THE UNIVERSITY OF NEWCASTLE
NEW SOUTH WALES

FACULTY OF MATHEMATICS
HANDBOOK 1983

THE UNIVERSITY OF NEWCASTLE
NEW SOUTH WALES 2308

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Preface

I am most happy to welcome to the Faculty of Mathematics all those students who are enrolling in the Faculty 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 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 am sure that all other members of the academic staff of the Faculty will also be keen to help you with such 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 17.

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 of what ought to happen”, according to one of the originators of the subject) is one example. Two others, in which the Faculty’s activity has expanded recently, 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 special skills will always be in demand. 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 is 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 was 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 your activities to meeting only with people whose courses are the same as your own.

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.
FACULTY OF MATHEMATICS

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

Faculty Secretary
Linda S. Harrigan, BA

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(Coordinator)

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W. T. F. Lau, ME(New South Wales), PhD(Sydney), MAIAA
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W. P. Wood, BSc, PhD(New South Wales), FRAS

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Computer Programmer
C. S. Hoskins, BMath, PhD
A. Nymeyer, BMath, DipCompSc

Departmental Office Staff
Ros Adams
Cath Claydon
Jan Garney
Julie H. Latimer

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" p124.

DEGREES AND POSTGRADUATE DIPLOMAS OFFERED IN THE FACULTY OF MATHEMATICS

(i) Bachelor of Mathematics (B.Math.)
   Bachelor of Mathematics with Computer Science
   Bachelor of Mathematics with Statistics

(ii) Master of Mathematics (M.Math.)
(iii) Doctor of Philosophy (Ph.D.)
(iv) Diploma in Computer Science (Dip. Comp. Sc.)
(v) Diploma in Mathematical Studies (Dip. Math. Stud.)
(vi) Diploma in Medical Statistics (Dip. Med. Stats.) (together with the Faculty of Medicine)

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 II A, Mathematics II C, Accounting II C.

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 I.
(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 II A, Mathematics II C and Psychology II C.
Year 3 Mathematics III A, Psychology III C.

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 II A, Mathematics II C and Civil Engineering IIM.
Year 3 Mathematics III A and Civil Engineering III M.
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.

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 the subjects offered in other degree courses. Subjects which have been approved in the past are listed below.

<table>
<thead>
<tr>
<th>Part I</th>
<th>Part II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accounting I</td>
<td>Biology IIA, IIB &amp; IIB</td>
</tr>
<tr>
<td>Biology I</td>
<td>Chemistry IIA</td>
</tr>
<tr>
<td>Chemistry I</td>
<td>Classical Civilisation II</td>
</tr>
<tr>
<td>Classical Civilisation I</td>
<td>Economics IIA &amp; IIB</td>
</tr>
<tr>
<td>Drama I</td>
<td>Education II</td>
</tr>
<tr>
<td>Economics IA</td>
<td>Electronics &amp; Instrumentation II</td>
</tr>
<tr>
<td>English I</td>
<td>English IIA</td>
</tr>
<tr>
<td>French IN or IS</td>
<td>French IIA, IIB &amp; IIB</td>
</tr>
<tr>
<td>Geography I</td>
<td>Geography IIA, IIB &amp; IIB</td>
</tr>
<tr>
<td>Philosophy I</td>
<td>Geology I</td>
</tr>
<tr>
<td>Physics IA or IB</td>
<td>History IIA</td>
</tr>
<tr>
<td>Psychology I</td>
<td>History IIA, IIB &amp; IIC</td>
</tr>
<tr>
<td>Sanskrit I</td>
<td>Japanese IIA</td>
</tr>
<tr>
<td>Sociology I</td>
<td>Law Studies I</td>
</tr>
</tbody>
</table>

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 or 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.

The Diploma in Education course offers the following Curriculum and Method units:

(a) Secondary
   - English
   - History
   - Social Sciences (Geography, Commerce)
   - Modern Languages (French, German)
   - Mathematics
   - Science
   - Candidates are strongly urged to opt for two units.

(b) 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 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 — (offered only if sufficient demand)

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 geometries; 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 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.

160407 Mathematics Education III — (offered only if sufficient demand)

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.

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 last 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 enrolls 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 degree 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.

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 II A, 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 IIC shall not be entitled to count either Psychology IIIA or Psychology IIIB;
(vi) a candidate counting Economics IIC shall not be entitled to count either Economics IIIA or Economics IIIB;
(vii) a candidate counting Geology IIC shall not be entitled to count 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, 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 IIC shall not be entitled to count either Psychology IIIA or Psychology IIIB;
(v) a candidate counting Economics IIC shall not be entitled to count either Economics IIIA or Economics IIIB;
(vi) a candidate counting Geology IIC 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 or 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 completed 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 completed 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 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
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 IIB, Mathematics IIIC, 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.

<table>
<thead>
<tr>
<th>SCHEDULE A</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mathematics Subjects</strong></td>
</tr>
<tr>
<td><strong>Part I</strong></td>
</tr>
<tr>
<td>Mathematics I</td>
</tr>
<tr>
<td><strong>Part II</strong></td>
</tr>
<tr>
<td>Mathematics IIA</td>
</tr>
<tr>
<td>Mathematics IIB</td>
</tr>
<tr>
<td>Mathematics IIC</td>
</tr>
<tr>
<td><strong>Part III</strong></td>
</tr>
<tr>
<td>Mathematics IIIA</td>
</tr>
<tr>
<td>Mathematics IIIB</td>
</tr>
<tr>
<td>Mathematics IV</td>
</tr>
</tbody>
</table>

**Prerequisites** Mathematics I

The Dean may permit a candidate to take this subject in two parts, each of three terms duration

**Pre-requisite** Mathematics I

**Pre-requisite** Mathematics IIA

**Pre-requisite** Mathematics IIIC

It is assumed that students have studied Higher School Certificate Mathematics at the two-unit level or higher

**Remarks including Prerequisites and Corequisites**

<table>
<thead>
<tr>
<th><strong>Computer Science Subjects</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Part II</strong></td>
</tr>
<tr>
<td>Computer Science IIA</td>
</tr>
<tr>
<td><strong>Part III</strong></td>
</tr>
<tr>
<td>Computer Science III</td>
</tr>
<tr>
<td><strong>Statistics Subject</strong></td>
</tr>
<tr>
<td>Mathematics IIA</td>
</tr>
</tbody>
</table>

**Prerequisites** Mathematics IIA & Mathematics IIB, Computer Science III or Statistics III

**SCHEDULE B**

**Subjects With a Substantial Mathematical Content**

<table>
<thead>
<tr>
<th><strong>Part I</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering I</td>
</tr>
</tbody>
</table>

It is assumed that students have studied Higher School Certificate Mathematics at the two-unit level or higher with either Multistrand Science or Mathematics at the two-unit level or Physics at the two-unit level and Chemistry at the two-unit level

<table>
<thead>
<tr>
<th><strong>Part II</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Accounting IIC</td>
</tr>
<tr>
<td>Civil Engineering IIM</td>
</tr>
<tr>
<td>Psychology IIC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Part III</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics IIA</td>
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<tr>
<td>Mathematics IIB</td>
</tr>
<tr>
<td>Mathematics IIC</td>
</tr>
<tr>
<td><strong>Part IV</strong></td>
</tr>
<tr>
<td>Mathematics IIA</td>
</tr>
<tr>
<td>Mathematics IIB</td>
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<tr>
<td>Mathematics IIC</td>
</tr>
<tr>
<td><strong>Psychology IIIC</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>SCHEDULE C</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Combined Honours Subjects</strong></td>
</tr>
<tr>
<td>Mathematics/Geology IV</td>
</tr>
<tr>
<td>Mathematics/Physics IV</td>
</tr>
<tr>
<td>Mathematics/Psychology IV</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>NOTES ON COMBINED DEGREE COURSES</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ARTS/MATHEMATICS</strong></td>
</tr>
</tbody>
</table>
| 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 II,
Mathematics IIC, Mathematics IIB, 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 IIA plus two other subjects which must include at least one Part III subject,
Year IV either Mathematics IIB, 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 IIB and either Mathematics IIB, 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
Introduction 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 IIB, Computer Science III, Statistics III or 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 degree course should contain Mathematics I, Mathematics IIA, Mathematics IIC, Mathematics IIB and one of Mathematics IIB, 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
Introduction 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 IIB, 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 IIB, 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 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 Processes & Equipment
ChE152 Industrial Process Design I
GE151 Introduction to Materials Science
Chemistry I
Mathematics I
Physics I
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
Year V  ChE462 Environmental Control
ChE471 Industrial Safety
ChE471 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
- GE131 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
  - CE223 Engineering Geology
  - GE204 Engineering Computations I
  - GE205 Engineering Computations II
  - ME223 Engineering Technology

