IIC**

| | |
|---|---|
| *Prerequisites* | Accounting I, Mathematics I |
| *Hours* | 4 lecture hours and 4 tutorial hours per week |
| *Examination* | 4 3-hour papers at end of year |
| *Content* | Accounting IIA and Accounting IIB |

**Accounting IIA**

Theory and practice of company accounting; accounting for the formation, reconstruction, amalgamation, take-over, official management, receivership and liquidation of companies; the preparation of holding company and group financial statements; equity accounting; presentation, analysis and interpretation of financial statements; the valuation of shares and goodwill; funds statements; accounting for inflation; accounting for executorship, bankruptcy, hire purchase and instalment-purchase, lease agreements and tax-effect accounting.

**Accounting IIB**

The theory and practice of management accounting: the management planning and control process; the concept and classification of cost; cost estimation; cost-volume-pofit analysis; incremental decision analysis; budgeting; job costing; process costing; joint and by-product costing; accounting for materials labour and overhead; standard costing and variance analysis; responsibility accounting and performance evaluation; transfer pricing; capital investment analysis, inventory costing and control.



*Texts*

| | |
|---|---|
| Henderson, S. & Peirson, G. | *Issues in Financial Accounting* 2nd edn (Cheshire) |
| Johnson, T. R. et al. | *The Law and Practice of Company Accounting in Australia* 4th edn (Butterworths) |
| Taylor, R. B. & O'Shea, B. P. | *Questions on the Law & Practice of Company Accounting* 2nd edn (Butterworths) |
| — | *Accountants Exercises* 2nd edn (University of Newcastle) |
| — | *Companies Act, 1981* (N.S.W. Govt. Printer) |
| DeCoster, D. T. et al. | *Accounting for Managerial Decision Making* 2nd edn (Wiley) |
| Horngren, C. T. | *Cost Accounting — A Managerial Emphasis* 4th edn (Prentice-Hall) |

**522700 Civil Engineering IIM**

| | |
|---|---|
| *Prerequisites* | Mathematics I, CE111, ME131, GE112 and ME111 |
| *Hours* | 5 lecture hours & 2½ tutorial hours per week |
| *Examination* | Five 3-hour papers |

*Content*

5 units from:

**(i) CE212 Mechanics of Solids I**
**(ii) CE213 Mechanics of Solids II**
**(iii) CE231 Fluid Mechanics I**
**(iv) CE232 Fluid Mechanics II**
**(v) CE224 Civil Engineering Materials**

**(i) 522102 CE212 Mechanics of Solids I — 1 unit**

| | |
|---|---|
| *Prerequisites* | CE111 & Mathematics I |
| *Hours* | 2 lecture hours & 1 tutorial hour per week for first half year |
| *Examination* | One 3-hour paper |

*Content*

Stress, strain, axial load problems; states of stress and strain; stress-strain relationships; internal actions, internal stresses in beams; deflection of beams; torsion in circular sections; combined stresses.

*Text*

| | |
|---|---|
| Popov, E. P. | *Mechanics of Materials* 2nd edn (S.I.) (Prentice-Hall 1978) |

**(ii) 522111 CE213 Mechanics of Solids II — 1 Unit**

| | |
|---|---|
| *Prerequisite* | CE212 |
| *Hours* | 2 lecture hours & 1 tutorial hour per week for second half year |
| *Examination* | One 3-hour paper |

*Content*

Buckling of columns, introduction to theory of elasticity; non uni-planar bending; shear centre; torsion of non-cicular sections; lateral instability of beams; energy methods.

*Text* — As for CE212

**(iii) 522202 CE231 Fluid Mechanics I — 1 Unit**

| | |
|---|---|
| *Prerequisites* | Mathematics I, ME131 Dynamics |
| *Hours* | 2 lecture hours & 1 tutorial/laboratory hour per week for first half of year |

*Examination* One 3-hour paper

*Content*
Fundamentals, fluid statics, kinematics of fluid motion, flow of an incompressible ideal fluid.

*Text*
Vennard, J. K. & Street, R. L. — *Elementary Fluid Mechanics* 5th edn S.I. (Wiley 1976)

**(iv) 522204 CE232 Fluid Mechanics II — 1 Unit**

*Prerequisite* CE231

*Hours* 2 lecture hours & 1 tutorial/laboratory hour per week for second half year

*Examination* One 3-hour paper

*Content*
Flow of compressible ideal fluid, impulse-momentum principle, flow of a real fluid, similitude and dimensional analysis.

*Text* As for CE231

**(v) 522112 CE224 Civil Engineering Materials — 2 Units**

*Content*
Theoretical background and laboratory tests of elastic and inelastic properties, creep, hardness and fracture of metals and timber. (½ unit)

Properties and behaviour of brick masonry and timber (¼ unit)

Properties and behaviour of bituminous materials.

Concrete: component materials, properties of plastic and hardened concrete, concrete mix design, manufacturing and field control. (1¼ unit)

*Texts*
Jackson, N. — *Civil Engineering Materials* (Macmillan 1980)
Nagarajan, N. & Antill, J. M. — *Australian Concrete Inspection Manual* (Pitman - Australia)

**752300 Psychology IIC**

*Prerequisites* Psychology I & Mathematics I

*Hours* 3 lecture hours, one 2-hour practical session & 1 tutorial hour per week

*Examination* Two 3-hour papers plus an assessment of practical work

*Content*
1. Statistics, Scientific Method, Quantitative Psychology (Mathematical Models and Individual Differences), Learning, Perception.
2. Two other topics chosen from those topics available in Psychology IIA and Psychology IIB.
3. Mathematical Psychology.

*Texts* } To be advised
*References* }

## PART III

**413900 Accounting IIIC**

*Prerequisites* Mathematics IIA & IIC & Accounting IIC

*Hours* 4 lecture hours & 1 tutorial hour per week

*Examination* Two 3-hour & two 2-hour papers



*Content*
(i) *Either* Accounting IIIA or Accounting IIIB and two appropriately chosen Part III topics offered by the Department of Mathematics and approved by the Head of the Department.
*OR*
(ii) Accounting IIIB and Financial Management.

**413100 Accounting IIIA**

*Hours* 2 lecture hours per week

*Examination* Two 3-hour papers

*Content*
Selected contemporary problems in the theory and practice of financial accounting, company financial reporting and public practice including a study of current approaches to the formulation of accounting theory; implications of the efficient market hypothesis in accounting.

*Preliminary Reading*
Henderson, S. & Peirson, G. — *An Introduction to Financial Accounting Theory* (Longman Cheshire)

*Text*
Anthony, N. V. et al. (eds) — *Readings in Advanced Accounting Theory* (Butterworths)

*References*
Journal articles and extracts from relevant accounting monographs including the following:

American Accounting Association — *A Statement of Basic Accounting Theory*
American Institute of Certified Public Accountants — *Objectives of Financial Statements*
Backer, M. (ed.) — *Modern Accounting Theory* (Prentice-Hall 1966)
Baxter, W. T. & Davidson, S. — *Studies in Accounting* (I.C.A.E.W.)
Chambers, R. J. — *Accounting Evaluation and Economic Behaviour* (Prentice-Hall 1966)
Dean, G. W. & Wells, M. C. (eds) — *Current Cost Accounting: Identifying the Issues*
Financial Accounting Standards Board — *Statements of Financial Accounting Concepts*
Goldberg, L. — *An Inquiry into the Nature of Accounting* (American Accounting Assn 1965)
Hendriksen, E. S. — *Accounting Theory* (Irwin 1970)
Jager, M. O. et al. — *Company Financial Statements: Form and Content* (Butterworths)
Keane, S. M. — *The Efficient Market Hypothesis and Implications for Financial Reporting*
Moonitz, M. — *The Basic Postulates of Accounting* (A.I.C.P.A.)
Parker, R. H. & Harcourt, G. C. — *Readings in the Concept of Measurement of Income* (Cambridge U.P.)
Sprouse, T. R. & Moonitz, M. — *A Tentative Set of Broad Accounting Principles for Business Enterprises* (A.I.C.P.A.)
Vatter, W. J. — *The Fund Theory of Accounting* (Chicago Uni. Press)

**413200 Accounting IIIB**

*Hours* 2 lecture hours per week

*Examination* One 3-hour paper

*Content*
Review and extension of classical optimization; transfer pricing; linear programming with applications; review and extension of C.U.P. (under certainty); review of probability theory;

C.U.P. analysis (under uncertainty); mathematics of finance; capital budgeting (under uncertainty); parametric methods of quality control; nonparametric methods of quality control; methods of cost estimation; learning curves.

*Texts* To be advised. Articles in Accounting Journals

*References*

Anton, H. R. & Firman, P. A. — *Contemporary Problems in Cost Accounting* (Houghton Mifflin 1966)
Bailey, E. — *Pricing Practices and Strategies* (Conference Board)
Benston, G. J. — *Contemporary Cost Accounting and Control* (Dickenson 1970)
Chase, R. B. & Acquilano, N. J. — *Production and Operations Management* (Irwin)
Corcoran, A. — *Costs* (Wiley)
Gordon, L. A. et al. — *Normative Models in Managerial Decision-Making* (N.A.A.)
Mintzberg, H. — *Impediments to the Use of Management Information* (N.A.A.)
O'Connor, R. — *Planning Under Uncertainty: Multiple Scenarios and Contingency Planning* (Conference Board)

### 413602 Financial Management

*Prerequisite* Accounting I

*Hours* 2 lecture hours per week

*Examination* One 3-hour paper

*Content*

An examination of some of the decision-making aspects of finance, such as, its goals and functions; financial planning, incentive schemes, evaluation of capital projects; methods of capital budgeting; cost of capital; risk analysis and capital budgeting; capital structure; dividend policy; management of current assets; short and intermediate term financing; mergers and takeovers; liquidation and abandonment of assets. A critical evaluation of the role accountants adopt in providing relevant information for financial decisions.

*Texts*

Brigham, E. F. et al. — *Cases in Managerial Finance* (Holt, Rinehart & Winston)
Pierson, G. & Bird, R. — *Business Finance* (McGraw-Hall) OR
Weston, J. F. & Brigham, E. F. — *Managerial Finance* (Holt, Rinehart & Winston)

*References*

Boudreaux, K. J. & Long, H. W. — *The Basic Theory of Corporate Finance* (Prentice-Hall)
Brigham, E. F. et al. — *Decisions in Financial Management* (McGraw-Hill)
Chambers, R. J. — *Accounting, Finance and Management* (Butterworths)
Jean, W. H. — *The Analytical Theory of Finance* (Holt, Rinehart & Winston)
Lerner, E. M. — *Managerial Finance* (Harcourt, Brace & Jovanovich)
Pollard, A. H. — *Mathematics of Finance* (Pergamon)
Quirin, G. D. — *The Capital Expenditure Decision* (Irwin)
Samuels, J. M. & Wilkes, F. M. — *Management of Company Finance* (Nelson)
Solomon, E. & Pringle, J. J. — *An Introduction to Financial Management* (Goodyear)
Van Horne, J. — *Financial Management and Policy* (Prentice-Hall)
Weston, J. F. — *The Scope and Methodology of Finance* (Prentice-Hall)
Weston, J. F. & Brigham, E. F. — *Managerial Finance* (Holt, Rinehart & Winston)
Weston, J. F. & Woods, D. H. — *Basic Financial Management: Selected Readings* (Wadsworth)
Wolf, H. A. & Richardson, L. — *Readings in Finance* (Appleton-Century Crofts)



### 713200 Biology IIIB

*Prerequisites* Mathematics IIA & IIC & either Biology IIA or IIB

*Hours* 4 lecture hours & 8 turorial hours per week

*Examination* Two 3-hour papers

*Content*

Biology IIIB consists of two units, Environmental Physiology, and Ecology and Quantitative Genetics.

### (i) 713201 Environmental Physiology

*Content*

**Plants**

Interrelationships between the environment and the operation of key physiological processes including photosynthesis, mineral ion acquisition and assimilate transfer.

**Animals**

Biology of reproduction in vertebrates with particular emphasis on gamete physiology.

*Texts*

Baker, D. A. — *Transport Phenomena in Plants* (Chapman & Hall 1978)
Milthorpe, F. L. & Moorby, J. — *An Introduction to Crop Physiology* 2nd edn (Cambridge U.P. 1980)
Nalbandov, A. V. — *Reproductive Physiology* 3rd edn (Freeman 1976)

*References*

Austin, C. R. & Short, R. V. — *Reproduction in Mammals* Vols 1-8 (Cambridge 1972)
Bloom, W. & Fawcett — *A Textbook of Histology* 10th edn (Saunders 1975)
Evans, L. T. — *Crop Physiology* (Paperback ed. Cambridge University Press)
Leopold, A. C. & Kriedemann, P. E. — *Plant Growth and Development* (McGraw-Hill 1975)
Setchell, B. P. — *The Mammalian Testis* (Paul Elek 1978)
Torrey, T. W. & Feduccia, A. — *Morphogenesis of the Vertebrates* 4th edn (John Wiley 1979)

### (ii) 713204 Ecology and Quantitative Genetics

*Content*

**Ecology**

Stucture and dynamics of biological communities, evolutionary ecology.

**Quantitative Genetics**

Continuous varition components of generation means. Heritability. The effect of selection and inbreeding. Neutral traits.

*Texts*

Krebs, C. J. — *Ecology* 2nd edn (Harper & Row)
Stewart, J. (ed.) — *S299 Genetics, Units 11, 12, 13* (Open University Press 1976)
Zar, J. H. — *Biostatistical Analysis* (Prentice-Hall)

*References*

C.S.I.R.O. — *The Australian Environment* (Melbourne University Press 1970)
Daubenmire, R. F. — *Plants and Environment* 3rd edn (Wiley 1974)
Ford, E. B. — *Ecological Genetics* (Methuen 1975)
Kershaw, K. A. — *Quantitative and Dynamic Plant Ecology* 2nd edn (Arnold 1973)

### 523700 Civil Engineering IIIM

*Prerequisite* Civil Engineering IIM, Mathematics IIA & IIC

*Hours* 6 lecture hours & 4½ tutorial/laboratory hours per week

*Examination* Four 3-hour papers, one 2-hour paper & two 1½-hour term papers

*Content*

(i) CE324 **Soil Mechanics**
(ii) CE314 **Structural Analysis I**
(iii) CE333 **Fluid Mechanics III**
(iv) CE334 **Fluid Mechanics IV**
(v) CE351 **Civil Engineering Systems I**

### (i) 523102 CE324 Soil Mechanics

*Prerequisite* CE212

*Pre- or Corequisites* CE333 & CE334

*Hours* 1 lecture hour & 2 tutorial & laboratory hours per week

*Examination* One 2-hour paper

*Content*

Index properties, classification of soils; permeability, capillarity, seepage and flow nets; stresses in soils; settlement and consolidation; compaction, shear strength and failure criteria; stability of retaining walls.

*Text*

Scott, C. R. — *An Introduction to Soil Mechanics and Foundations* 2nd edn (Applied Science 1974)

*References*

Capper, P. L. & Cassie, W. F. — *The Mechanics of Engineering Soils* 6th edn (Spon 1976)
Lambe, T. W. — *Soil Testing for Engineering* (Wiley)
SAA — *Methods of Testing Soils for Engineering Purposes* AS1289
Wu, T. H. — *Soil Mechanics* 2nd edn (Allyn & Bacon 1966)

### (ii) 523109 CE314 Structural Analysis I

*Prerequisites* CE212, CE213 & Mathematics I

*Hours* 2 lecture hours & 1 tutorial hour per week

*Examination* One 3-hour paper

*Content*

Analysis of statically indeterminate, elastic plane structures by force and displacement methods. Elements of flexibility and stiffness matrix methods. Limit analysis. Familiarisation with computer packages.

*Texts* Nil

### (iii) 523306 CE333 Fluid Mechanics III

*Prerequisite* CE232

*Hours* 2 lecture hours & 1 tutorial & laboratory hour per week for the first half year

*Examination* One 3-hour paper

*Content*

Fluid flow in pipes, fluid measurements, elementary hydrodynamics, fluid flow about immersed objects.

*Text* As for CE231

### (iv) 523307 CE334 Fluid Mechanics IV

*Prerequisite* CE333

*Hours* 2 lecture hours & 1 tutorial/laboratory hour per week for the second half year

*Examination* One 3-hour paper



*Content*

Open channel flow, basic concepts, energy and momentum principles, flow resistance, non uniform flow, channel controls, channel transitions. Unsteady flow; surges in closed conduits, water hammer, elements of unsteady flow in open channels.

*Text*

Henderson, F. M. — *Open Channel Flow* (Collier-Macmillan 1966)

### (v) 523107 CE351 Civil Engineering Systems I

*Hours* 1 lecture hour & ½ tutorial hour per week

*Examination* Two 1½-hour term papers & one 3-hour final paper

*Content*

General introduction to the systems approach. Techniques available as aids to the identification of optimal policies — mathematical modelling, computer simulation, various mathematical programming techniques, heuristics. Choice of techniques, problem formulation. Example applications of the systems approach to civil engineering problems.

*Text*

de Neufville, R. & Stafford, J. H. — *Systems Analysis for Engineers and Managers* (McGraw-Hill)

*References*

Baumol, W. J. — *Economic Theory and Operations Analysis* (Prentice-Hall)
Meredith, D. D. et al. — *Design and Planning of Engineering Systems* (Prentice-Hall 1973)
Wagner, H. M. — *Principles of Operations Research* (Prentice-Hall)

### 533900 Communications and Automatic Control

*Prerequisites* Mathematics IIA & IIC (including Topics CO, D)

*Hours* 6 lecture, tutorial & laboratory hours per week

*Examination* Progressive assessment & final examination

*Content*

Four of the following:

(i) 533213 EE341 **Automatic Control**
(ii) 533110 EE342 **Linear System Theory**
(iii) 534132 EE443 **Optimization Techniques**
(ME404 Mathematical Programming I may be substituted for EE443 — see page 93 for content)
(iv) 533113 EE344 **Communications**
(v) 534134 EE447 **Digital Communications**

### (i) 533213 EE341 Automatic Control — G. C. Goodwin

*Hours* 3 lecture, tutorial & laboratory hours per week for first half year

*Examination* Progressive assessment & final examination

*Content*

An introductory course in linear control systems. Mathematical models of systems and components; differential equations and transfer functions. Simple systems of first and second order. Analysis of steady state performance. System stability and transient response by algebraic, root-locus and frequency response methods. Introduction to compensation techniques.

Description of components of servo-mechanisms and process control systems.

*Text*

Fortmann, T. E. & Hitz, K. L. — *Introduction to Linear Control System Theory* (Dekker 1977)

**(ii) 533110 EE342 Linear System Theory** — K. L. Hitz

*Hours* 3 lecture, tutorial & laboratory hours per week for second half year

*Examination* Progressive assessment & final examination

*Content*

Multivariable control systems. Frequency domain design methods. Controllability. Observability. Canonical decomposition. Minimal realisations. Pole positioning by state variable feedback. Luenburger observers. The type 1 servomechanism problem. Introduction to Kalman filtering. Nonlinear control systems. Popov criterion and describing functions.

The course consists mainly of lectures which are supplemented by laboratory work and tutorial sessions.

*Text* As for EE341 Automatic Control

**(iii) 534132 EE443 Optimization Techniques** — Not offered in 1982

*Hours* 3 hours per week for first half year

*Content*

Mathematical background to optimization. Comparison of optimization methods; engineering applications — such as to problems of identification, control, pattern recognition and resource allocation.

*Texts*

Aoki, M. *Introduction to Optimization Techniques* (Macmillan 1971)

Luenberger, D. G. *Introduction to Linear and Non-Linear Programming* (Addison-Wesley 1973)

*Reference*

Luenberger, D. G. *Optimisation via Vector Space Methods* (Wiley 1969)

**(iv) 533113 EE344 Communications** — G. C. Goodwin

*Hours* 3 hours per week for second half year

*Examination* Progressive assessment & final examination

*Content*

Introduction to the common forms of analog modulation, as well as pulse modulation systems including pulse code modulation. Performance in the presence of noise is considered.

The course consists mainly of lectures which will be supplemented by some tutorial sessions.

*Text*

Gregg, W. D. *Analog and Digital Communications: Concepts. Systems. Applications and Services* (Wiley)

**(v) 534134 EE447 Digital Communications**

*Prerequisite* EE344 Communications

*Content*

Pulse modulation schemes, including pulse code modulation, multi-plexing, matched filters.

The course consists mainly of lectures supplemented by tutorial sessions.

*Text* As for EE344 Communications

**533901 Digital Computers and Automatic Control**

*Prerequisites* Mathematics IIA & IIC (including Topics CO, D)

*Hours* 6 lecture, tutorial & practical hours per week

*Examination* Progressive assessment & final examination



*Content*

**(i) 533213 EE341 Automatic Control** — see page 83

(ii) 533110 EE342 Linear System Theory — see page 84

**(iii) 532116 EE264 Introduction to Computer Architecture and Assembly Language** — see CS topic, page 100

**(iv) 533222 EE362 Switching Theory & Logic Design** — see CS topic, page 100

**423800 Economics IIIC**

*Prerequisites* Mathematics IIA & IIC & Economics IIA

*Hours* As indicated in the description of the components

*Examination* To be advised

*Content*

Two points of the following so as to include Econometrics I or Mathematical Economics or both:

**(i) 423208 Econometrics I** — 1.0 point

**(ii) 423204 Mathematical Economics** — 1.0 point

**(iii) 423113 Development** — 0.5 point

**(iv) 423102 International Economics** — 0.5 point

**(v) 423103 Public Economics** — 1.0 point

**(vi) 423114 Growth and Fluctuations** — 0.5 point

**(vii) 423115 Topics in International Economics** — 0.5 point

**(i) 423208 Econometrics I** — R. W. McShane

*Prerequisite* Economic Statistics II or Statistical Analysis

*Hours* 2 lecture hours per week

*Examination* One 3-hour paper

*Content*

A knowledge of matrix algebra and of the mathematical statistics dealt with in Statistical Analysis is recommended for students attempting this course.

The course is concerned with examining the usefulness of single equation regression analysis in applied economic research and also with providing an introduction to simultaneous estimation procedures.

*Text*

Johnston, J. *Econometric Methods* (McGraw-Hill 1972)

*References*

Goldberger, A. *Econometrics* (John Wiley & Sons 1964)

Hadley, G. *Linear Algebra* (Addison-Wesley 1961)

Huang, D. S. *Regression and Econometric Methods* (John Wiley & Sons 1970)

Johnston, J. *Econometric Methods* (McGraw-Hill 1972)

Koutsoyiannis, A. *A Theory of Econometrics* (Macmillan 1973)

Kmenta, J. *Elements of Econometrics* (Macmillan)

Pindyck, R. S. & Rubinfeld, D. L. *Econometric Models and Economic Forecasts* (McGraw-Hill)

**(ii) 423204 Mathematical Economics**

*Prerequisites* Economics II or IIA

*Hours* 3 lecture hours per week

*Examination* One 3-hour paper

*Content*

1. The first part of the course is designed to provide an introduction to Mathematical Economics for students who have some mathematical ability but whose university level

work in this area has been confined to one or more statistics-oriented subject. After a review of some mathematical preliminaries, five topics are covered including an introduction to calculus, linear modelling and constrained optimization. The material is so arranged that each topic consists of two lectures, the first covering the necessary mathematics and the second its application to economics.

2. The second section of the course deals with the theory and economic application of difference and differential equations, the mathematical reformulation and interpretation of traditional macro-theory (including matrix algebra), the techniques of input-output analysis, linear (and to a limited extent non-linear) programming, game theory and concludes with a discussion of the theory and economic application of the calculus of variations.

3. A number of "case studies" chosen to cover areas in which the role of mathematics in illuminating and integrating material in micro and macro-economic theory and applied economics is of particular interest.

*Text*

Archibald, G. C. & Lipsey, R. G. — *An Introduction to a Mathematical Treatment of Economics* 3rd edn (Weidenfeld & Nicholson 1977)

*References*

Benavie, A. — *Mathematical Techniques for Economic Analysis* (Prentice-Hall 1972)

Chiang, A. C. — *Fundamental Methods of Mathematical Economics* 2nd edn (McGraw-Hill)

Dernburg, T. F. — *Macoeconomic Analysis: An Introduction to Comparative Statics and Dynamics* (Addison-Wesley 1969)

Dowling, E. T. — *Mathematics for Economists* (McGraw-Hill 1980)

Hadley, G. & Kemp, M. C. — *Finite Mathematics in Business and Economics* (North-Holland 1972)

Haeussler, E. F. & Paul, R. S. — *Introductory Mathematical Analysis* 2nd edn (Reston Publishing Co. 1976)

Henderson, J. & Quandt, R. — *Microeconomic Theory — A Mathematical Approach* 2nd edn (Prentice-Hall)

Intriligator, M. D. — *Mathematical Optimization and Economic Theory* (Prentice-Hall)

Yamane, T. — *Mathematics for Economists — An Elementary Survey* (Prentice-Hall)

### (iii) 423113 Development

*Prerequisite* — Economics II

*Hours* — 2 lecture hours per week & 1 tutorial hour per fortnight

*Examination* — Two 3-hour papers, (i) at the end of the first half of the academic year and (ii) in the end of the academic year examination period

*Content*

The course commences with a discussion of the concepts of development and poverty. In the course of the discussion the concepts of sociological and economic dualism are developed. Using theoretical models and case studies, the focus then shifts to the role of agriculture in development. Next to be discussed is the issue of rural to urban migration. Particular attention is paid to the performance of the industrial sector of poor countries in terms of job creation. The course is concluded with a discussion of the ecological viability of alternative development strategies.