**Year III**
- Mathematics IIB
  - 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 IIC
  - CE314 Structural Analysis I
  - CE315 Structural Design I
  - EE211 Energy Conversion
  - EE221 Semiconductor Devices
  - EE232 Electrical Circuits
  - EE262 Systematic Programming
  - Mathematics IIA
  - Mathematics IIB
  - Mathematics IIC

**Year V**
- Mathematics IIB 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 courses involving the Computer Engineering specialty and consists of the following subjects:
  - CE111 Statics
  - EE131 Circuit Fundamentals
  - CE112 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

(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
- EE271 Electromagnetics & Quantum Mechanics

**Year III**
- Mathematics IIB 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 I
- EE324 Linear Electronics II
- EE325 Introduction to Digital Technology
- EE333 Advanced Circuit Analysis
- EE341 Automatic Control
- EE344 Communications
- EE345 Digital Switching Proc.
- EE350 Seminar
- 4 Units of electives

- 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 Seminars
- 4 Units from List I
- 1 Unit or Elective

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

Year I
- Mathematics I
- Physics I
- Chemistry I
- 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
- ME212 Engineering Design I
- ME232 Dynamics of Machines I
- ME242 Properties of Materials I
- ME251 Fluid Mechanics I
- ME271 Thermodynamics I

Year III
- Mathematics IIIA
- EE211 Energy Conversion
- ME204 Engineering Computations I
- ME205 Engineering Computations II
- ME212 Engineering Design I
- ME232 Dynamics of Machines I
- ME242 Properties of Materials II
- ME361 Automatic Control
- ME496 Project/Seminar
- 3 units Departmental Technical Electives
- ME485 Numerical Control & Computer Aided Manufacturing

Year IV
- Mathematics IIIB or 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
- 3 units Departmental Technical Electives
- ME481 Engineering Administration
- ME482 Engineering Economics I
- GE302 Technology & Human Values II
- ME485 Numerical Control & Computer Aided Manufacturing
- GE301 Technology & Human Values I
- GE302 Technology & Human Values II
- 3 units Departmental Technical Electives

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 IIA plus two other subjects which must include at least one Part III subject.

Year IV one of Mathematics IIB, Computer Science III, Statistics III or a Schedule II 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 IIA and one of Mathematics IIB, 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 I
Chemistry
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 Computation I
GE205 Engineering Computation II
Met214 Theory of Metallurgy Processes I
Met261 Extration Metallurgy
Met251 Metallography
Met241 Microplasticity
Met271 Fabrication Metallurgy
Met281 Electronic & Atomic Structure

Year III
Mathematics IIA
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
Metadata 392 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 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 reached 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 last Monday in first term;

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

(c) in the case of any other subject — the last 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

<table>
<thead>
<tr>
<th>Core Subjects</th>
<th>Department Offering Subject</th>
<th>Assumed Standard of Attainment</th>
<th>No. of Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS—Commercial Programming</td>
<td>Commerce</td>
<td>Mathematics I, Topic SC, or Commercial Electronic Data Processing</td>
<td>1</td>
</tr>
<tr>
<td>CS—Introduction to Computer Architecture &amp; Assembly Language</td>
<td>Electrical Engineering</td>
<td>Mathematics I or suitable alternative preparation</td>
<td>1</td>
</tr>
<tr>
<td>CS—Switching Theory &amp; Logical Design</td>
<td>Electrical Engineering</td>
<td>Mathematics I or suitable alternative preparation</td>
<td>1</td>
</tr>
<tr>
<td>CS—Programming &amp; Algorithms</td>
<td>Mathematics</td>
<td>Mathematics I or suitable alternative preparation</td>
<td>1</td>
</tr>
<tr>
<td>CS—Data Structures &amp; Programming</td>
<td>Mathematics</td>
<td>CS—Prog. &amp; Algor.</td>
<td>1</td>
</tr>
</tbody>
</table>

CS—Numerical Analysis Mathematics 1

Systems Analysis Mathematics 1 or suitable alternative preparation

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, Statistics and Computer Science 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 last Monday in First Term, in the case of a unit lasting only the first half-year,

* No more than 3 units at the Part II level may be counted.
the last Monday in Second Term, in the case of a unit lasting the whole year, the fourth Monday in Third Term, in the case of a unit lasting only the second half-year, withdrawn 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 or 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 or 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 last Monday in first term;
      (b) in the case of any subject offered in the second half of the academic year - the fourth Monday in third term;
      (c) in the case of any other subject - the last 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

<table>
<thead>
<tr>
<th>Subject</th>
<th>Offered by</th>
<th>No. of Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS—Seminar of Population Research Group</td>
<td>Faculty of Medicine</td>
<td>1</td>
</tr>
<tr>
<td>MS—Scientific Method and Critical Thinking Design</td>
<td>Faculty of Medicine</td>
<td>1</td>
</tr>
<tr>
<td>MS—Epidemiology and Study Design</td>
<td>Department of Mathematics, Statistics &amp; Computer Science</td>
<td>1</td>
</tr>
<tr>
<td>MS—Theory of Statistics</td>
<td>Department of Mathematics, Statistics &amp; Computer Science</td>
<td>1</td>
</tr>
<tr>
<td>MS—Regression, design, and analysis of experiments</td>
<td>Department of Mathematics, Statistics &amp; Computer Science</td>
<td>1</td>
</tr>
<tr>
<td>MS—Demography and survival analysis</td>
<td>Department of Mathematics, Statistics &amp; Computer Science</td>
<td>1</td>
</tr>
<tr>
<td>MS—Generalised linear statistical modelling</td>
<td>Department of Mathematics, Statistics &amp; Computer Science</td>
<td>1</td>
</tr>
<tr>
<td>CS—Programming and Algorithms</td>
<td>Department of Mathematics, Statistics &amp; Computer Science</td>
<td>1</td>
</tr>
<tr>
<td>CS—Data Structures and Programming</td>
<td>Department of Mathematics, Statistics &amp; Computer Science</td>
<td>1</td>
</tr>
<tr>
<td>MS—Survey Sampling Methods</td>
<td>Department of Mathematics, Statistics &amp; Computer Science</td>
<td>1</td>
</tr>
</tbody>
</table>
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 or 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 last Monday in first term;

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

(c) in the case of any other subject — the last 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 thesis 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
(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 certificates of the candidate's thesis 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 Master of Mathematics.

¹ At present there is no fee payable.

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 out 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 enrolls 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 — Department of Mathematics, Statistics and Computer Science

The Department 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 II, IIIA, IIIB, 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.)

Statistics III is a specified course, requiring previous topic selection in Mathematics II. The subjects Computer Science II and III are taught and examined jointly by the Department and the Departments of Electrical and Computer Engineering and Commerce. 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 his performance during the year will be ignored 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 included in determining his final result.

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

References

Apostol, T. Calculus Vol. 1 2nd edn (Blaisdell 1967)
Spivak, M. Calculus (Benjamin 1967)
Kolman, B. Elementary Linear Algebra (Wiley 1977)
Lipschutz, S. Linear Algebra (Schaum 1974)

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. Vector geometry in two and three dimensions. Vector spaces, basis and dimension, subspaces. Linear maps, matrix representation, rank and nullity. Eigenvectors and eigenvalues. Determinants. 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)
Lipshitz, S. Algebra for Scientists and Engineers (Wiley 1971)

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

Prerequisites Nil

Hours 1 lecture hour and ½ tutorial hour per week

Content


Text

Nil

References

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

Calculus (Topic CA) — G. W. Southern

Prerequisites Nil

Hours 1 lecture hour and ½ tutorial hour per week

Content


Text


Prerequisites
Nil

Hours
1 lecture hour and ½ tutorial hour per week

Content

Text
University of Newcastle Statistical Tables

References
Conte, S. D. & de Boor, C. A Programmed Text in Statistics Vols 1, 2, 3 (Chapman & Hall 1975)
Hoel, P. G. Elements of Statistical Inference (Allyn & Bacon 1981)
Huntsberger, O. V. & Billingsley, P. Problem Solving and Structured Programming in PASCAL (Addison-Wesley 1981)

PART II SUBJECTS

The Department 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 prerequisite 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 II subject in the Faculty of Mathematics). Students taking all three of the Part II subjects would study all of the topics listed below and perhaps an additional topic.

Summaries and booklists for these topics are given on page 42 et seq. of this handbook. The Department also offers (jointly with the Department of Electrical and Computer 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 38 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 IIA, Mathematics IIB, 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 prerequisite

<table>
<thead>
<tr>
<th>Topic</th>
<th>Corequisite or Prerequisite Topic</th>
<th>Part III Topic having this Part II Topic as prerequisite</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Mathematical Models</td>
<td>CO</td>
<td>—</td>
</tr>
<tr>
<td>B Complex Analysis</td>
<td>CO</td>
<td>M, N, P, PD, Q, QRS, TC, Y, Z</td>
</tr>
<tr>
<td>C Vector Calculus &amp; Differential Equations (Double topic)</td>
<td>—</td>
<td>P, T, X, Z, GT</td>
</tr>
<tr>
<td>D Linear Algebra</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>E Topic in Applied Mathematics e.g. Mechanics, Potential Theory and Fluid Dynamics</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>F Numerical Analysis &amp; Computing</td>
<td>—</td>
<td>TC</td>
</tr>
<tr>
<td>H Probability &amp; Statistics</td>
<td>CO</td>
<td>R, ST, U, Y</td>
</tr>
<tr>
<td>I Applied Probability</td>
<td>H</td>
<td>—</td>
</tr>
<tr>
<td>K Topic in Pure Mathematics e.g. Group Theory</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>L Analysis of Metric Spaces</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

The selection rules and definitions of the Part II subjects follow. Details of these topics are on page 42.

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 of Computer Science II, 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 II

**Prerequisite**
Mathematics I

**Pre- or Corequisite**
Mathematics II A

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

**Examination**
Each topic is examined separately

**Content**
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 II A 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 II A, II B, II C 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.

**COMPUTER SCIENCE SUBJECT**

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.

A statement concerning the relation between the Diploma in Computer Science and the undergraduate subjects can be found on page 8.

663400 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

Details of all the above Part II topics appear on page 48 et seq.

**PART III SUBJECTS**

The Department offers two Part III Mathematics subjects, each comprising four topics chosen from the list below. It also offers Part III subjects in Statistics and Computer Science.

Students wishing to proceed to Honours in Mathematics are required to take Mathematics III A and at least one of Mathematics III B, Computer Science III or Statistics III. Students wishing to proceed to Combined Honours are required to take Mathematics III A 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 I II A.

Passes in both Mathematics II A and II C are prerequisite for entry to all Part III subjects and Mathematics III A is pre- or corequisite for Mathematics III B. It will be assumed that students taking third-year topics in 1983 have already studied topics CO, D, K and L (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 III A 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 III A or Computer Science III, but not both.

Summaries of these topics, together with texts and references, appear on page 50 et seq. of this handbook.

**List of Topics for Part III Mathematics Subjects**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>FM</td>
<td>Foundations of Mathematics (not offered in 1983)</td>
</tr>
<tr>
<td>M</td>
<td>General Tensors and Relativity</td>
</tr>
<tr>
<td>N</td>
<td>Variational Methods and Integral Equations</td>
</tr>
<tr>
<td>O</td>
<td>Mathematical Logic and Set Theory</td>
</tr>
<tr>
<td>P</td>
<td>Ordinary Differential Equations</td>
</tr>
<tr>
<td>PD</td>
<td>Partial Differential Equations</td>
</tr>
<tr>
<td>PL</td>
<td>Programming Languages and Systems</td>
</tr>
<tr>
<td>Q</td>
<td>Fluid Mechanics</td>
</tr>
<tr>
<td>QRS</td>
<td>Quantum, Relativistic and Statistical Mechanics</td>
</tr>
<tr>
<td>R</td>
<td>Theory of Statistics</td>
</tr>
<tr>
<td>S</td>
<td>Geometry</td>
</tr>
<tr>
<td>SS</td>
<td>Survey Sampling Methods</td>
</tr>
<tr>
<td>T</td>
<td>Group Theory</td>
</tr>
<tr>
<td>TC</td>
<td>Theory of Computing</td>
</tr>
<tr>
<td>U</td>
<td>Regression, Design &amp; Analysis of Experiments</td>
</tr>
<tr>
<td>V</td>
<td>Measure Theory &amp; Integration</td>
</tr>
<tr>
<td>W</td>
<td>Functional Analysis</td>
</tr>
<tr>
<td>X</td>
<td>Rings &amp; Fields</td>
</tr>
<tr>
<td>Y</td>
<td>Theory of Probability</td>
</tr>
<tr>
<td>Z</td>
<td>Mathematical Principles of Numerical Analysis</td>
</tr>
<tr>
<td>GT</td>
<td>Applied Graph Theory</td>
</tr>
</tbody>
</table>

Some topics may be offered in alternate years, and, in particular, some may be available as Mathematics IV topics.
* Not offered in 1983 but will be offered in 1984.

The selection rules and definitions of the Part III subjects follow.
663100 Mathematics IIA

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, SS, 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 IIB

Prerequisite or Corequisite
Mathematics IIA

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 IIA and Mathematics IIB, a student must study eight topics from the above with due regard to the composition of Mathematics IIA 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, SS, Y.

663400 Computer Science III

Prerequisites
Computer Science II, Mathematics IIA and Mathematics IIC

Hours
See individual topics

Examination
See information given in description 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 (**0)
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 IIA including the topic or who are enrolled for Mathematics IIA 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 IV SUBJECT

664100 Mathematics IV

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

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 this Department, select up to 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 81.

**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. Work on this thesis normally starts early in February.

**Content**

A selection of at least eight Part IV topics. 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. Summaries of topics are on page 65, but the Department should be consulted for further details.

**NOTE:** A meeting will be held on the first Tuesday of first term in Room V107 at 1:00 p.m. to determine the timetable for Mathematics IV topics.

**THE FOLLOWING PAGES GIVE DETAILS OF THE TOPICS FOR THE PART II, III AND IV SUBJECTS OFFERED BY THE DEPARTMENT**

**PART II TOPICS**


**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**


Bender, E. A. An Introduction to Mathematical Modelling (Wiley 1978)


Dym, C. L. & Ivey, E. S. Principles of Mathematical Modelling (Academic 1980)

Haberman, R. Mathematical Models (Prentice-Hall 1977)

Kemeny, J. G. & Snell, J. L. Mathematics in Social Sciences (Blaisdell 1963)

Noble, B. Applications of Undergraduate Mathematics in Engineering (M.A.A./Collier-Macmillan 1967)

Smith, J. M. Mathematical Ideas in Biology (Cambridge 1971)

662102 Topic B — Complex Analysis — M. J. Hayes

**Prerequisite or Corequisite**

Topic CO

**Hours**

1 lecture hour per week and 1 tutorial hour per fortnight

**Examination**

One 2-hour paper

**Content**


**Text**


**References**


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


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**


Text
Lipschutz, S.  
Linear Algebra (Schuam 1974)

References
Anton, H.  
Elementary Linear Algebra 2nd edn (Wiley 1977)  
Linear Algebra and Geometry (Cambridge 1979)  
A Basis for Linear Algebra (Wiley 1973)
662204  Topic H — Probability & Statistics — C. J. Ashman

Prerequisite

Topic C0

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 \( \chi^2 \), \( t \), \( F \) and normal random variables to hypothesis testing.

Text

Hoel, P. G.

*Introduction to Mathematical Statistics* 4th edn (Wiley 1971)

References

Allendoerfer, C. B. & Oakley, C. O.

*Feller, W.*

*Preliminary Mathematics* 2nd edn (Wiley 1968)

*Hoel, P. G.*

*Introduction to Mathematical Statistics* 4th edn (Wiley 1971)

*Allendoerfer, C. B. & Oakley, C. O.*

*Feller, W.*

*Preliminary Mathematics* 2nd edn (Wiley 1968)

*Hoel, P. G.*

*Introduction to Mathematical Statistics* 4th edn (Wiley 1971)

*References*

Kemeny, J. G. & Snell, J. L.

*Finite Markov Chains* (Van Nostrand 1969)

Snell, J. L. & Thompson, G. L.

*Finite Mathematical Structures* (Prentice-Hall 1959)

662301  Topic I — Applied Probability — V. Ficker

Prerequisite

Topic H

Hours

1 lecture hour per week and 1 tutorial hour per fortnight

Examination

One 2-hour paper

Content


Text

Feller, W.*

*An Introduction to Probability Theory and its Applications* Vol. 1, 3rd edn (Wiley 1968)

*Hoel, P. G.*

*Introduction to Mathematical Statistics* 4th edn (Wiley 1971)

References

Kemeny, J. G. & Snell, J. L.

*Finite Markov Chains* (Van Nostrand 1969)

Snell, J. L. & Thompson, G. L.

*Finite Mathematical Structures* (Prentice-Hall 1959)
662304 Topic I — 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**

**References**
- Dieudonné, J. *Analysis of Metric Spaces* (University of Newcastle 1974)
- Graham, N. *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)

**COMPUTER SCIENCE II TOPICS**

662401 Topic I — 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, dequeus 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.