*Text*

No specific text is required. Students will be required to read articles and chapters from books relevant to the various sections of this half of the course.



Below is a list of some of the main books which will be referred to. The student is encouraged to read extensively and these references should be considered as valuable sources.

*References*

Bauer, P. T. — *Dissent on Development* (Weidenfeld & Nicholson 1971)

Coleman, D. & Nixson, F. — *The Economics of Change in Less Developed Countries* (Philip Alan 1978)

Enke, S. — *Economics for Development* (Dobson 1963)

George, S. — *How the Other Half Dies* (Penguin 1976)

Gill, R. T. — *Economic Development: Past and Present* 3rd edn (Prentice-Hall 1973)

Higgins, B. — *Economic Development* rev. edn (Norton 1968)

Kindleberger, C. — *Economic Development* 2nd edn (McGraw-Hill 1965)

Meier, G. M. (ed.) — *Leading Issues in Economic Development* 3rd edn (Oxford U.P. 1976)

Myrdal, G. — *Asian Drama* (Twentieth Century Fund 1968)

Myint, H. — *The Economics of Developing Countries* 4th edn (Hutchinson 1973)

Szentes, T. — *The Political Economy of Underdevelopment* (Budapest: Akademiai Kiado 1973)

Todaro, M. P. — *Economic Development in the Third World* (Longmans 1977)

### (iv) 423102 International Economics

*Hours* — 2 lecture hours per week for half the year

*Examination* — One 3-hour paper and progressive assessment

*Content*

1. The theory and analysis of trade policy. This covers the role and scope for international specialization, the gains from trade, optimal trade intervention, the effects of trade at the national and international levels and the theory of preferential trading. Australian illustrations are used wherever possible.

2. The theory of balance of payments policy. This covers balance of payments problems, alternative adjustment processes including a synthesis of the elasticities, absorption and monetary approaches, international monetary systems and balance of payments policy. Australian illustrations are used wherever possible.

*Texts*

Meier, G. M. — *International Economics, The Theory of Policy* New York (Oxford 1980)

Perkins, J. — *Australia in the World Economy* 3rd edn Melbourne (Sun Books 1979)

*References*

Caves, R. E. & — *Readings in International Economics* (Allen & Unwin 1968)

Heller, H. R. — *International Trade: Theory and Empirical Evidence* 2nd edn (Prentice-Hall 1973)

Heller, H. R. — *International Monetary Economics* (Prentice-Hall 1974)

Kindleberger, C. P. & Lindert, P. H. — *International Economics* 6th edn (Irwin 1978)

McColl, G. D. (ed.) — *Overseas Trade and Investment* (Pelican 1972)

Snape, R. H. — *International Trade and the Australian Economy* 2nd edn (Longman 1973)

### (v) 423103 Public Economics

*Hours* — 2 lecture hours plus seminars

*Examination* — One 3-hour paper

*Content*

The effects of government intervention in the economy through the budget and through the operation of publicly-owned business undertakings and inter-governmental fiscal relationships are examined. At the microeconomic level, there is an analysis of the effects of tax and expenditure policies on, in particular, community welfare and incentives.

At the macroeconomic level, aggregative models are used to analyse the relation of fiscal policy to other economic policies for stability and growth.

*Texts* Nil

*References*


Brown, C. V. & Jackson, P. M. — *Public Sector Economics* (Martin Robertson)
Buchanan, J. M. & Flowers, M. R. — *The Public Finances* (Irwin)
Culbertson, J. M. — *Macroeconomic Theory and Stabilisation Policy* (McGraw-Hill)
Groenewegen, P. D. (ed.) — *Australian Taxation Policy* (Longman-Cheshire)
Groenewegen, P. — *Public Finance in Australia: Theory and Practice* (Prentice-Hall)
Houghton, R. W. (ed.) — *The Politics of Taxation* (Hodder & Stoughton)
Johansen, L. — *Public Economics* (North-Holland 1971)
Keiser, N. F. — *Reading in Macroeconomics* (Prentice-Hall)
Mishan, E. J. — *Cost-Benefit Analysis* (Allen & Unwin)
Musgrave, R. A. & P. B. — *Public Finance in Theory and Practice* (McGraw-Hill)
Shoup, C. S. — *Public Finance* (Weidenfeld & Nicholson)
Wilkes, J. (ed.) — *The Politics of Taxation* (Hodder & Stoughton)


### (vi) 423114 Growth and Fluctuations

*Prerequisite* Nil

*Hours* 2 lecture hours per week for half the year

*Examination* One 3-hour paper

*Content*

This course deals with the dynamics of fluctuations and growth in the framework of an advanced economy. A critical appraisal is undertaken of leading contributions in this field. Topics such as the production function, technical progress and various models of growth are dealt with in detail.

*Text*


Hamberg, D. — *Models of Economic Growth* (Harper International 1973)


*References*


Bober, S. — *The Economics of Cycle and Growth* (Wiley 1968)
Clark, J. S. & Cohen, M. (eds.) — *Business Fluctuations, Growth and Economic Stabilisation: A Reader* (Random House 1963)
Hicks, J. R. — *A Contribution to the Theory of the Trade Cycle* (Clarendon 1967)
Meade, J. E. — *A Neoclassical Theory of Economic Growth* (Allen & Unwin 1962)
Neher, P. A. — *Economic Growth and Development — A Mathematical Introduction* (Wiley 1971)


### (vii) 423115 Topics in International Economics

*Prerequisite* Economics II

*Hours* 2 lecture hours per week for half the year

*Examination* One 3-hour paper and progressive assessment

*Content*

This course provides a more advanced theoretical treatment of selected topics introduced in the International Economics course. It also uses empirical studies and policy materials to provide a more detailed exposition and analysis of trade policy problems. The content consists of:



1. The neo-classical theory of international trade and equilibrium, the modern theory of trade, its clarification, extension and qualification, the sources of economic growth and international trade, equivalence among trade intervention measures, a general equilibrium approach to protection, analysis of Australian protection policy, international factor mobility and host country costs and benefits.
2. International monetary economics, the foreign exchange market and the role of arbitrage, extension of the analysis of the flexible exchange rate systems, extension of the analysis of fixed exchange rate systems, monetary and fiscal policies for internal and external balance, a single open economy and two country model, international monetary reform.

*Texts*


Chacholiades, M. — *International Trade Theory and Policy* New York (McGraw-Hill 1978)
Chacholiades, M. — *International Monetary Theory and Policy* New York (McGraw-Hill 1978)
Snape, R. H. — *International Trade and the Australian Economy* (Longman 1973)


### 733300 Geology IIIC

*Prerequisites* Physics IA, Mathematics IIA, IIC & Geology IIA

*Hours* 3 lecture hours, 6 laboratory hours per week & 12 days field work

*Examination* Two 3-hour papers plus assessment

*Content*

Sedimentology — the petrogenesis of sedimentary rocks. Economic geology — principles of formation of economic mineral deposits; major Australian ore deposits; ore mineralogy. Structural geology — structural aspects of geosynclinal concept; orogenies; continental drift; global tectonics. Photogrammetry and Photogeology — basic principles of interpretation; aerial photographs and their use in stratigraphic and structural studies. Exploration Geophysics: geophysical techniques — their interpretation and the application in petroleum and mining exploration, and hydrogeological and engineering investigations. Appropriate Computer Science subject or Mathematics topic not previously taken in the course (to be decided in consultation with the Head of Department).

*Texts* Consult lecturers concerned

### 543500 Industrial Engineering I

*Prerequisites* Mathematics IIA & IIC

*Hours* Approximately 6 lecture hours per week

*Examination* Progressive assessment & examination

*Content*

Four of the following:

**(i) 543501 ME381 Methods Engineering**
**(ii) 543502 ME383 Quality Engineering**
**(iii) 543503 ME384 Design for Production**
**(iv) 544425 ME419 Bulk Materials Handling Systems Analysis and Design**
**(v) 544418 ME449 Reliability Analysis for Mechanical Systems**
**(vi) 544433 ME482 Engineering Economics I**
**(vii) 544463 ME483 Production Engineering**
**(viii) 544464 ME484 Engineering Economics II**

### (i) 543501 ME381 Methods Engineering

*Hours* 1½ hours per week

*Examination* Progressive assessment

*Content*

The integration of man, machines and materials to achieve maximum efficiency of operation. The critical questioning attitude. Charting methods. Work study. Ergonomics. Activity sampling. Case studies.

*Text*

Niebel, B. W. *Motion and Time Study* (Irwin)

*or*

Stevenson, M. G. *Methods Engineering* (N.S.W. Univ. Press)

**(ii) 543502 ME383 Quality Engineering**

*Hours* 1½ hours per week

*Examination* Progressive assessment & examination

*Content*

Concepts of quality. Sampling plans. Inspection by attributes, by measurement. Operating characteristic curves, control charts. Design of experiments. Analysis of variance.

*Text* Nil

**(iii) 543503 ME384 Design for Production**

*Hours* 1½ hours per week

*Examination* Progressive assessment & examination

*Content*

The application of economics, methods engineering, ergonomics and mechanical engineering to the development and design of a product. Production, distribution and marketing of engineering products. Production, assembly and inspection methods in relation to scale of output. Principles of metrology and tool, jig and fixture design.

*Text* Nil

**(iv) 544425 ME419 Bulk Materials Handling Systems Analysis and Design** — A. W. Roberts

*Hours* 42

*Examination* Progressive assessment

*Content*

Principles of granular mechanics. Flow patterns and characteristics. Strength and flow of properties of bulk solids in relation to hopper design. Analysis and design of hoppers for "mass" flow and "funnel" flow conditions. Bin wall pressures.

Design features and performance characteristics of conveyors and handling systems. Introduction to the optimum design of handling systems.

*Text*

Arnold, P. C., McLean, A. G. & Roberts, A. W. *Bulk Solids: Storage, Flow and Handling* (The Univ. of Newcastle Research Associates Ltd. (TUNRA 1979)

**(v) 544418 ME449 Reliability Analysis for Mechanical Systems**

*Hours* 1½ hours per week

*Examination* Progressive assessment

*Content*

Some important probability concepts. Fundamental concepts of the theory of reliability. Some quantitative aspects of reliability. Component reliability and reliability of assemblies of components, gradual and sudden failure. Matrix formulation of problems. Spectral method for calculation of reliability.



Basic concepts of systems. Reliability analysis of systems. Methods for improving the reliability of systems. Cost-Benefit analysis.

Reliability Case Studies. Automobile suspension, ignition systems.

Measuring system.

*Text*

Shooman, M. L. *Probabilistic Reliability. An Engineering Approach* (McGraw-Hill 1968)

**(vi) 544433 ME482 Engineering Economics I**

*Hours* 42

*Examination* To be advised

*Content*

Elementary accounting concepts. Time value of money, interest formulae. Comparison of alternatives, annual and present equivalent rate of return. Depreciation and income tax effects. Projects financed from public funds. Replacement and retirement economics. Capital budgeting.

*Text*

Smith, G. W. *Engineering Economy: Analysis of Capital Expenditures* 3rd edn (Iowa State U.P. 1979)

**(vii) 544463 ME483 Production Engineering**

*Hours* 42

*Examination* Progressive assessment & examination

*Content*

Production systems; job shop, line production, group technology; Computer aided manufacture, numerically controlled systems; Materials handling. Production scheduling and sequencing. Computer algorithms for scheduling and sequencing problems.

*Text* Nil

**(viii) 544464 ME484 Engineering Economics II**

*Hours* 1½ hours per week

*Examination* Progressive assessment

*Content*

Accounting concepts, use of accounting data in decision making. Utility, risk and uncertainty. Expansion and economic package concepts. Capital expenditure programming. Effects of inflation. Application of mathematical programming to economic problems.

*Text*

Smith, G. W. *Engineering Economy: Analysis of Capital Expenditures* 3rd edn (Iowa State U.P. 1979)

**553900 Mechanical Engineering IIIC**

*Prerequisites* Mathematics IIA & IIC (including Topics F & H)

*Hours* 6 hours per week

*Examination* Progressive assessment

*Content*

Students may choose one of the following alternatives (a), (b), (c) or (d) but all 4 alternatives may not be available each year.

(a) (i) ME361 Automatic Control
(ii) ME401 Systems Analysis
(iii) ME505 Systems Analysis, Organisation & Control

(iv) ME487 Operations Research — Deterministic Models

(b) (iii) ME505 Systems Analysis, Organisation & Control
(iv) ME487 Operations Research — Deterministic Models
(v) ME488 Operations Research — Probabilistic Models

(c) (iii) ME505 Systems Analysis, Organisation & Control
(vi) ME404 Mathematical Programming I
(v) ME488 Operations Research — Probabilistic Models

(d) (i) ME361 Automatic Control
(vii) ME434 Advanced Kinematics & Dynamics of Machines
(viii) ME448 An Introduction to Photomechanics
(ix) ME449 Reliability Analysis for Mechanical Systems

**(i) 543204 ME361 Automatic Control** — G. C. Goodwin

*Hours* 1½ hours per week

*Examination* Progressive assessment & examination

*Content*

An introductory course in linear control systems. Mathematical models of systems and components; differential equations and transfer functions. Simple systems of first and second order. Analysis of steady state performance. System stability and transient response by algebraic, root-locus and frequency response methods. Introduction to compensation techniques. Description of components of servo-mechanisms and process control systems.

*Text*

Fortmann, T. E. & Hitz, K. L. — *Introduction to Linear Control Systems Theory* (Dekker 1977)
*or*
Cannon, R. H. — *Dynamics of Physical Systems* (McGraw-Hill 1967)
*or*
Distefano, et al. — *Feedback and Control Systems* (Schaum's Outline Series 1976)

**(ii) 544451 ME401 Systems Analysis**

*Hours* 1½ hours per week

*Examination* Progressive assessment & examination

*Content*

System concepts and system classification. Mathematical modelling. Deterministic and probabilistic models, Stochastic models. Deterministic systems — Linear Graph theory and Network Analysis; Classical time and frequency domain analysis of continuous and discrete systems; Matrix methods in systems modelling and analysis. Stochastic Processes — Random data and signal analysis; Response of systems to random excitation; System identification.

*Texts*

Bendat, J. S. & Piersol, A. G. — *Measurement and Analysis of Random Data* (Wiley 1968)
Schwarzenbach, J. & Gill, K. F. — *System Modelling and Control*

**(iii) 540126 ME505 Systems Analysis, Organisation & Control**

*Hours* 1½ hours per week

*Examination* Progressive assessment & examination

*Content*

Types of systems, physical and organizational. Mathematical modelling and system simulation. System performance criteria. Concepts of Optimization. Application of systems techniques of organizational analysis and design. Examples of industrial and business systems.

*Text* Nil



**(iv) 544841 ME487 Operations Research — Deterministic Models**

*Hours* 1½ hours per week

*Examination* Progressive assessment

*Content*

Concept of optimisation; optimisation approaches; formulation of models; linear programming; allocation and assignment; simplex method; duality; theory of games, parametric programming; integer programming; zero-one programming; quadratic programming; decomposition principle. Network theory; dynamic programming. Geometric programming. Applications.

*Texts*

Ackoff, R. L. & Sasieni, M. W. — *Fundamentals of Operations Research* (Wiley)
*or*
Taha, H. A. — *Operations Research* (Macmillan)
*or*
Wagner, H. W. — *Principles of Operations Research* (Prentice-Hall)

**(v) 544842 ME488 Operations Research — Probabilistic Models** — G. D. Butler

*Hours* 1½ hours per week

*Examination* Progressive assessment

*Content*

Statistical decision theory; forecasting methods, moving average, exponentially smoothed average. Inventory control theory. Fixed order quantity; fixed order cycle systems; production — inventory systems. Queueing theory; simple queue, multiserver queues. Queues in series. Transients in queues; simulation of systems. Applications.

*Text* As for ME487

**(vi) 544427 ME404 Mathematical Programming I** — K. L. Hitz

*Hours* 1½ hours per week

*Examination* Progressive assessment

*Content*

Introduction to static optimization problems. Linear programming and its applications; the Simplex algorithm and its revised form; duality theory; sensitivity analysis. Transportation and assignment problems. Some problems involving networks: shortest paths and maximal flows. Introduction to linear programs in integers.

*Text*

Murty, K. G. — *Linear and Combinatorial Programming* (Wiley 1976)

**(vii) 544419 ME434 Advanced Kinematics and Dynamics of Machines**

*Hours* 1½ hours per week

*Examination* To be advised

*Content*

Dynamic Motion Analysis: energy distribution method, equivalent mass-and-force method, the rate-of-change-of-energy method.

Advanced Kinematics of the Plane Motion: the inflection circle, Euler-Savary equation, Bobillier's construction, Hartmann's construction. Introduction to synthesis: graphical and analytical methods.

*Text*

Hirschorn, J. — *Kinematics and Dynamics of Plane Motion* (McGraw-Hill)

**(viii) 544416 ME448 An Introduction to Photomechanics**

*Hours* 1½ hours per week

*Examination* Progressive assessment

*Content*

Concepts of bi-refringence. Polarized light-plane, circular and elliptical polarization. Fundamentals of photoelastic method — stress-optic law in two dimensions. Isochromatics, isoclinics, isopachics — fundamental equations for linear and non-linear model materials.

Model analysis for two and three dimension problems which may involve static, dynamic or thermal loading conditions.

Calibration of material and solution of disc problem.

*Text* Nil

**(ix) 544418 ME449 Reliability Analysis for Mechanical Systems** — A. J. Chambers/ A. W. Roberts

*Hours* 1½ hours per week

*Examination* To be advised

*Content*

Some important probability concepts. Fundamental concepts of the theory of reliability. Some quantitative aspects of reliability. Component reliability and reliability of assemblies of components, gradual and sudden failure. Matrix formulation of problems. Spectral method for calculation of reliability.

Basic concepts of systems. Reliability analysis of systems. Methods for improving the reliability of systems. Cost-Benefit analysis. Reliability Case Studies. Automobile suspension ignition system. Measuring system.

*Text*

Shooman, M. L. *Probabilistic Reliability. An Engineering Approach* (McGraw-Hill 1968)

**743100 Physics IIIA**

*Prerequisites* Physics II, at least one Mathematics II subject which should include, in addition to topic CO (which counts as two topics), topic B and one of the topics D, F and H

*Hours* Approximately 4 lecture hours & 8 laboratory hours per week

*Examination* Assessment to the equivalent of 12½ hours of examination time

*Content*

The areas of classical and quantum physics essential to the understanding of both advanced pure physics and also the many applications of physics. Some electronics is also included.

A. *Classical Physics*

Mathematical methods, advanced mechanics, special theory of relativity, electromagnetics including waveguide and antenna theory.

B. *Quantum Physics*

Quantum mechanics, atomic and molecular physics, statistical physics, solid state physics, nuclear physics, electronics.

C. *Laboratory*

Parallels the lecture course in overall content with at least one experiment available in each topic, although students are not expected to carry out all the experiments available.

*Texts* Refer to the Physics Department notice board. Students should retain their Physics II texts.



**753300 Psychology IIIC**

*Prerequisites* Mathematics IIA, IIC & Psychology IIC

*Hours* 4 lecture hours & 3 laboratory hours per week

*Examination* To be advised

*Content*

**Computer Assisted Data Analysis**
**Personality Assessment**
**Vision**
**Human Information Processing**
**Cognition**
**Perception**

Two additional topics to be selected from Psychology IIIA or IIIB. Students will also be required to complete an independent investigation in mathematical psychology under supervision.

*Text* To be advised

*References* To be advised

*SCHEDULE C*

**664500 Mathematics/Geology IV**

*Prerequisites* Geology IIIC and Mathematics IIIA and such additional work as is required for combined honours students by the Department of Mathematics. A student desiring admission to this subject must apply in writing to the Dean of the Faculty of Mathematics before 7th December of the preceding year

*Hours* To be advised

*Examination* To be advised

*Content*

At least four topics chosen from those available to honours students in Mathematics for the current year together with work offered by the Department of Geology for that year. The subject will also include a major thesis which embodies the results of a field research project involving the application of mathematical studies to a particular geological problem. Other work e.g. seminars and assignments may be required by either Department.

*Texts* To be advised

*References* To be advised

**664300 Mathematics/Physics IV**

*Prerequisites* Mathematics IIIA & Physics IIIA & such additional work as is required for combined honours students by the Dept. of Mathematics. A student desiring admission to this subject must apply in writing to the Dean of the Faculty of Mathematics before 7th December of the preceding year.

*Hours* To be advised. A project of mathematical and physical significance, jointly supervised.

*Examination* Assessment will be in the appropriate Mathematics & Physics topics selected. In addition the research project will be avaluated and normally an oral examination conducted.

*Content*

The student shall complete four topics from Mathematics IV, chosen for their application to Physics, and topics from Physics IV, as approved by Head of Department of Physics. Project work will normally begin in the first week of February.

**664200 Mathematics/Psychology IV**

*Prerequisites* Mathematics IIIA, Psychology IIIC.
A student desiring admission to this subject must apply in writing to the Dean of the Faculty of Mathematics before 7th December of the preceding year.

*Hours* To be advised

*Examination* To be advised

*Content*
4 Mathematics topics chosen from the Part IV Mathematics topics (see page 54 et seq.)
Psychological Measurement (see below).
Mathematical Models in Perception and Learning (see below).

**(i) Psychological Measurement** — J. A. Keats

*Prerequisites* Nil

*Hours* 1½ hours per week

*Examination* To be advised

*Content*
The logic of measurement and its application to psychological phenomena and at least one paper on one of the more recently developed psychological scaling methods.

*Text* Nil

*References* To be advised

**(ii) Mathematical Models in Perception & Learning** — R. A. Heath

*Prerequisites* Part II Mathematics Topic H recommended

*Hours* 1½ hours per week

*Examination* To be advised

*Content*
An introduction to the application of stochastic process models to the analysis of psychological processes involved in human information processing. Use of a real-time computer.

*Text* To be advised

*References* To be advised





SCHEDULE OF SUBJECTS

1 The lecturer in the subject will assume that all students have a good understanding of the content of items in the column headed "Assumed Standard of Attainment".

2 Subjects with a prefix CS are subjects offered in the Faculty of Mathematics specifically for the Diploma in Computer Science.

Topics C and E existing before 1978 are no longer offered as separate topics, and have been replaced by the Topic CO, whose present content is a good guide to the assumed standard of attainment indicated below.

**Core Subjects**

| *Subject* | *Department Offering Subject* | *Assumed Standard of Attainment* | *No. of Units* |
|---|---|---|---|
| CS—Commercial Programming | Commerce | Mathematics I, Topic SC, or Commercial Electronic Data Processing | 1 |
| CS—Introduction to Computer Architecture & Assembly Language | Electrical Engineering | Mathematics I or suitable alternative preparation | 1 |
| CS—Switching Theory & Logical Design | Electrical Engineering | Mathematics I or suitable alternative preparation | 1 |
| CS—Programming & Algorithms | Mathematics | Mathematics I or suitable alternative preparation | 1 |
| CS—Data Structures & Programming | Mathematics | CS—Programming & Algorithms | 1 |
| CS—Numerical Analysis | Mathematics | Mathematics I or suitable alternative preparation | 1 |
| Systems Analysis | Mathematics | — | 1 |

**General Notes**

A student is referred to page 10 for information on the concurrent degree/Diploma programme.

The subjects listed below are approved pursuant to Section 7 of the Requirments for the Diploma in Computer Science. The Board may approve from time to time additions to the lists of subjects shown below. A candidate may count not more than two Group B subjects towards the Diploma.

The Board may approve the inclusion in a student's programme of a project. This project would be in lieu of Group B subjects and may not count more than two units.

A student may suggest to the Dean for consideration by the Board the inclusion in his programme of a subject not listed below.

Students interested in positions as Computer Systems Officers in the Australian Public Service are strongly advised to include the subject Systems Design in their course.

The Australian Computer Society has granted full exemption from the educational requirements for admission to the Society to those who have completed the Diploma in Computer Science.