**References**
- Dieudonné, J. *Analysis of Metric Spaces* (University of Newcastle 1974)
- Graham, N. *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)

662402 Topic SP — Systematic Programming — D. W. E. Blatt

**Prerequisite**
Mathematics I

**Hours**
1 lecture hour per week 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**

**References**
Programming in PASCAL 2nd edn
(Addison-Wesley 1980)

Guttman, A. J.
Programming and Algorithms (Heinemann 1977)

Jensen, K. &

Wirth, N.
Foundations of Programming (Ellis Horwood 1980)

Wegner, P.
The Ada Programming Language (Prentice-Hall 1981)

Wirth, N.

Yourdon, E. J.
Techniques of Program Structure and Design (Prentice-Hall 1975)

Guttmann, A. J.
Programming Algorithms (Heinemann 1977)

Jensen, K. &

Moore, L.
Foundations of Programming (Ellis Horwood 1980)

Pyle, I. C.
The Ada Programming Language (Prentice-Hall 1981)

Wegner, P.
The Ada Programming Language (Prentice-Hall 1981)

Wirth, N.
Systematic Programming (Prentice-Hall 1973)

H. Stone,

Content
Instruction sets, pseudo ops, machine language programming, subroutines, co-routines,
Hardware components, processor structure, addressing modes. Assembly language.
Lectures will be supplemented with practical assignments using

References
Examination

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.

Texts
Eckhouse, R. H. &
Minicomputer Systems Organisation Programming and
Applications (PDP-11) 2nd edn (Prentice-Hall 1979)

Morris, L. R.

References
Chu, Y. H.
Computer Organization and Micro Programming
(Prentice-Hall 1972)

Donovan, J. J.
Logical Design of Digital Systems (Computer Science)

Friedman, A. D.
Introduction to Computer Organization and Data Structures (McGraw-Hill 1972)

Stone, H. S.

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

Prerequisite
Topic CO

Hours
2 lecture hours and 1 tutorial hour per week
for the 1st half year

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. &
The Classical Theory of Fields (Pergamon 1962)

Lifshitz, E. M.
Elements of Tensor Calculus (Methuen 1962)

Lichtenberowicz, A.
An Introduction to Tensor Analysis (Longman 1975)

Tyllesley, J. R.

Willmore, T. J.
An Introduction to Differential Geometry (Oxford 1972)
663102  Topic N — Variational Methods and Integral Equations — W. T. F. Lau

Prerequisite

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Content


Text

References

663103  Topic O — Mathematical Logic and Set Theory — W. Brisley

Prerequisite

Topics K & L

Hours

1 lecture hour per week and 1 tutorial hour per fortnight

Examination

One 2-hour paper

Content


Text

References

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

Prerequisite

Topics CO, D & L

Hours

1 lecture hour per week and 1 tutorial hour per fortnight

Examination

One 2-hour paper

Content


Text

References

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

References

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

Prerequisite

Knowledge of FORTRAN and PASCAL
Survey and detailed comparisons of the properties of representative languages of various
types with special consideration of some of LISP, SNOBOL, APL, Ada and C. 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
Barnes, J. G. P.
Concepts of Programming Languages
(Science Research Associates 1973)
Gimpel, J. F.
Algorithms in SNOBOL (Wiley 1976)
Griswold, R. E.
The SNOBOL Programming Language 2nd edn
(Prentice-Hall 1971)
Pyle, I. C.
The Ada Programming Language (Prentice-Hall 1981)

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
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)
References
Cox, D. R. & Hinkley, D. V. Theory of Statistics (Chapman & Hall)
Silvey, S. D. Statistical Inference (Chapman & Hall 1975)

663107  Topic S — Geometry — R. F. Berghout

Prerequisites  Nil

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

Examination  One 2-hour paper

Content

Text
Greenberg, M. J. Euclidean and non-Euclidean geometries 2nd edn (Freeman 1980)

References
Blumenthal, L. M. Studies in Geometry (Freeman 1970)
Coxeter, H. S. M. Introduction to Geometry (Wiley 1969)
Efimov, N. V. Higher Geometry (Mir 1980)
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)

663141  Topic SS — Survey Sampling Methods — R. W. Gibberd

Prerequisite  Topic H

Hours  2 lecture hours and 1 tutorial hour per week for 1st half year

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. Topics covered include: simple random sampling, ratio and regression estimators, stratified sampling and cluster sampling, and other relevant sections from the text. Some consideration of the practical problems will be obtained through the class projects.

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

References
Cochran, W. G. Sampling Techniques 3rd edn (Wiley 1977)
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 p³, pq or p², finite p-groups, Finite generated abelian groups. Free groups, homomorphisms of free groups, free abelian groups.

Texts
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 — A. J. Guttmann

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
Denning, P. J. Dennis, J. B. & Qualitz, J. E. Machines, Languages and Computation (Prentice-Hall 1978)
Garey, M. R. & Johnson, D. S. Computers and Intractability (Freeman 1979)
Hopcroft, J. E. & Ullman, J. D. Introduction to Automata Theory, Languages and Computation (Addison-Wesley 1979)

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

Prerequisite Topic H

Hours 2 lecture hours and 1 tutorial hour per week for 2nd half year

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. Polynomial 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) (2nd edn (Oliver & Boyd) 1966)
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 — Not offered in 1983

Prerequisite Topic L

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

Examination One 2-hour paper


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)
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 Nil

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

References
Banach, S. Théorie des Opérations Linéaires 2nd edn (Chelsea)
Giles, J. R. Analysis of Metric Spaces (University of Newcastle 1975)
Kreyszig, E. Introductory Functional Analysis with Applications (Wiley 1978)

Taylor, A. E. 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


**Text**

**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**

**References**

- Loève, M. *Probability Theory* (Van Nostrand 1960)

### 663207 Topic Z — Mathematical Principles of Numerical Analysis — A. J. Guttmann

**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**

**References**

- Atkinson, K. E. *An Introduction to Numerical Analysis* (Wiley 1978)

### 663134 Topic GT — Applied Graph Theory — Not offered in 1983

**Prerequisite**: Topic D

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

**Examination**: One 2-hour paper

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.
Combinatorial Theory: An Introduction (Charles Babbage Research Centre 1977)
Wallis, W. D.
Introduction to Graph Theory (Longman 1972)
Wilson, R. J.
Applications of Graph Theory (Academic 1979)

COMPUTER SCIENCE 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
4 lecture hours per week and associated practical work for the first half year
Examination
Examination at mid-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.
Feingold, C.

References
Chai, W. A. & Clifton, H. D.
Programming Standard COBOL (Academic)

Systems Analysis for Business Data Processing (Business Books)

Elementary Cobol Programming (McGraw-Hill)

Learning COBOL Fast (Reston)

Programming in Standard COBOL (S.R.A.)

Systems Design for Computer Applications (Wiley)

Programming Business Computers (Wiley)

Standard COBOL (S.R.A.)

Computers in Business (McGraw-Hill)

Computing with COBOL (Harper & Row)

Cobol Programming (Wiley)

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

References
Coffman, E. G. & Denning, P. J. Operating Systems Theory (Prentice-Hall)
Hansen, P. B. Operating Systems Principles (Prentice-Hall)

533902 Switching Theory & Logical Design — K. K. Saluja

Prerequisite
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)

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; multiprogramming.

Text
As for Systems Analysis

PART IV TOPICS

NOTE: A meeting will be held on the first Tuesday of first term in Room V107 at 1 p.m. to determine the timetable for Mathematics IV topics.

664179 History of Analysis to Around 1900 — R. F. Berghout

Prerequisite
Topic FM

Hours
About 27 lecture hours

Examination
One 2-hour paper

Content
A course of 26 lectures on the history of mathematics with emphasis on analysis. Other branches of mathematics will be referred to to put the analysis into context. Where feasible, use will be made of original material, in translation. The course will be assessed by essays and a final 2-hour examination.

Topics to be covered include: pre-Greek concepts of exactness and approximation; Greek concepts of continuity, irrationality, infinity, infinitesimal, magnitude, ratio, proportion and their treatment in Elements V, XII and the works of Archimedes; developments of number systems and their equivalents; scholastic mathematics; virtual motion; Renaissance quadrature/cubature by infinitesimals and by “geometry”; Cartesian geometry; 17th and 18th century calculus; rigorization of analysis in the 19th century with stress on the developments of number systems, continuity, function concept, differentiability, integrability.

Text
Nil

References
Lists will be presented during the course

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

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

References

Barnes, J. G. P.  
Programming in Ada (Addison-Wesley 1982)

Bowen, B. A. & Buhr, R. J. A.  
The Logical Design of Multiple Microprocessor Systems (Prentice-Hall 1980)

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Habermann, A. N.  
Introduction to Operating Systems Design (SRA 1976)

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

Pyle, I. C.  
The Ada Programming Language (Prentice-Hall 1981)

Satyanarayan, M.  
Multi-processors — A comparative Study (Prentice-Hall 1980)
The University of Newcastle Calendar consists of the following volumes:

Volume 1 — Legislation:
  Part 1 — The University of Newcastle Act,
  Part 2 — By-laws and Regulations,
  Part 3 — Bodies Established by Resolution of Council,
  Part 4 — Scholarships, Prizes and Financial Assistance.