**Subjects Overlapping in Content**

The Board of Studies in Computer Science has decided that a candidate is not permitted to include in his programme more than one of each pair of the mutually exclusive subjects listed in the Table below, nor may he include a subject if he has previously included the content of that subject in his work for a degree or Diploma which has already been conferred or awarded or approved for conferment or award.

| | |
|---|---|
| Quantitative Business Analysis II | ME487—Operations Research-Deterministic Models |

## Subjects Approved for the Diploma

*Group A*

### Subjects in the main-stream of computer science

| *Subject*2 | *Department Offering Subject* | *Assumed Standard of Attainment*1 | *No. of Units* |
|---|---|---|---|
| Information Systems | Commerce | Commercial EDP | 1 |
| Quantitative Business Analysis II | Commerce | Introductory Quantitative Methods | 1 |
| Systems Design | Commerce | CS—Commercial Programming<br>Systems Analysis | 1 |
| EE341—Automatic Control | Electrical Engineering | Part II Mathematics, Topics CO, D, H | 1 |
| EE345—Digital Signal Processing | Electrical Engineering | EE341 or ME361—Automatic Control | 1 |
| EE325—Introduction to Digital Technology | Electrical Engineering | EE264 or CS—Introduction to Computer Architecture & Assembly Language<br>EE221—Semiconductor Devices | 1 |
| EE447—Digital Communications | Electrical Engineering | EE344—Communications | 1 |
| EE463—Computer Operating Systems | Electrical Engineering | EE264 or CS—Introduction to Computer Architecture & Assembly Language | |
| EE464—Compiler Construction | Electrical Engineering | EE264 or CS—Introduction to Computer Architecture & Assembly Language | 1 |
| EE462—Topics in Switching Theory | Electrical Engineering | EE362 or CS—Switching Theory & Logical Design | 1 |
| CS—Theory of Computing | Mathematics | Part II Mathematics, Topics CO, F or equivalent | 1 |
| CS—Mathematical Principles of Numerical Analysis | Mathematics | Part II Mathematics, Topics CO, D | 1 |
| CS—Programming Languages & Systems | Mathematics | Part II Mathematics, Topic F | 1 |
| CS—Concurrent Programming Techniques | Mathematics | CS—Theory of Computing<br>OR<br>EE463—Computer Operating Systems | 1 |
| CS—High Level Software Development | Mathematics | Programming experience in a high-level language | 1 |
| ME505—Systems Analysis, Organization & Control | Mechanical Engineering | Part II Mathematics, Topics CO, D, H<br>ME361—Automatic Control | 1 |
| ME404—Mathematical Programming I | Mechanical Engineering | Part II Mathematics, Topics CO, D | 1 |
| ME581—Mathematical Programming II | Mechanical Engineering | ME404—Mathematical Programming I | 1 |

*Group B*

### Subjects which have some application to computer science

| *Subject*2 | *Department Offering Subject* | *Assumed Standard of Attainment*1 | *No. of Units* |
|---|---|---|---|
| CE510—Elastic Continua | Civil Engineering | CE212—Mechanics of Solids I<br>Part II Mathematics, Topic D | 1 |
| Theories of Organisation | Commerce | Organisational Behaviour | 1 |
| EE323—Linear Electronics | Electrical Engineering | EE203—Introduction to Electrical Information<br>EE321—Electronics | 1 |
| EE324L—Electronics Laboratory | Electrical Engineering | PH221—Electromagnetics & Quantum Mechanics<br>EE322—Electronics | 1 |
| EE342—Linear System Theory | Electrical Engineering | EE341—Automatic Control | 1 |
| EE344—Communications | Electrical Engineering | EE331—Circuits<br>Part II Mathematics, Topic H | 1 |
| EE421—Electronic Design A | Electrical Engineering | EE323—Linear Electronics | 1 |
| EE422—Electronic Design B | Electrical Engineering | EE324L—Electronics Laboratory<br>EE421—Electronics | 1 |
| EE442—Nonlinear Optimal Control | Electrical Engineering | EE342—Linear System Theory | 1 |
| EE443—Optimization Techniques | Electrical Engineering | Part II Mathematics, Topic CO, D | 1 |
| CS—Mathematical Logic and Set Theory | Mathematics | Part II Mathematics, Topics K & L | 1 |
| CS—Theory of Statistics | Mathematics | Part II Mathematics, Topic H | 1 |
| CS—Random & Restricted Walks | Mathematics | Part II Mathematics, Topics CO, H<br>Part III Mathematics, Topic R | 1 |
| CS—Signal Detection | Mathematics | Part II Mathematics, Topic H | 1 |
| CS—Combinatorial Designs | Mathematics | Part II Mathematics, Topics D, K | 1 |
| CS—Combinatorics | Mathematics | Part II Mathematics, Topic K | 1 |
| CS—Graph Theory and Applications | Mathematics | Part II Mathematics, Topics D, K | 1 |
| ME449—Reliability Analysis for Mechanical Systems | Mechanical Engineering | Part II Mathematics, Topic H | 1 |
| ME487—Operations Research—Deterministic Models | Mechanical Engineering | Part II Mathematics, Topics CO, D, H | 1 |
| ME488—Operations Research—Probabilistic Models | Mechanical Engineering | Part II Mathematics, Topics CO, D, H | 1 |
| ME503—Design of Experiments for Engineering Research | Mechanical Engineering | Part II Mathematics, Topic CO, D | 1 |
| Met312—Modelling and Control of Metallurgical Processes | Metallurgy | — | 1 |
| CS—Instrumentation Techniques | Physics | Physics IA or IB | 1 |

## DESCRIPTION OF SUBJECTS

*CORE SUBJECTS*

### 410136 CS — Commercial Programming

*Assumed Standard of Attainment* — Mathematics I Topic SC or Commercial E.D.P.

*Hours* — 2 lecture hours per week for second half year

*Examination* — One 3-hour paper

*Content*

Basic concepts of file handling and file maintenance, including file creation and processing.

Flow charting; file merging and updating of transactions; tape blocking and buffering.

General run types including editing; searching and sorting. Direct access versus serial; random or sequential organisation; re-run techniques; verifying programme accuracy; table lookup; programme documentation and use of test data.

DIBOL as a business data processing and file organisation language. Extensive practical work in DIBOL, including case studies.

*Texts*

Feingold, C. — *Fundamentals of COBOL Programming* (W. C. Brown)

D.E.C. — *DIBOL-II Language Reference Manual*

*References*

| | |
|---|---|
| Chai, W. A. & H. W. | *Programming Standard COBOL* (Academic) |
| Clifton, H. D. | *Systems Analysis for Business Data Processing* (Business Books) |
| Davis, G. B. & Litecky, C. R. | *Elementary Cobol Programming* (McGraw-Hill) |
| DeRossi, C. J. | *Learning COBOL Fast* (Reston) |
| Kapur, G. K. | *Programming in Standard COBOL* (S.R.A.) |
| Laden, H. N. & Gildersleeve, T. R. | *System Design for Computer Applications* (Wiley) |
| McCracken, D. D. et al. | *Programming Business Computers* (Wiley) |
| Murach, M. | *Standard COBOL* (S.R.A.) |
| Sanders, D. H. | *Computers in Business* (McGraw-Hill) |
| Sprowls, R. C. | *Computing with COBOL* (Harper & Row) |
| Stern, N. B. & R. A. | *Cobol Programming* (Wiley) |
| Watters, J. L. | *Cobol Programming* (Heinemann) |

**532117 CS — Introduction to Computer Architecture & Assembly Language** — K. K. Saluja

| | |
|---|---|
| *Assumed Standard of Attainment* | Mathematics I |
| *Hours* | 2 hours of lectures & practical work per week for first two terms |
| *Examination* | Progressive assessment & final examination |

*Content*

**Number Systems:** Representation and Arithmetic

Hardware components, processor structure, addressing modes, Assembly Language. Instruction set, pseudo ops, Machine Language programming, Subroutines, Co-routines, use of stacks, interrupts, macros, recursion, re-entry, linkers and loaders.

Lectures will be supplemented with practical assignments using the PDP-11 computer.

*Text*

| | |
|---|---|
| Eckhouse, R. H. & Morris, L. R. | *Minicomputer Systems: Organisation, Programming and Applications (PDP-11)* 2nd edn (Prentice-Hall 1979) |

*References*

| | |
|---|---|
| Chu, Y. | *Computer Organization and Micro Programming* (McGraw-Hill) |
| Donovan, J. J. | *Systems Programming* (McGraw-Hill) |
| Friedman, A. D. | *Logical Design of Digital Systems* (Computer Science) |
| Stone, H. S. | *Introduction to Computer Organization and Data Structures* (McGraw-Hill) |

**533221 CS — Switching Theory & Logical Design** — K. K. Saluja

| | |
|---|---|
| *Assumed Standard of Attainment* | Mathematics I |
| *Hours* | 3 hours of lectures, tutorials & practical work per week for the first half year |
| *Examination* | Progressive assessment & final examination |

*Content*

Boolean algebra, combinational logic, logical circuits, minimization techniques, threshold logic. Data representation, binary arithmetic, codes, error checking and correcting. Sequential logic, flip-flops, state diagrams, state reduction, races and hazards. Logic subsystems: registers, adders, counters, converters, coders, etc. Basic architecture of digital computers.

Lectures will be supplemented by practical assignments on logic trainers and some tutorial sessions.



*Text*

| | |
|---|---|
| Nagle, Carroll & Irwin | *An Introduction to Computer Logic* (Prentice-Hall) |

**660111 CS — Programming and Algorithms** — D. W. E. Blatt

| | |
|---|---|
| *Assumed Standard of Attainment* | Mathematics I |
| *Hours* | 1 lecture hour per week and 1 tutorial hour per fortnight |
| *Examination* | One 2-hour paper |

*Content*

Systematic programming and modular design. An introduction to Pascal. Overview and comparison of several high level languages, including BASIC, FORTRAN, ALGOL 60, PL/I and COBOL.

The course will be run in parallel with Computer Science II, topic SP, with additional reading and assignment work required on selected topics from decision tables, random numbers, simulation and use of some of the other high level languages discussed in lectures.

*Text*

| | |
|---|---|
| Grogono, P. | *Programming in PASCAL* 2nd edn (Addison-Wesley 1979) |

*References*

| | |
|---|---|
| Day, A. C. | *Fortran Techniques: with Special Reference to Non-numerical Applications* (Cambridge 1972) |
| Guttmann, A. J. | *Programming and Algorithms* (Heinemann 1977) |
| Jensen, K. & Wirth, N. | *PASCAL User Manual and Report* 2nd edn (Springer-Verlag 1978) |
| Kernighan, B. W. & Plaugher, P. J. | *The Elements of Programming Style* (McGraw-Hill 1974) |
| Kernighan, B. W. & Plaugher, P. J. | *Software Tools* (Addison-Wesley 1976) |
| Knuth, D. | *The Art of Computer Programming* Vols. I — Fundamental Algorithms 2nd edn (1973), II — Semi-numerical Algorithms (1969), III — Sorting & Searching (1973) (Addison-Wesley) |
| Yourdon, E. | *Techniques of Program Structure and Design* (Prentice-Hall 1975) |

**660112 CS — Data Structures and Programming** — P. Moylan

| | |
|---|---|
| *Corequisite* | CS — Programming & Algorithms |
| *Hours* | 1 lecture hour & 1 tutorial hour per fortnight throughout the year |
| *Examination* | One 2-hour paper |

*Content*

Introduction to structuring of information. Data structures: lists, trees, queues, deques, stacks. Implementation methods. Storage allocation. Scatter storage and hash addressing. Elementary string processing and list processing. Searching and sorting algorithms.

The course will be run in parallel with Computer Science II, topic SI, with additional reading and assignment work required on selected topics from topological sorting, manipulation of algebraic formulae, symbolic differentiation and subroutine linkage and loading.

*Text*

| | |
|---|---|
| Tenenbaum, A. M. & Augenstein, M. J. | *Data Structures Using Pascal* (Prentice-Hall 1981) |

*References*

| | |
|---|---|
| Berztiss, A. T. | *Data Structures: Theory and Practice* 2nd edn (Academic 1975) |

| | |
|---|---|
| Day, A. C. | *Fortran Techniques: with Special Reference to Non-numerical Applications* (Cambridge U.P. 1972) |
| Galler, B. A. & Perlis, A. J. | *A View of Programming Languages* (Addison-Wesley 1970) |
| Gear, W. | *Computer Organization and Programming* (McGraw-Hill 1969) |
| Knuth, D. E. | *The Art of Computer Programming* Vols. I — Fundamental Algorithms 2nd edn (1973), II — Semi-numerical Algorithms (1969), III — Sorting & Searching (1973) (Addison-Wesley) |
| McCameron, F. A. | *COBOL Logic and Programming* (Irwin-Dorsey 1974) |
| Page, E. S. & Wilson, L. B. | *Information Representation and Manipulation in a Computer* 2nd edn (Cambridge U.P. 1978) |
| Sammet, J. E. | *Programming Languages: History and Fundamentals* (Prentice-Hall 1969) |


**660113 CS — Numerical Analysis** — R. J. Vaughan

| | |
|---|---|
| *Assumed Standard of Attainment* | Mathematics I |
| *Hours* | 1 lecture hour per week & 1 tutorial hour per fortnight |
| *Examination* | One 2-hour paper |

*Content*

The course will be run in parallel with Mathematics II, Topic F, with additional reading and assignments.

*Texts and References*

See Topic F page 40.

**410127 Systems Analysis**

| | |
|---|---|
| *Assumed Standard of Attainment* | Nil |
| *Hours* | 2 lecture hours per week for the first half year & associated practical work |
| *Examination* | An examination at mid-year |

*Content*

This course is concerned with the early activities carried out in the development of computer-based information systems.

Topics covered include, the role of systems in modern business; the profession of systems analysis and design; management of the life cycle of a business information system; the tools of the systems analyst; the study phase, its associated documentation and its relationship to design, development and implementation. Students are also introduced to the concepts of structured analysis.