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 1982.

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

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## I PRINCIPAL DATES 1983

### January
- **1 Saturday**  New Year's Day
- **3 Monday**  Public Holiday
- **7 Friday**  Last day for return of Re-Enrolment Forms — Continuing Students
- **17 Monday**  Deferred Examinations begin
- **28 Friday**  Deferred Examinations end
- **31 Monday**  Public Holiday

### February
- **7 Monday**  New students attend in person to enrol and pay charges
- **14 Monday**  Late enrolment session for new students
- **21 Monday**  First Term begins
- **25 Friday**  Last day for withdrawal without academic penalty from first half year subjects

### April
- **1 Friday**  Good Friday — Easter Recess commences
- **6 Wednesday**  Lectures resume
- **25 Monday**  Public Holiday — Anzac Day
- **26 Tuesday**  Last day for withdrawal without academic penalty from first half year subjects

### May
- **7 Saturday**  First Term ends
- **23 Monday**  Examinations begin
- **27 Friday**  Examinations end
- **30 Monday**  Second Term begins

### June
- **17 Friday**  Last day for return of Confirmation of Enrolment forms
- **13 Monday**  Public Holiday — Queen's Birthday
- **30 Thursday**  Closing date for Applications for Admission to the Bachelor of Medicine course in 1984

### July
- **4 Monday**  Examinations begin
- **8 Friday**  Examinations end

### August
- **8 Monday**  Last day for withdrawal without academic penalty from full year subjects
  (See page (vii) for Dean’s discretion)
- **13 Saturday**  Second Term ends
- **15 Monday**  Examinations begin
- **19 Friday**  Examinations end

### September
- **5 Monday**  Third Term begins
- **26 Monday**  Last day for withdrawal without academic penalty from second half year subjects
  (See page (vii) for Dean’s discretion)

### October
- **1 Saturday**  Closing date for Applications for Admission 1984
  (Undergraduate courses other than Medicine)
- **3 Monday**  Public Holiday — Eight Hour Day

### November
- **5 Saturday**  Third Term ends
- **7 Monday**  Annual Examinations begin
- **25 Friday**  Annual Examinations end

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

### 1984
- **January**
  - **16 Monday**  Deferred Examinations begin
  - **27 Friday**  Deferred Examinations end

### February
- **27 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 1983 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 1982 annual examination results, and forward it to the Secretary, University of Newcastle, N.S.W., 2308.

Enrolment forms from continuing students are due by 7 January 1983 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 2 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 Number. This card, with its 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 1982, 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 1982.

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.

<table>
<thead>
<tr>
<th>Withdrawal Dates</th>
<th>Full Year Subjects</th>
<th>First Half-Year Subjects</th>
<th>Second Half-Year Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>8 August 1983</td>
<td>26 April 1983</td>
<td>26 September 1983</td>
</tr>
<tr>
<td>Tuesday</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 a failure being recorded.
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;
- 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 secrerny 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.

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A notice board on the wall opposite the entrance to Lecture Theatre B01 is used for the specific purpose of displaying examination timetables 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.

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**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, tutorial 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:** 23 to 27 May, 1983
- **Mid Year:** 4 to 8 July, 1983
- **End of Second Term:** 15 to 19 August, 1983
- **End of Year:** 7 to 26 November, 1983

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 in the examination room.

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 programmable calculator will be permitted provided program cards and devices are not taken into the examination room.
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 results 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 13 January 1984.

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 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.

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**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 7 January 1983.

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 satisfactory progress the Head of 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
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 by the
Admissions Committee to be unsatisfactory, the Faculty Board may 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 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 Admissions 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
depowered 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) 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 Admissions 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 written evidence that a
sponsor will meet all charges.

New students are required to pay all 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 if late
charges are to be avoided. 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 ........................................... $135
      Per annum

      Part-time students ........................................... $130
      Per annum

   (b) Plus Students joining Newcastle University Union for the first
time ............................................................. $10

   (c) Non-Degree Students

      Newcastle University Union charge ...................... $61
      Per annum

   The exact amount 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 the
      Enrolment form by Friday, 7 January, 1983 ................ $14

      where a candidate for a special or deferred examination
      in January does not lodge the Enrolment form by
      Monday, 14 February, 1983 ................................. $14

   (b) Late Lodgement of Authority to Complete Enrolment Form

      with Cashier

      Where the Authority to Complete Enrolment Form together

         (i) General Services Charge payable; or

      (ii) evidence of sponsorship (e.g. scholarship voucher or letter

            from Sponsor); or

(xii)
should be made payable at the Newcastle Students
Cashier's Office Complete
that a sponsor will meet these charges.
with the Authority to
Students who
with the University
Scholarship Holders
The refund will be based on the date of notification of withdrawal, as follows:
their courses should also lodge a claim form for a refund of charges that they have paid.
Refund oj' Charges
No
rejimd ,,,ill be
possibly 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 arcs 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 I.
Shaw, A. C.  
*The Logical Design of Operating Systems*  
(Prentice-Hall 1974)

Weitzman, C.  
*Distributed Micro/Minicomputer Systems*  
(Prentice-Hall 1980)

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)

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

Kernighan, 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)

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.
Carmichael, R. D.
Harary, F.
Lomont, J. S.
White, A. T.
Wilson, R. J.

Finite Groups of Automorphisms (Cambridge 1971)
Groups of Finite Order (Dover reprint)
Graph Theory (Addison-Wesley 1969)
Applications of Finite Groups (Academic 1959)
Graphs, Groups and Surfaces (North-Holland 1973)
Finite Permutation Groups (Academic 1964 et seq)
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.
Hirsch, M. W. & Smale, S.
Marsden, J. E. & McCracken, M.
Nayfeh, A. H. & Moors, D. T.
Stoker, J. J.

Ordinary Differential Equations (Wiley 1969)
Differential Equations, Dynamical Systems and Linear Algebra (Academic 1974)
The Hopf Bifurcation and its Applications (Springer-Verlag 1976)
Nonlinear Oscillations (Wiley 1979)
Nonlinear Vibrations (Wiley 1950)

664170 Many-body Theory — C. A. Croxton

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-Feenberg 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. Polymeric systems.

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 — C. A. Croxton

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.
Matthews, P. T.

Introductory Eigenphysics (Wiley 1974)
Introduction to Quantum Mechanics (McGraw-Hill 1968)

664172 Generalised Linear Statistical Modelling — A. J. Dobson

Prerequisites
Topics R and U

Hours
About 27 hours

Examination
One 2-hour paper

Content
The course covers the theory of generalised linear models and illustrates how many methods for analysing continuous, binary and multivariate categorical 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
Notes and references to research papers will be provided

664171 Algebraic Number Theory — R. B. Eggleton

Prerequisites
Topic T or X

Hours
About 27 lecture hours

Examination
One 2-hour paper

69
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, selects from the following topics: 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, as time permits. Symmetric graphs, with attention to the trivalent case. Covering graph 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 chromatic polynomial.

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

664153 Algebraic Graph Theory — R. B. Eggleton

Prerequisite
Topic D

Hours
About 27 lecture hours

Examination
One 2-hour paper

Content

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

References
Bondy, J. A. & Murty, U. S. R. *Graph Theory with Applications* corrected edn (Macmillan 1977)
Harary, F. *Graph Theory* (Addison-Wesley 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 some details of the proof of the Four Colour Theorem by Appel and Hakin; transsection-free chain decompositions of graphs embedded in surfaces.

Text
Nil

References
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.
Burlill, C. W.
Halmos, P. R.
Kingman, J. F. C.
Munroe, M. E.
Parthasarathy, K. R.
Rogers, C. A.

664180 Demography and Survival Analysis — R. W. Gibberd

Prerequisite
Topic H

Hours
About 27 lecture hours for 1st half year

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.
Gross, A. J.
Kabyleisch, J. D. & Prentice, R. L.
Keyfitz, N.
Pollard, J. H.

664103 Banach Algebra — J. R. Giles

Prerequisite
Topic W

or Corequisite

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 polynomials; ideals and maximal ideals.

Text
Giles, J. R.
Convex Analysis with application in Differentiation of Convex Functions (Pitman 1982)
References
Day, M. M.
Diestel, J.
Ekeland, I. & Teman, R.
Giles, J. R.
Holmes, R. B.
Roberts, A. W. & Varberg, D. E.
Rockafeller, R. T.
Valentine, F. A.
Wilansky, A.

664116 Mathematical Models of Phase Transitions — A. J. Guttmann

Prerequisites
Nil

Hours
About 27 lecture hours

Examination
One 2-hour paper

Content

Text
Thompson, C. J.

Mathematical Statistical Mechanics (Princeton 1979)

References
Amit, D. J.
Domb, C. & Green, M. S. (eds)
Fisher, M. E.
Huang, K.
Stanley, H. E.

664150 General & Algebraic Topology — M. J. Hayes

Prerequisite
Topic L

Hours
About 27 lecture hours

Examination
One 2-hour paper

Content

References
Batchelor, G. K.
Landau, L. D. & Lifshitz, E. M.
Langlois, W. E.
Pai, S. I.
Rosenhead, L. (ed.)
Schlichting, H.
Teman, R.

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.
Landau, L. D. & Lifshitz, E. M.
Langlois, W. E.
Pai, S. I.
Rosenhead, L. (ed.)
Schlichting, H.
Teman, R.

664118 Perturbation Theory — D. L. S. McElwain

Prerequisite
Topic CO

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.
References
Bender, C. M. & Orszag, S. A.
Cole, J. D.
Nayfeh, A. H.
Van Dyke, M.

Advanced Mathematical Methods for Scientists and Engineers (McGraw-Hill 1978)
Perturbation Methods in Applied Mathematics (Blaisdell 1968)
Introduction to Perturbation Techniques (Wiley 1981)
Perturbation Methods (Wiley 1973)
Perturbation Methods in Fluid Mechanics (Parabolic 1975)

664106 Combinatorics — R. B. Eggleton and W. Brisley
(To be offered if sufficient demand)

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
Beckenback, E. F. (ed.)
Hall, M.
Harary, F. & Palmer, E. M.
Liu, C. L.
Riordan, J.

Applied Combinatorial Mathematics (Wiley 1964)
Combinatorial Theory (Blaisdell 1967)
Graphical Enumeration (Academic 1974)
Introduction to Combinatorial Mathematics (McGraw-Hill 1968)
Combinatorial Analysis (Wiley 1958)

664164 Number Theory — Not offered in 1983

Prerequisite
Nil

Hours
About 27 lecture hours

Examination
One 2-hour paper

Content

Text
Nil

References
Andrews, G. E.
Hardy, G. & Wright, E. M.
Niven, I. & Auckerman, H. S.

Number Theory (Saunders 1971)
Introduction to Number Theory (Oxford 1960)
An Introduction to the Theory of Numbers (Wiley 1968)

664159 Foundations of Modern Differential Geometry — Not offered in 1983

Prerequisite
Topic CO

Hours
About 27 lecture hours

Examination
One 2-hour paper

Content

Text
Nil

References
Auslander, L.
Chevalley, C.
Kobayashi, S. & Nomizu, K.

Differential Geometry (Harper & Row 1967)

664181 Numerical Methods and Analysis — W. Summerfield

Prerequisite
Topic Z

Hours
About 27 lecture hours

Examination
One 2-hour paper

Content
The three major problem areas of numerical analysis involve rounding error, discretisation error and convergence 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 investigates methods of solution, of either linear systems of equations, eigenvalue problems, ordinary differential equations or partial differential equations. At the same time, the basic theoretical results pertaining to the three types of error for the methods will be examined.

Text
Nil

References
Ames, W. F.
Forsythe, G. & Moler, C. B.
Gear, C. W.
Isaacson, E. & Keller, H. M.

Computer Solution of Linear Algebraic Systems (Prentice-Hall 1967)
The Numerical Solution of Initial Value Problems in Ordinary Differential Equations (Prentice-Hall 1971)
Analysis of Numerical Methods (Wiley 1966)
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


Christensen, H. N. Biological Transport (W.A. Benjamin, 1975)


Guyton, A. C. Textbook of Medical Physiology (W.A. Saunders 1971)


Margaria, R. Biomechanics and Energetics of Muscular Exercise (Clarendon 1976)

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. Combinatorial Theory: An Introduction (CBRC 1977)

References Berlekamp, E. R. Algebraic Coding Theory (McGraw-Hill 1968)

Murray, J. D. Lectures on Nonlinear-Differential-Equation Models in Biology (Clarendon 1977)


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


Text Nil

References Kendall, M. G. & Moran, P. A. P. Families of Bivariate Distributions (Griffin 1970)

Kendall, M. G. Geometrical Probability (Griffin 1963)

Mardia, K. V. An Introduction to Bivariate Distributions (Griffin 1970)

Wallis, W. D. Combinatorial Theory: An Introduction (CBRC 1977)
Deterministic Models

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 Akadémiai Kiado 1947)
Hall, M. J. 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. Combinatorial Designs (Univ. of Surrey 1977)

664176 Graph Theory and Applications — Not offered in 1983

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 61

664168 Astrophysical Applications of Magnetohydrodynamics
Not offered in 1983

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 $10^4$ gauss in the galaxy to $10^7$ gauss in a neutron star.

Text
Nil

References
Cowling, T. G. Magneto-hydrodynamics (Interscience 1957)

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 94
EE447 Digital Communications — see page 94

Department of Mechanical Engineering

ME401 Mathematical Programming I — see page 105
ME487 Operations Research — Deterministic Models — see page 104
ME488 Operations Research — Probabilistic Models — see page 104

Additionally, students permitted to select courses from this list may 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

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: Four of the following units to be chosen.

(i) 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.

(ii) 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.

(iii) 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:
- Australian Standard Engineering Drawing Practice CZ1 1976 (Inst. of Engineering, Australia)

References:
- Levens, A. S. Luzadder, W. J. Graphics (Wiley)
- Basic Graphics (Prentice-Hall)

(iv) GE112 Introduction to Engineering Design
   Content: Philosophy and fundamentals of engineering design.
   Texts:
- Australian Standard Engineering Drawing Practice CZ1 1976 (Inst. of Engineers, Australia)
- Krick, E. V. An Introduction to Engineering and Engineering Design (John Wiley & Sons)

(v) EE131 Circuit Fundamentals
   Part 1 (Introduction)
   Introduction to Electrical Engineering, Model Theory, Units.
   Part 2 (Resistive Circuits)
   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.

(vi) ChE141 Industrial Process Principles
   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)
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 IIIC

Prerequisites

Accounting I, Mathematics I

Hours

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

Text

Henderson, S. & Peirson, G.

Johnson, T. R. et al.

Taylor, R. B. & O'Shea, B. P.

Issues in Financial Accounting

2nd edn (Cheshire)

The Law and Practice of Company Accounting in Australia 4th edn (Butterworths)

Questions on the Law & Practice of Company Accounting 2nd edn (Butterworths)

Accountants Exercises 2nd edn (University of Newcastle)
(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

Fluid properties, Fluid statics, stability of submerged and floating bodies, relative equilibrium. Fluid-flow concepts and basic equations of continuity, energy, linear and angular momentum.

Text


(iv) 522204 CE232 Fluid Mechanics II — 1 Unit

Prerequisites

CE231

Hours

2 lecture hours & 1 tutorial/laboratory hour per week for second half year

Examination

One 3-hour paper

Content


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 (⅓ unit)

Texts

Jackson, N.
Nagarajan, N. & Antill, J. M.
Civil Engineering Materials (Macmillan 1980)
Australian Concrete Inspection Manual (Pitman-Australia)

87
American Institute of Certified Public Accounts
Baxter, W. T. & Davidson, S.
Chambers, R. J.

Dean, G. W. & Wells, M. C. (eds)
Financial Accounting Standards Board
Goldberg, L.

Hendriksen, E. S.
Jager, M. O. et al.
Keane, S. M.
Moonitz, M.
Parker, R. H.
Vatter, W. J.

413200 Accounting IIIB

Hours
2 lecture hours per week

Examination
One 3-hour paper and progressive assessment

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.

Text
Kaplan, R.

Advanced Management Accounting (Prentice Hall)

References
Anton, H. R. & Firman, P. A.
Bailey, E.
Benston, G. J.
Chase, R. B. & Acquavilla, N. J.
Cocoran, A.
Gordon, L. A. et al.
Mintzberg, H.
O'Connor, R.

413602 Financial Management

Prerequisite
Accounting I

Hours
2 lecture hours and 1 tutorial hour 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
Brealey, R. & Myers, S.
Brigham, E. F. et al.
Pierson, G. R. & Bird, R.
Weston, J. F. & Brigham, E. F.

References
Boudreaux, K. J. & Long, H. W.
Chambers, R. J.
Jean, W. H.
Lerner, E. M.
Pollard, A. H.
Quinlin, G. D.
Samuels, J. M. & Wilkes, F. M.
Solomon, E. & Pringle, J. J.
Van Horne, J.
Weston, J. F.
Weston, J. F. & Brigham, E. F.
Weston, J. F. & Woods, D. H.
Wolf, H. A. & Richardson, L.