*Texts*


| | |
|---|---|
| Gore, M. & Stubbe, J. | *Elements of Systems Analysis* (W. C. Brown) |
| Gore, M. & Stubbe, J. | *Elements of Systems Analysis Workbook* (William C. Brown) |
| Gane, C. & Sarson, T. | *Structured Systems Analysis: Tools and Techniques* (Prentice-Hall) |


*References*


| | |
|---|---|
| Davis, W. | *Information Processing Systems* (Addison-Wesley) |
| Davis, W. | *Information Processing Systems — Student Workbook* (Addison-Wesley) |
| Gildersleeve, T. | *Successful Data Processing Systems Analysis* (Prentice-Hall) |
| Semprevivo, P. C. | *Systems Analysis: Definition, Process and Design* (S.R.A.) |






**Offered by the Department of Commerce**

**413611 Information Systems**

| | |
|---|---|
| *Assumed Standard of Attainment* | Commercial Electronic Data Processing |
| *Hours* | 2 lecture hours per week, 1 tutorial/group meeting hour per week |
| *Examination* | Progressive assessment/group assignments<br>One 2-hour paper |

*Content*

COBOL programming: a general consideration of information systems: a particular consideration of compiter associated business systems. Subject matter is aimed towards students who will be undertaking business careers. Topics include: data v. information; people and systems; the industrial or computer revolution; data base concepts; problem solving. Students will correct, deburg, rewrite and write several programs using COBOL.

*Texts*


| | |
|---|---|
| Burch, J. G. J., Strater, F. R. Jr & Grudnitski, G. | *Information Systems: Theory and Practice* 2nd edn (Wiley) |
| Digital Equipment | *VAX-11 COBOL Language Reference Manual* |


*References*


| | |
|---|---|
| Dock, V. T. & Essick, E. | *Principles of Business Data Processing* (Science Research Associates) |
| Murach, M. | *Business Data Processing with COBOL* (Science Research Associates) |
| Hartman, W., Matthes, H. & Proeme, A. | *Information Systems Handbook (ARDI)* (Kluwer-Harrap) |
| International Labour Office | *Introduction to Work Study* |
| Johnson, R. A. et al. | *The Theory and Management of Systems* (McGraw-Hill) |
| Knight, K. E. & McDaniel, R. R. | *Organisations: An Information Systems Perspective* (Wadsworth) |
| Schoderbeck, P. P. | *Management Systems* (Wiley) |
| Senn, J. A. | *Information Systems in Management* (Wadsworth) |
| Sordillo, D. A. | *The Programmers ANSI COBOL Reference Manual* (Prentice-Hall) |
| Stern, Nancy | *Flowcharting: A tool for understanding computer logic* (Wiley) |
| Jeffrey, D., Ross & Dale, B. | *Computer Based Business Systems: Text and Cases* (Prentice-Hall) |


**412601 Quantitative Business Analysis II**

| | |
|---|---|
| *Assumed Standard of Attainment* | Introductory Quantitative Methods |
| *Hours* | 2 lecture hours per week |
| *Examination* | One 2-hour paper; progressive assessment & project |

*Content*

Quantitative methodology; BASIC review; mathematics review; problem-solving in business and industry; decision theory; applications of statistics; CPM/PERT; inventory modelling; linear programming in practice; game theory; Markov analysis; queueing theory; dynamic programming; business forecasting; elements of simulation; quantitative analysis projects.

*Texts*

| | |
|---|---|
| Gallagher, A. & Watson, J. | *Quantitative Methods for Business Decisions* |
| Starr, M. K. & Stein, I. | *The Practice of Management Science* (Prentice-Hall) |

**410128 Systems Design**

| | |
|---|---|
| *Assumed Standard of Attainment* | CS — Commercial Programming, Systems Analysis |
| *Hours* | 2 lecture hours per week for the second half year & associated practical work |
| *Examination* | An examination at end of year |

*Content*

This subject is a development of Systems Analysis and includes: data transmission; real time systems; information retrieval; file processing form design; management and the computer; file design; systems design and determination; operating systems; multi-programming.

*Texts*, *References* — As for Systems Analysis

**Offered by Department of Electrical Engineering**

**533213 EE341 Automatic Control** — see page 83.

**533116 EE345 Digital Signal Processing**

| | |
|---|---|
| *Assumed Standard of Attainment* | EE341 or ME361 Automatic Control |
| *Hours* | 3 hours of lectures & tutorials per week for second half year |
| *Examination* | Progressive assessment & final examination |

*Content*

Z-transforms; realization of discrete time systems, steady state frequency response. Approximations and filter design. Classical frequency transformations, Butterworth and Chebyshev. Recursive design. Finite Impulse Response Filters, Classical Window design. Discrete Fourier Transforms. The Fast Fourier Transform Algorithm.

Discrete Random Signals, Power Spectrum Estimation; Application of Fast Fourier Transforms to Covariance and Spectrum estimation.

The course consists mainly of lectures which will be supplemented by tutorial sessions.

*Text*

| | |
|---|---|
| Stanley, W. D. | *Digital Signal Processing* (Reston 1975) |

*References*

| | |
|---|---|
| Gold, B. & Rader, C. | *Digital Signal Processing* (McGraw-Hill 1969) |
| Kuo, B. C. | *Discrete-Data Control Systems* (Prentice-Hall 1970) |
| Oppenheim, A. V. & Schafer, R. W. | *Digital Signal Processing* (Prentice-Hall 1975) |

**533115 EE325 Introduction to Digital Technology** — A. Cantoni

| | |
|---|---|
| *Assumed Standard of Attainment* | EE264 Introduction to Computer Architecture & Assembly Language and EE362 Switching Theory & Logical Design |
| *Hours* | 3 hours per week for second semester |
| *Examination* | Progressive assessment & final examination |

*Content*

Logic families: static and transient characteristics, interfacing, limitations and applications.



Digital System Interconnection: bus system, single and differential transmission, open collector, trislate, transient and static characteristics, bus control techniques.

Memory Technology.

Random Logic techniques: pipelining, ROM, PLA, encoder and multiplexer based design.

Programmed Logic: Microprogrammed and microprocessor based design, memory and I/O addressing.

Lectures will be supplemented by laboratory sessions on a microprocessor system.

| | |
|---|---|
| *Text* | Nil |

**534134 EE447 Digital Communications** — J. B. Moore

| | |
|---|---|
| *Assumed Standard of Attainment* | EE344 Communications |
| *Hours* | 3 hours of lectures & tutorials per week for first half year |
| *Examination* | Progressive assessment & final examination |

*Content*

Pulse modulation schemes, including pulse code modulation, multi-plexing, matched filters.

The course consists mainly of lectures supplemented by tutorial sessions.

*Text*

| | |
|---|---|
| Gregg, W. D. | *Analog and Digital Communications: Concepts, Systems, Applications and Services* (Wiley) |

*References*

| | |
|---|---|
| Lucky, R. W. et al. | *Principles of Data Communication* (McGraw-Hill) |
| Wozencraft, J. M. | *The Principles of Communication Engineering* (Wiley) |

**534124 EE463 Computer Operating Systems** — A. Cantoni

| | |
|---|---|
| *Assumed Standard of Attainment* | EE264 Introduction to Computer Architecture & Assembly Language |
| *Hours* | 3 hours per week for the second half year |
| *Examination* | Progressive assessment & final examination |

*Content*

Views of an operating system. Multiprogramming, interacting concurrent processes, process control primitives. Processor management, memory management, name management. Protection.

The course consists mainly of lectures supplemented by tutorial sessions.

*Text*

| | |
|---|---|
| Lister, A. M. | *Fundamentals of Operating Systems* 2nd edn (Macmillan 1979) |

*References*

| | |
|---|---|
| Coffman, E. G. & Denning, P. J. | *Operating Systems Theory* (Prentice-Hall) |
| Hansen, P. B. | *Operating Systems Principles* (Prentice-Hall) |
| Madnick, S. E. & Donovan, J. J. | *Operating Systems* (McGraw-Hill) |

**534143 EE464 Compiler Construction** — R. J. Evans

| | |
|---|---|
| *Assumed Standard of Attainment* | EE264 Introduction to Computer Architecture & Assembly Language |
| *Hours* | 3 hours per week for the first half year |
| *Examination* | Progressive assessment & final examination |

*Content*
The design of assemblers. Introduction to the theory of grammars, parsing techniques, construction of compilers, object code generation. Construction of interpreters.

The course consists mainly of lectures and assignments on computer.

*Text*

Aho, A. V. & Ullman, J. D. — *Principles of Compiler Design* (Addison-Wesley)

*References*

Aho, A. V. & Ullman, J. D. — *The Theory of Parsing, Translation and Compiling* Vol. 2 (Prentice-Hall)

Donovan, J. J. — *Systems Programming* (McGraw-Hill)

Further references will be given in class.

**534145 EE462 Topics in Switching Theory** — Not offered in 1982

*Assumed Standard of Attainment*: EE362 Switching Theory & Logical Design

*Hours*: 3 hours per week for the first half year

*Content*
Complete set of logic primitives, strong and weak complete sets. Post's theorem. Equivalence classes of functions. Decomposition Cellular realization of combinational and sequential logic functions. Universal Logic Modules. Finite and infinite cellular arrays and their testing. Programmable cellular logic.

### Offered by Department of Mathematics

**660127 CS— Theory of Computing** — Mathematics III Topic TC, see page 50

**660128 CS— Mathematical Principles of Numerical Analysis** — Mathematics III Topic Z, see page 52

**660135 CS— Programming Languages & Systems** — Mathematics III Topic PL, see page 47

**664403 CS— Concurrent Programming Techniques** — Mathematics IV, see page 55

**660133 CS— High Level Software Development** — Mathematics IV, see page 61

### Offered by Department of Mechanical Engineering

**540126 ME505 Systems Analysis, Organisation & Control** — see page 92

**544427 ME404 Mathematical Programming I** — see page 93

**540132 ME581 Mathematical Programming II**

*Assumed Standard of Attainment*: ME404 or equivalent

*Content*
An introduction to non-linear optimization problems. Dynamic programming and its application to a range of resource allocation, production planning and inventory control problems. Linear programming problems in integers; introduction to branch-and-bound methods and implicit enumeration algorithms for problems in binary variables.

*Texts*

Nemhauser, G. L. — *Introduction to Dynamic Programming* (Wiley 1966)

Garfinkel, R. S. & Nemhauser, G. L. — *Integer Programming* (Wiley 1972)





Listed below are a number of subjects which the Board regards as suitable for Group B. This list is not, however, intended to be exhaustive and other subjects will be considered.

### Offered by Department of Civil Engineering

**520137 CE510 Elastic Continua** — For details consult the Engineering Faculty Handbook

### Offered by Department of Commerce

**413612 Theories of Organisation**

*Assumed Standard of Attainment*: Organisational Behaviour

*Hours*: 2 lecture hours per week

*Examination*: Two 3-hour papers

*Content*
The influence of politics, power and conflict: topics include organisations and the rationalisation of work; organisational structures; bureaucracies as working communities; the scientific management movement; Mayo and the Hawthorne experiments; Kurt Lewin and field theory; group membership and intergroup conflict; search for principles of management; worker participation models; organisational development; and propositions of organisational behaviour.

*Texts*: To be advised

*References*

Argyle, M. — *The Psychology of Interpersonal Behaviour* (Penguin)

Albrow, M. — *Bureaucracy* (Macmillan)

Dunphy, D. C. — *Organizational Change by Choice* (McGraw-Hill 1981)

Huse, E. F. — *Organisation Development and Change* 2nd edn (West Publishing 1980)

Kast, F. & Rosenzweig, J. E. — *Organisations and Management: A Systems Approach* (McGraw-Hill)

Katz, D. & Kahn, R. L. — *The Social Psychology of Organisations* (Wiley)

Kerr, C. D. et al. — *Industrialism and Industrial Man* (Penguin)

Klein, L. — *New Forms of Work Organisations* (Tavistock)

March, J. G. & Simon, H. A. — *Organisations* (Wiley)

Margulies, N. & Raid, A. P. — *Organisation Development: Values, Process and Technology* (McGraw-Hill)

Osborn, R. et al. — *Organisation Theory: An Integrated Approach* (Wiley 1980)

Silverman, D. — *The Theory of Organisations* (Heinemann)

Woodward, J. — *Industrial Organisation: Theory and Practice* (Oxford U.P.)

### Offered by Department of Electrical Engineering

**533107 EE323 Linear Electronics I**

**533108 EE324L Electronics Laboratory I**

**533110 EE342 Linear System Theory** — see page 84

**533113 EE344 Communications** — see page 84

**534109 EE421 Electronic Design A I**

**534110 EE422 Electronic Design B I**

**534140 EE442 Nonlinear Optimal Control** — not offered in 1982

**534132 EE443 Optimization Techniques** — not offered in 1982

For details consult the Engineering Faculty Handbook.