713200 Biology IIIB

Prerequisites
Mathematics IIA & IIC & either Biology IIA or IIIB

Hours
4 lecture hours & 8 tutorial 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)
Nalbandov, A. V. Reproductive Physiology 3rd edn (Freeman 1976)

References
Leopold, A. C. & Kriedemann, P. E. Plant Growth and Development (McGraw-Hill 1975)
Setchell, B. P. The Mammalian Testis (Paul Elek 1978)

(ii) 713204 Ecology and Quantitative Genetics

Content
Ecology
Structure and dynamics of biological communities, evolutionary ecology.

Quantitative Genetics

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
Daubenmire, R. F. Plants and Environment 3rd edn (Wiley 1974)
Ford, E. B. Ecological Genetics (Methuen 1975)

523100 Civil Engineering IIIM

Prerequisite
Civil Engineering IIIM, 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

References
Lambe, T. W. Soil Testing for Engineering (Wiley)
SAA Methods of Testing Soils for Engineering Purposes ASI289

(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

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

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
As for CE231

(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)
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 105 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

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

Text
As for EE341 Automatic Control
(iii) 534132 EE443 Optimization Techniques — Not offered in 1983

**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

423800 Economics III C

**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**

**References**
Goldberger, A.
Hadley, G.
Huang, D. S.
Koutsoyiannis, A.
Kmenta, J.
Pindyck, R. S. & Rubinfeld, D. L.

Econometrics (John Wiley & Sons 1964)
Linear Algebra (Addison-Wesley 1961)
Regression and Econometric Methods (John Wiley & Sons 1970)
A Theory of Econometrics (Macmillan 1973)
Elements of Econometrics (Macmillan)
Econometric Models and Economic Forecasts (McGraw-Hill)
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 or poor countries in terms of job creation. The course is concluded with a discussion of the ecological viability of alternative development strategies.

Text
Todaro, M. P.  
Economic Development in the Third World  
2nd edn (Longmans 1981)

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.  
Economics for Development (Dobson 1963)
Enke, S.  
Gill, R. T.  
George, S.  
Harrison, P.  
Harrison, P.  
Higgins, B.  
Kindleberger, C.  
Meier, G. M. (ed.)  
Economic Development 2nd edn (McGraw-Hill 1965)  
Myrdal, G.  
Myint, H.  
Szentes, T.  
Ward, B.  
Asian Drama (Twentieth Century Fund 1968)
The Economics of Developing Countries 4th edn  
(Budapest: Akademiai Kiado 1973)
The Political Economy of Underdevelopment  
Progress on a Small Planet (Penguin 1979)

(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
Kreinin, M.
Meier, G. M.
Perkins, J.

References
Caves, R. E.
Heller, H. R.
Heller, H. R.
Kindleberger, C. P.
McCullough, G. D. (ed.)
Snape, R. H.

(v) 423103 Public Economics

Hours
2 lecture hours per week

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.

References
Brown, C. V. & Jackson, P. M.
Buchanan, J. M. & Flowers, M. R.
Cubertson, J. M.
Groenewegen, P. D. (ed.)
Groenewegen, P. D.
Houghton, R. W. (ed.)
Johansen, L.
Mishan, E. J.
Musgrave, R. A. & P. B.
Shoup, C. S.
Wilkes, J. (ed.)

Public Sector Economics (Martin Robertson)
The Public Finances (Irwin)
Macroeconomic Theory and Stabilisation Policy (McGraw-Hill)
Australian Taxation Policy (Longman-Cheshire)
Public Finance in Australia: Theory and Practice (Prentice-Hall)
Public Finance (Penguin)
Public Economics (North-Holland)
Cost-Benefit Analysis (Allen & Unwin)
Public Finance in Theory and Practice (McGraw-Hill)
Public Finance (Weidenfeld & Nicolson)
The Politics of Taxation (Hodder & Stoughton)

(vi) 423114 Growth and Fluctuations

Prerequisite
Nil

Hours
2 lecture hours per week for half the year

Examination
Progressive assessment

Content
This course aims to impart a thorough comprehension of basic growth models (e.g. classical, Keynesian-Kaleckian, neoclassical) and of the rationale of trade cycles. Theoretical constructs are examined in light of the empirical evidence on growth and instability in mature economies.

References
Kregel, J. A.
Lundberg, E.
Rau, N.

(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
To be advised

733300 Geology IIC

Prerequisites
Physics I, Mathematics IIA, IIC & Geology IIA

Hours
3 lecture hours, 6 laboratory hours per week & 12 days field work

Examination
Two 2-hour papers in Geology plus assessment, appropriate paper(s) in the selected Mathematics topic
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 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 II A & I IC

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

Text
Niebel, B. W. or Stevenson, M. G. Motion and Time Study (Irwin) or Methods Engineering (N.S.W. Univ. Press)

(ii) 543502 ME383 Quality Engineering

Hours
1½ hours per week

Examination
Progressive assessment & examination

Content

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

Text

(v) 544418 ME449 Reliability Analysis for Mechanical Systems

Hours
1½ hours per week

Examination
Progressive assessment

Content
Texts
Schwarzenbach, J. & Gill, K. F. System Modelling and Control

(iii) 540126 ME305 Systems Analysis, Organisation & Control

Hours 1½ hours per week
Examination Progressive assessment & examination

Content

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
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

Text Nil

(ix) 544411 ME449 Reliability Analysis for Mechanical Systems — A. J. Chambers/A. W. Roberts

Hours 1½ hours per week
Examination To be advised

**Text**


**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 IIC**

**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 IIB. 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 IIC and Mathematics IIA and such additional work as is required for combined honours students by the Department of Mathematics, Statistics and Computer Science. 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 IIA & Physics IIA & such additional work as is required for combined honours students by the Dept of Mathematics, Statistics and Computer Science. 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 evaluated 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.
Prerequisites
Mathematics IIIA, Psychology IIIA.
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 65 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
### Subjects Approved for the Diploma

#### Group A

<table>
<thead>
<tr>
<th>Subjects in the main-stream of computer science</th>
<th>Department Offering Subject</th>
<th>Assumed Standard of Attainment</th>
<th>No. of Units</th>
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</thead>
<tbody>
<tr>
<td>Information Systems</td>
<td>Commerce</td>
<td>Commercial EDP</td>
<td>1</td>
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<tr>
<td>Quantitative Business Analysis II</td>
<td>Commerce</td>
<td>Introductory Quantitative</td>
<td>1</td>
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<tr>
<td>Systems Design</td>
<td>CS—Commercial Programming</td>
<td>Systems Analysis</td>
<td>1</td>
</tr>
<tr>
<td>EE341—Automatic Control</td>
<td>Electrical Engineering</td>
<td>EE341 or ME361—Automatic</td>
<td>1</td>
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<tr>
<td>EE365—Digital Signal Processing</td>
<td>Electrical Engineering</td>
<td>Engineering</td>
<td>1</td>
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<tr>
<td>EE325—Introduction to Digital Technology</td>
<td>Electrical Engineering</td>
<td>EE264 or CS—Introduction to</td>
<td>1</td>
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<td>Computer Architecture &amp;</td>
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<td>Assembly Language</td>
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<td>EE221—Semi-conductor Devices</td>
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<td></td>
<td>Electrical Engineering</td>
<td>EE344—Communications</td>
<td>1</td>
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<tr>
<td>EE447—Digital Communications</td>
<td>Electrical Engineering</td>
<td>EE264 or CS—Introduction to</td>
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<td>Computer Architecture &amp;</td>
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<td>Assembly Language</td>
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<td></td>
<td>EE221—Semi-conductor Devices</td>
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<tr>
<td>EE563—Computer Operating Systems</td>
<td>Electrical Engineering</td>
<td>EE362 or CS—Switching Theory</td>
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<td>&amp; Logical Design</td>
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<td></td>
<td>Mathematics</td>
<td>Part II Mathematics, Topics</td>
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<td>CO, D</td>
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<tr>
<td></td>
<td>CS—Theory of Computing</td>
<td>Part II Mathematics, Topics</td>
<td>1</td>
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<tr>
<td></td>
<td>Mathematics</td>
<td>CO, F or equivalent</td>
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<tr>
<td>CS—Mathematical Principles of Numerical</td>
<td>Mathematics</td>
<td>Part II Mathematics, Topics</td>
<td>1</td>
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<tr>
<td>Analysis</td>
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<td>CO, D</td>
<td></td>
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<tr>
<td>CS—Programming Languages &amp; Systems</td>
<td>Mathematics</td>
<td>Part II Mathematics, Topic F</td>
<td>1</td>
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<tr>
<td>CS—Concurrent Programming Techniques</td>
<td>Mathematics</td>
<td>CS—Theory of Computing or</td>
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<td>EE563—Computer Operating</td>
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<td>Systems Programming experience</td>
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<td>in a high-level language</td>
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<tr>
<td>CS—High Level Software Development</td>
<td>Mathematics</td>
<td>ME361—Automatic Control</td>
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<tr>
<td>ME505—Systems Analysis, Organisation &amp; Control</td>
<td>Mechanical Engineering</td>
<td>Part II Mathematics, Topics</td>
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<td>CO, D</td>
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<td>ME404—Mathematical Programming I</td>
<td>Mechanical Engineering</td>
<td>ME361—Automatic Control</td>
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</tr>
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<td>ME381—Mathematical Programming II</td>
<td>Mechanical Engineering</td>
<td>Part II Mathematics, Topics</td>
<td>1</td>
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<td>CO, D</td>
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#### Group B