Offered by Department of Mathematics

660136 CS— Mathematical Logic and Set Theory — See Mathematics III, Topic O page 46
660129 CS— Theory of Statistics — See Mathematics III, Topic R page 48
660119 CS— Random and Restricted Walks — not offered in 1982
660120 CS— Signal Detection — See Mathematics IV, page 62
660122 CS— Combinatorial Designs — See Mathematics IV, page 67
660123 CS— Combinatorics — See Mathematics IV, page 64
660137 CS— Graph Theory and Applications — See Mathematics IV, page 67

Offered by Department of Mechanical Engineering

544418 ME449 Reliability Analysis for Mechanical Systems — see page 90
544841 ME487 Operations Research — Deterministic Models — see page 93
544842 ME488 Operations Research — Probabilistic Models — see page 93
540137 ME503 Design of Experiments for Engineering Research[1]

Offered by Department of Metallurgy

113393 Met312 Modelling and Control of Metallurgical Processes[1]

1 For details consult the Engineering Faculty Handbook.

Offered by Department of Physics

742201 CS — Instrumentation Techniques — not offered in 1982

*Assumed Standard of Attainment* Physics IA or IB

*Hours* 1 hour per week & a 12-hour project

*Examination* Project assessment & one 2-hour paper

*Content*
From the subject Electronics and Instrumentation II:
Specialist Intrumentation — 8 lectures
Instrumentation Systems — 8 lectures
Measurement Devices — 14 lectures

*Text*
Malmstadt, H. V. et al. *Instrumentation for Scientists Series* (Vols 1-4) Text with Experiments or Text only or combined volume (Benjamin 1973)

*DIPLOMA IN MEDICAL STATISTICS*

The requirements are set out on page

*Course Content*

**Subjects offered by the Faculty of Medicine**
MS—Seminar of Population Research Group
MS—Scientific Method and Critical Thinking
MS—Epidemiology and Study Design

**Subjects offered by the Department of Mathematics**
MS—Theory of Statistics — see page 48
MS—Regression, Design and Analysis of Experiments — see page 50
MS—Demography and Survival Analysis — see Mathematical Demography and Survival Models — page 59



MS—Generalised Linear Statistical Modelling — see page 57
CS—Programming and Algorithms — see page 101
CS—Data Structures and Programming — see page 101
MS—Survey Sampling Methods — see Topic ST — Sampling Theory — page 49

RUSSIAN FOR THE SCIENTIST AND MATHEMATICIAN — Not offered in 1982

Formal enrolment in this course is not required.

*Prerequisites* None, although familiarity with a modern language would be of advantage

*Hours* Approximately 27 lecture hours

*Examination* None

*Content*
This is a voluntary course designed to give students and members of staff a working reading knowledge of scientific and technical Russian. Translation from Russian into English is costly, and only a very small proportion of the Soviet Union's technical literature is routinely translated into English; often translation of the abstract alone is sufficient to determine whether a complete translation is warranted. Emphasis throughout the course will be on translation from Russian into English, although both written and spoken Russian will necessarily be involved. The course should provide a good introduction for those seeking a somewhat more literary understanding of the language.

RESEARCH IN THE DEPARTMENT OF MATHEMATICS

*Algebra*
Associate Professor W. Brisley is working on some problems in group theory which arise from graph theory, and also on some applications of algebra to data-processing problems.

*Astrophysics*
Dr. Wood is investigating the structure and internal dynamics of the oblique rotator model of magnetic stars. The problem of magno-acoustic waves in the atmosphere of Ap stars is also being studied.

*Biomathematics*
Dr. W. Summerfield is currently studying fluid mechanical features of the cardiovascular circulatory system. He is interested in the mathematical modelling of all functions of the human body.

*Chemical Kinetics*
Dr. D. L. S. McElwain is working on the mathematical modelling of non-equilibrium phenomena in gases, using the Master Equation approach.

*Combinatorial Theory and Operations Research*
Dr. R. B. Eggleton is interested in all aspects of combinatorial mathematics, particularly graph theory.

Professor R. W. Robinson is applying combinatorics to the counting of various structures, such as graphs and search trees.

Dr. R. J. Vaughan is interested in the application of optimisation methods to industrial production problems.

Associate Professor W. D. Wallis is carrying out research on block designs and arrays and graph theory.

*Computer Science and Numerical Analysis*
Dr. D. W. E. Blatt is working on models of programme referencing behaviour and studying performance of memory management systems. He is also developing concurrent programming systems and techniques for writing software for multiprocessor systems. In addition, he is interested in analysis of algorithms and computational complexity, and the development of programming languages and systems.

Associate Professor A. J. Guttmann is interesting in methods of function approximation, particularly from the viewpoint of using a differential equation representation. He is also interested in the analysis of theoretical and experimental data.

Dr. W. Summerfield is working on ways of determining the "condition" of linear systems of equations. Further, he is interested in the solution by linear marching schema of ordinary differential equations, in particular "stiff" systems. He is also investigating the finite element method of solution for partial differential equations.

*Differential Geometry and Relativity*
Associate Professor P. Smrz is working on generalizations of Einstein's theory of relativity using modern differential geometry — in particular, the theory of Lie groups and fibre bundles.

*Dynamical Systems*
Dr. J. G. Couper is working on stable and generic properties of flows and diffeomorphisms.

*Environmental and Urban Studies*
Dr. R. W. Gibberd is studying the art of population projections and various models of urban structure and urban development.

Dr. R. J. Vaughan is investigating mathematical models in urban geography.

Associate Professor W. D. Wallis is working on mathematical models in urban geography and urban sociology.

*Fluid Mechanics*
Associate Professor A. J. Guttmann is studying the problem of extrapolating regular perturbation series in fluid mechanics.

Dr. W. T. F. Lau is concerned with viscous flow problems, particularly those involving free boundaries.

Dr. W. Summerfield is interested in all phenomena in which fluid dynamics plays a significant role; for example, ocean waves, turbulence, estuarien-dynamics, weather prediction, sailing vessels, surfing, animal propulsion.

*Functional Analysis*
Associate Professor J. R. Giles is carrying out research in the particular area of the geometry of Banach spaces, and interest there is focused on various smoothness and rotundity properties of the norm and their implications for the space. This work is being generalised to a study of differentiation of convex functions on Banach spaces. Particular attention is being given to characterising Banach spaces where the continuous convex functions have various differentiability properties.

Dr. V. Ficker and Mr. C. J. Ashman are working in measure theory, particularly in some problems of families of sets.

*History of Mathematics*
Mr. R. F. Berghout is pursuing research into the development of algebra, notably modern algebra, as well as the relations between this and classical occidental and oriental algebra.

Mr. Berghout is working on Greek algebra.



*Information Theory*
Professor R. G. Keats is continuing to work in co-operation with research scientists at the Defence Research Centre at Salisbury, S.A. Current work is concerned with processing clipped data from a number of receivers arrayed in various geometric patterns.

*Integral Geometry*
Dr. T. K. Sheng studies the powers of distances between random points in convex and non-convex regions in $\mathbb{R}_h$.

*Lexicostatistics*
Dr. A. J. Dobson studies the historical and geographical relationships between languages by statistical analysis of their vocabularies. Stochastic models of language evolution are developed.

*Mathematical Biology*
Dr. D. L. S. McElwain is developing mathematical models of biological systems including solid tumours, transporting epithelia and leukocyte chemotaxis.

*Mathematical Models of Tumour Growth*
Dr. D. L. S. McElwain is investigating models for the growth of solid isolated tumours.

*Medical Statistics and Epidemiology*
Dr. A. J. Dobson and Dr. R. W. Gibberd collaborate with the Faculty of Medicine to investigate various problems in epidemiology and biostatistics. Current research includes: regional variations in mortality and morbidity; age and sex-specific death rates from ischaemic heart disease in Australia; collection and analysis of data from the Hunter Valley Heart Attack Study; validation of routinely collected data on ischaemic heart disease; design and analysis for a survey of smoking habits of schoolchildren and the evaluation of an intervention programme; spatial behaviour of hospital patients in the Hunter Region.

*Number Theory*
Dr. R. B. Eggleton is interested in number theory, particularly in combinatorial aspects of the subject.

Dr. T. K. Sheng studies the application of dispersive and explosive linear operators, distribution of algebraic numbers in the complex plane, and functions defined on rational numbers. Lines determined by lattice points and application of the results obtained to statistical mechanics are studied. Convexity indices and their applications to transport networks, etc.

*Problems in Biostatistics*
Mathematical problems arising from analysis of epidemiological data are investigated theoretically. For example Mrs. D. O'Connell and Dr. A. J. Dobson are studying measures of agreement between judges.

*Statistical Mechanics*
Associate Professor C. A. Croxton is working on the statistical mechanics of liquids, polymers and liquid interfaces.

Associate Professor A. J. Guttmann is working on the theory of equilibrium critical phenomena. He is particularly interested in the analysis of power series expansions which are frequently used to study systems exhibiting phase transitions.

Associate Professor A. J. Guttmann and Dr. J. S. Reeve are using renormalisation group methods to study the critical behaviour of systems with free surfaces.

*Transportation Problems*

Dr. R. J. Vaughan is continuing his work on the application of mathematics to traffic engineering, traffic accidents and transportation planning.



## Computer Numbers of Bachelor of Mathematics Subjects

Computer Numbers must be shown on enrolment and course variation forms in the following manner:

Candidates wishing to enrol in any subjects not listed should consult the Faculty Secretary.

| *Computer Number* | *Subject Name* | *Computer Number* | *Names of Components* |
|---|---|---|---|
| | **Part I Subjects** | | |
| 411100 | Accounting I | | |
| 711100 | Biology I | | |
| 721100 | Chemistry I | | |
| 311400 | Classical Civilisation I | | |
| 261100 | Drama I | | |
| 421300 | Economics IA | | |
| 541100 | Engineering I (4 components) | 511108 | ChE141 Industrial Process Principles |
| | | 521101 | CE111 Statics |
| | | 531203 | EE131 Circuit Fundamentals |
| | | 541104 | ME111 Graphics and Engineering Drawing |
| | | 501101 | GE112 Introduction to Engineering Design |
| | | 541103 | ME131 Dynamics |
| | | 501102 | GE151 Introduction to Materials Science |
| 331100 | English I | | |
| 341200 | French IN | | |
| 341300 | French IS | | |
| 351100 | Geography I | | |
| 731100 | Geology I | | |
| 361500 | German IN | | |
| 361600 | German IS | | |
| 311100 | Greek I | | |
| 371100 | History I | | |
| 291100 | Japanese I | | |
| 311200 | Latin I | | |
| 431100 | Legal Studies I | | |
| 271100 | Linguistics I | | |
| 661100 | Mathematics I | | |
| 381100 | Philosophy I | 381111 | Introduction to Philosophical Problems |
| | | 381105 | Marxism & Liberalism |
| | | 381106 | Moral Problems |
| | | 381107 | Philosophy of Public Policy |
| | | 381112 | Psychoanalysis & Philosophy |
| | | 381109 | Philosophy of Religion |
| | | 381110 | Critical Reasoning |
| | | 381113 | Logic |
| 741200 | Physics IA | | |
| 741300 | Physics IB | | |
| 751100 | Psychology I | | |
| 311300 | Sanskrit I | | |
| 301100 | Sociology I | | |
| | **Part II Subjects** | | |
| 412700 | Accounting IIC | | |
| 712100 | Biology IIA | 712101 | Biochemistry & Molecular Genetics |
| | | 712102 | Cell Biology |

| *Computer Number* | *Subject Name* | *Computer Number* | *Names of Components* |
|---|---|---|---|
| 712200 | Biology IIB | 712201 | Comparative Structure & Function |
| | | 712202 | Animal Ecology & Population Genetics |
| 722200 | Chemistry IIA | | |
| 522700 | Civil Engineering IIM | 522102 | CE212 Mechanics of Solids I |
| | | 522202 | CE231 Fluid Mechanics I |
| | | 522111 | CE213 Mechanics of Solids II |
| | | 522204 | CE232 Fluid Mechanics II |
| | | 522112 | CE224 Civil Engineering Materials |
| 312500 | Classical Civilisation II | | |
| 662400 | Computer Science II | | |
| 422100 | Economics IIA | | |
| 422200 | Economics IIB (2 components) | 422206 | Comparative Economic Systems |
| | | 422201 | Industry Economics |
| | | 422202 | Labour Economics |
| | | 422107 | Money & Banking |
| | | 422207 | Economics and Politics |
| 322200 | Education II (2 components) | 322201 | Individual/Social Development |
| | | 322203 | Comparative Aspects of Education |
| | | 323104 | History of Australian Education |
| | | 322204 | Modern Educational Theories |
| 742200 | Electronics & Instrumentation II | | |
| 332100 | English IIA | | |
| 342100 | French IIA | | |
| 352100 | Geography IIA | | |
| 352200 | Geography IIB | | |
| 732200 | Geology IIA | | |
| 732300 | Geology IIB | | |
| 372100 | History IIA | | |
| 372200 | History IIB | | |
| 372300 | History IIC | | |
| 372500 | History IID | | |
| 372600 | History IIE | | |
| 372700 | History IIF (Not offered in 1982) | | |
| 292100 | Japanese IIA | | |
| 432200 | Legal Studies IIA | | |
| 662100 | Mathematics IIA | | |
| 662200 | Mathematics IIB | | |
| 662210 | Mathematics IIB Part 1 | | Arrange topics with Department |
| 662220 | Mathematics IIB Part 2 | | |
| 662300 | Mathematics IIC | | |
| 382100 | Philosophy IIA | 382117 | Advanced Traditional Logic |
| 382200 | Philosophy IIB | 382111 | Reason & Religion |
| | | 383102 | Early Greek Philosophy |
| | | 382121 | Ontology |
| | | 382113 | Epistemology |
| | | 382114 | Kant |
| | | 382122 | Existentialism |
| | | 382123 | Formal Logic |
| | | 382124 | Introduction to Rationality Theory |
| | | 382125 | Hegel's Phenomenology of Mind |
| | | 382126 | Feminism & Philosophy |
| | | 382127 | Political Concepts |



| *Computer Number* | *Subject Name* | *Computer Number* | *Names of Components* |
|---|---|---|---|
| 742100 | Physics II | | |
| 752100 | Psychology IIA | | |
| 752200 | Psychology IIB | | |
| 752300 | Psychology IIC | | |
| | **Part III Subjects** | | **Either** |
| 413900 | Accounting IIIC | 413100 | Accounting IIIA **or** |
| | | 413200 | Accounting IIIB and two Part III Maths topics |
| | | | or |
| | | 413200 | Accounting III Band |
| | | 413602 | Financial Management |
| 713200 | Biology IIIB | 713201 | Environmental Physiology |
| | | 713204 | Ecology & Quantitative Genetics |
| 523700 | Civil Engineering IIIM | 523102 | CE324 Soil Mechanics |
| | | 523109 | CE314 Structural Analysis I |
| | | 523306 | CE333 Fluid Mechanics III |
| | | 523307 | CE334 Fluid Mechanics IV |
| | | 523107 | CE351 Civil Engineering Systems I |
| 533900 | Communications & Automatic Control (4 components) | 533213 | EE341 Automatic Control |
| | | 533110 | EE342 Linear System Theory |
| | | 534132 | EE443 Optimization Techniques1 |
| | | 533113 | EE344 Communications |
| | | 534134 | EE447 Digital Communications |
| 663400 | Computer Science III | 534137 | Compiler Construction |
| | | 410129 | Commercial Programming and Systems Analysis |
| | | 534138 | Computer Operating Systems |
| | | 533902 | Switching Theory & Logical Design |
| | | 663406 | Mathematical Logic and Set Theory |
| | | 663402 | Mathematical Principles of Numerical Analysis |
| | | 663405 | Programming Languages & Systems |
| | | 663404 | Theory of Computing |
| | | 410128 | Systems Design |
| 533901 | Digital Computers & Automatic Control | 533213 | EE341 Automatic Control |
| | | 533110 | EE342 Linear System Theory |
| | | 532116 | EE264 Introduction to Computer Architecture & Assembly Language |
| | | 533222 | EE362 Switching Theory & Logic Design |
| 423800 | Economics IIIC (2 components including Econometrics I &/or Mathematical Economics) | 423208 | Econometrics I |
| | | 423204 | Mathematical Economics |
| | | 423113 | Development |
| | | 423102 | International Economics |
| | | 423103 | Public Economics |
| | | 423114 | Growth and Fluctuations |
| | | 423115 | Topics in International Economics |
| 733300 | Geology IIIC | | |

| *Computer Number* | *Subject Name* | *Computer Number* | *Names of Components* |
|---|---|---|---|
| 543500 | Industrial Engineering I (4 components) | 543501 | ME381 Methods Engineering |
| | | 543502 | ME383 Quality Engineering |
| | | 543503 | ME384 Design for Production |
| | | 544425 | ME419 Bulk Handling Systems Analysis & Design |
| | | 544418 | ME449 Reliability Analysis for Mechanical Systems |
| | | 544433 | ME482 Engineering Economics I |
| | | 544463 | ME483 Production Engineering |
| | | 544464 | Engineering Economics II |
| 663100 | Mathematics IIIA | | Arrange topics with Department |
| 663200 | Mathematics IIIB | | |
| 553900 | Mechanical Engineering IIIC (4 components — check subject description) | 543204 | ME361 Automatic Control |
| | | 544451 | ME401 Systems Analysis |
| | | 540126 | ME505 Systems Analysis, Organisation & Control |
| | | 544427 | ME404 Mathematical Programming I |
| | | 544419 | ME434 Advanced Kinematics & Dynamics of Machines |
| | | 544416 | ME448 An Introduction to Photomechanics |
| | | 544418 | ME449 Reliability Analysis for Mechanical Systems |
| | | 544841 | ME487 Operations Research — Deterministic Models |
| | | 544842 | ME488 Operations Research — Probabilistic Models |
| 743100 | Physics IIIA | | |
| 753300 | Psychology IIIC | | |
| 663300 | Statistics III | | |
| | **Part IV Subjects** | | |
| 664100 | Mathematics IV | | |
| 664500 | Mathematics/Geology IV | | |
| 664300 | Mathematics/Physics IV | | |
| 664200 | Mathematics/Psychology IV | | |

**Extraneous Subjects**

| *Computer Number* | *Subject Name* |
|---|---|
| 160406 | Mathematics Education II1 |
| 160407 | **Mathematics Education III1** |

## Diploma in Computer Science Course

| | |
|---|---|
| 410136 | CS—Commercial Programming |
| 532117 | CS—Introduction to Computer Architecture & Assembly Language |
| 533221 | CS—Switching Theory & Logical Design |
| 660111 | CS—Programming & Algorithms |
| 660112 | CS—Data Structures & Programming |
| 660113 | CS—Numerical Analysis |
| 410127 | Systems Analysis |
| 413611 | Information Systems |
| 412601 | Quantitative Business Analysis II |

1 Not offered in 1982.



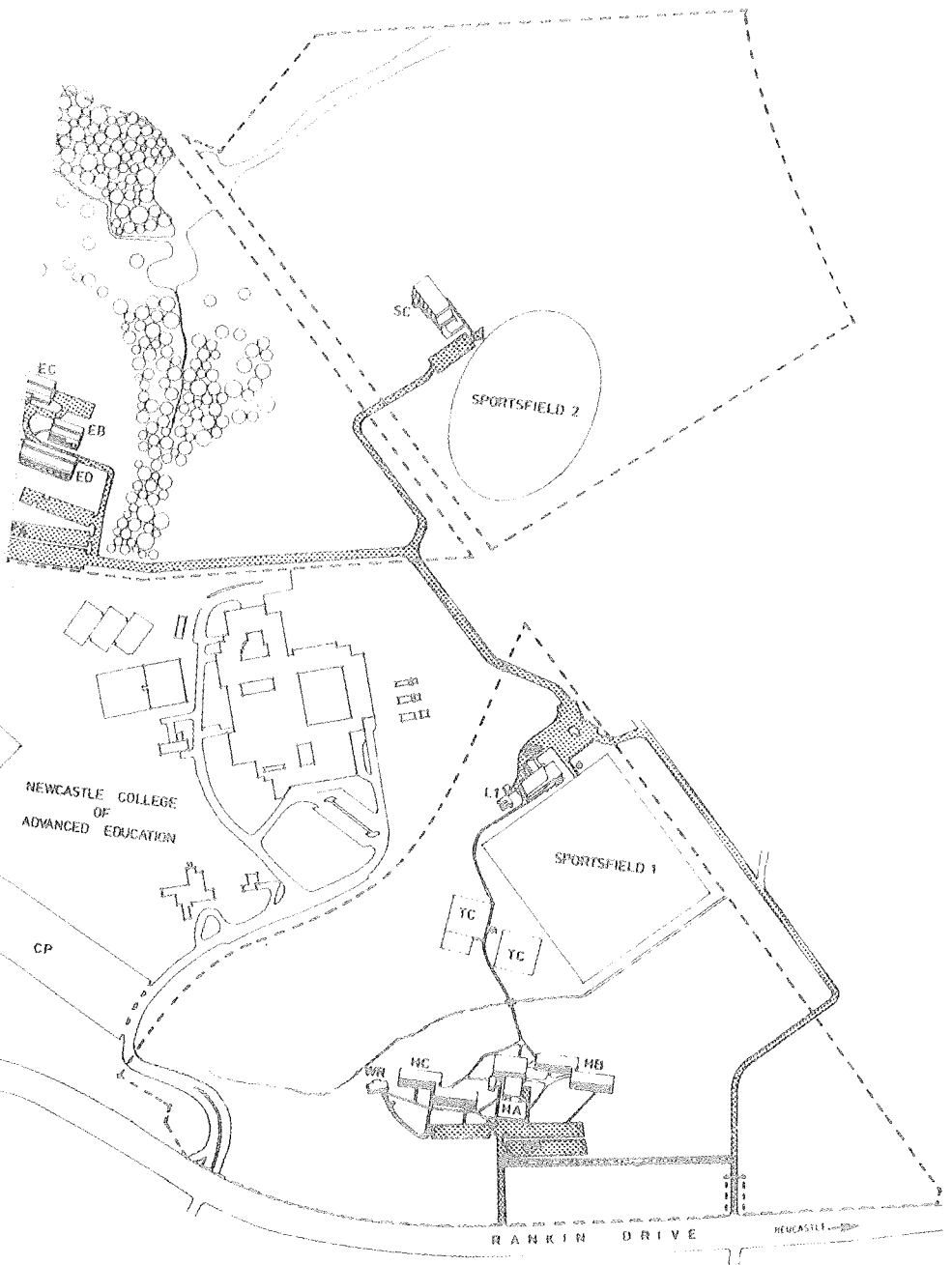
| *Computer Number* | *Subject Name* | *Computer Number* | *Names of Components* |
|---|---|---|---|
| 410128 | Systems Design | | |
| 533213 | EE341 Automatic Control | | |
| 533116 | EE345 Digital Signal Processing | | |
| 533115 | EE325 Introduction to Digital Technology | | |
| 534134 | EE447 Digital Communications | | |
| 534124 | EE463 Computer Operating Systems | | |
| 534143 | EE464 Compiler Construction | | |
| 534145 | EE462 Topics in Switching Theory1 | | |
| 660127 | CS—Theory of Computing | | |
| 660128 | CS—Mathematical Principles of Numerical Analysis | | |
| 660135 | CS—Programming Languages & Systems | | |
| 664403 | CS—Concurrent Programming Techniques | | |
| 660133 | CS—High Level Software Development | | |
| 540126 | ME505 Systems Analysis, Organisation & Control | | |
| 544427 | ME404 Mathematical Programming I | | |
| 540132 | ME581 Mathematical Programming II | | |
| 520137 | CE510 Elastic Continua | | |
| 413612 | Theories of Organisation | | |
| 533107 | EE323 Linear Electronics | | |
| 533108 | EE324L Electronics Laboratory | | |
| 533110 | EE342 Linear System Theory | | |
| 533113 | EE344 Communications | | |
| 534109 | EE421 Electronic Design A | | |
| 534110 | EE422 Electronic Design B | | |
| 534140 | EE442 Nonlinear Optimal Control1 | | |
| 534132 | EE443 Optimization Techniques1 | | |
| 660136 | CS—Mathematical Logic and Set Theory | | |
| 660129 | CS—Theory of Statistics | | |
| 660119 | CS—Random & Restricted Walks1 | | |
| 660120 | CS—Signal Detection | | |
| 660122 | CS—Combinatorial Designs | | |
| 660123 | CS—Combinatorics | | |
| 660137 | CS—Graph Theory and Applications | | |
| 544418 | ME449 Reliability Analysis for Mechanical Systems | | |
| 544841 | ME487 Operations Research — Deterministic Models | | |
| 544842 | ME488 Operations Research — Probabilistic Models | | |
| 540137 | ME503 Design of Experiments for Engineering Research | | |
| 113393 | Met312 Modelling and Control of Metallurgical Processes | | |
| 742201 | CS—Instrumentation Techniques1 | | |
| 660130 | Project - 2 units | | |

Not offered in 1982.

| *Computer Number* | *Subject Name* | *Computer Number* | *Names of Components* |
|---|---|---|---|

## Diploma in Medical Statistics Course

| | |
|---|---|
| 850001 | MS—Seminar of Population Research Group |
| 850002 | MS—Scientific Method and Critical Thinking |
| 850003 | MS—Epidemiology and Study Design |
| 666001 | MS—Theory of Statistics |
| 666002 | MS—Regression, design, and analysis of experiments |
| 666003 | MS—Demography and survival analysis |
| 666004 | MS—Generalised linear statistical modelling |
| 660111 | CS—Programming and Algorithms |
| 660112 | CS—Data Structures and Programming |
| 666005 | MS—Survey Sampling Methods |


SC
SPORTSFIELD 2
EC
EB
ED
NEWCASTLE COLLEGE
OF
ADVANCED EDUCATION
L1
SPORTSFIELD 1
TC
TC
CP
WR
NC
NB
NA
RANKIN DRIVE