<table>
<thead>
<tr>
<th>Subjects which have some application to computer science</th>
<th>Department Offering Subject</th>
<th>Assumed Standard of Attainment</th>
<th>No. of Units</th>
</tr>
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<tbody>
<tr>
<td>CE510—Elastic Continua</td>
<td>Civil Engineering</td>
<td>CE212—Mechanics of Solids I</td>
<td>1</td>
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<tr>
<td>Theories of Organisation</td>
<td>Engineering</td>
<td>Part II Mathematics, Topic D</td>
<td>1</td>
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<tr>
<td>EE322—Linear Electronics I</td>
<td>Electrical Engineering</td>
<td>EE203—Introduction to Electrical Information</td>
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<tr>
<td>EE321—Linear Electronics II</td>
<td>Electrical Engineering</td>
<td>EE321—Electronics</td>
<td>1</td>
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<tr>
<td>EE342—Linear System Theory</td>
<td>Electrical Engineering</td>
<td>EE331—Circuits</td>
<td>1</td>
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<tr>
<td>EE443—Optimization Techniques</td>
<td>Electrical Engineering</td>
<td>EE322—Electronics</td>
<td>1</td>
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<tr>
<td>CS—Mathematical Logic and Set Theory</td>
<td>Electrical Engineering</td>
<td>EE323—Linear Electronics II</td>
<td>1</td>
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<tr>
<td>CS—Graph Theory and Applications</td>
<td>Electrical Engineering</td>
<td>EE421—Electronics</td>
<td>1</td>
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<tr>
<td>CS—Combinatorial Designs</td>
<td>Part II Mathematics, Topic CO, D</td>
<td>1</td>
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<tr>
<td>CS—Combinatorics</td>
<td>Mathematics</td>
<td>Part II Mathematics, Topic CO, D</td>
<td>1</td>
</tr>
<tr>
<td>CS—Random &amp; Restricted Walks</td>
<td>Mathematics</td>
<td>Part II Mathematics, Topic CO, D</td>
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<td>CS—Concurrency</td>
<td>Mathematics</td>
<td>Part II Mathematics, Topic CO, D</td>
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<td>ME319—Reliability Analysis for Mechanical Systems</td>
<td>Mechanical Engineering</td>
<td>Part II Mathematics, Topic CO, D</td>
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<tr>
<td>ME487—Operations Research—Deterministic Models</td>
<td>Mechanical Engineering</td>
<td>Part II Mathematics, Topic CO, D</td>
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<tr>
<td>ME488—Operations Research—Probabilistic Models</td>
<td>Mechanical Engineering</td>
<td>Part II Mathematics, Topic CO, D</td>
<td>1</td>
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<tr>
<td>ME503—Design of Experiments for Engineering Research</td>
<td>Mechanical Engineering</td>
<td>Part II Mathematics, Topic CO, D</td>
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<tr>
<td>ME312—Modelling and Control of Metallurgical Processes</td>
<td>Mechanical Engineering</td>
<td>Part II Mathematics, Topic CO, D</td>
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<tr>
<td>CS—Instrumentation Techniques</td>
<td>Metalurgy</td>
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<td></td>
<td>Physics</td>
<td>Physics IA or IB</td>
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</tbody>
</table>
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 first 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. and D.E.C.
Fundamentals of COBOL Programming (W. C. Brown)
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)
DeRosis, 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.
Programming Business Computers (Wiley)
et al.
Standard COBOL (S.R.A.)
Murach, M.
Computers in Business (McGraw-Hill)
Sanders, D. H.
Computing with COBOL (Harper & Row)
Sprowls, R. C.
Cobol Programming (Wiley)
Stern, N. B. & R. A.
Watters, J. L.
Cobol Programming (Heinemann)

532177 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.

Texts
Eckhouse, R. H. & Morris, L. R.
Minicomputer Systems Organization, Programming and Application (PDP-11) 2nd edn (Prentice-Hall 1979)

References
Chu, Y.
Computer Organization and Micro Programming (McGraw-Hill)
Donovan, J. J.
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 topological sorting, random numbers, simulation and use of some of the other high level languages discussed in lectures.

Text

References
Graham, N. *Introduction to PASCAL* (West 1980)
Grogono, P. *Programming in PASCAL 2nd edn* (Addison-Wesley 1979)
Guttmann, A. J. *Programming and Algorithms* (Heinemann 1977)
Moore, L. *Foundations of Programming* (Ellis Horwood 1980)
Wirth, N. *Systematic Programming* (Prentice-Hall 1973)
Yourdon, E. J. *Techniques of Program Structure and Design* (Prentice-Hall 1975)

660113 CS — Numerical Analysis — R. J. Vaughan

Assumed Standard of Attainment
Mathematics I

Hours
1 lecture hour per week & 1 tutorial hour per fortnight throughout the year

Examination
One 2-hour paper

Content
The course will be run in parallel with Mathematics II, Topic F, with additional reading and assignments.

Text and References
See topic F page 45.

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**
- 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)

**GROUP A**

Subjects in the main-stream of Computer Science

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
One 2-hour paper

**Content**
COBOL programming: a general consideration of information systems: a particular consideration of computer 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, debug, rewrite and write several programs using COBOL.

**Texts**
- Digital Equipment *VAX-11 COBOL Language Reference Manual*

**References**
- Information Systems Handbook (ARDI) (Kluwer-Harrap)

412601 Quantitative Business Analysis II

**Assumed Standard of Attainment**
Introductory Quantitative Methods

**Hours**
2 lecture hours per week

**Examination**
Two 2-hour papers; 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*

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.
As for Systems Analysis

Offered by Department of Electrical and Computer Engineering

533213  EE341  Automatic Control — see page 93.

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

Text
Stanley, W. D.  Digital Signal Processing (Reston 1975)

References
Kuo, B. C.  Discrete-Control Systems (Prentice-Hall 1970)

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 characteristic, interfacing, limitations and applications. Digital System Interconnection: bus systems, single and differential transmission, open collector, tristate, 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
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

References
Coffman, E. G. & Denning, P. J.  Operating Systems Theory (Prentice-Hall)
Hansen, P. B.  Operating Systems Principles (Prentice-Hall)
534143 EE464 Compiler Construction — R. J. Evans

**Assumed Standard of Attainment**

EE464 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

**Assumed Standard of Attainment**

EE362 Switching Theory & Logical Design

**Hours**

3 hours per week for the first half year

**Content**


Offered by Department of Mathematics, Statistics and Computer Science

660127 CS—Theory of Computing

— Mathematics III Topic TC, see page 57

660128 CS—Mathematical Principles of Numerical Analysis

— Mathematics III Topic Z, see page 61

660135 CS—Programming Languages & Systems

— Mathematics III Topic PL, see page 53

664403 CS—Concurrent Programming Techniques

— Mathematics IV, see page 66

660133 CS—High Level Software Development

— Mathematics IV, see page 67

Offered by Department of Mechanical Engineering

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)

**GROUP B**

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 and Surveying

530137 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.

**Text**

Lansbury, R. D. & Gilmour, P.

Organisations: An Australian Perspective

(Cheshire)

**References**

Altman, D.

Argyle, M.

Albrow, M.

Anthony, P. D.

Dunphy, D. C.

Rehearsals for Change (Fontana)

The Psychology of Interpersonal Behaviour (Penguin)

Bureaucracy (Macmillan)

The Ideology of Work (Tavistock)

Organizational Change by Choice (McGraw-Hill 1981)
Offered by Department of Electrical and Computer Engineering

533117 EE323 Linear Electronics I
533118 EE324 Linear Electronics II
533110 EE342 Linear System Theory — see page 93
533113 EE344 Communications — see page 94
534109 EE421 Electronic Design A
534110 EE422 Electronic Design B
534132 EE443 Optimization Techniques — not offered in 1983

Offered by Department of Mathematics, Statistics and Computer Science

660136 CS—Mathematical Logic and Set Theory — See Mathematics III, Topic O page 52
660129 CS—Theory of Statistics — See Mathematics III, Topic R page 55
660119 CS—Random and Restricted Walks — not offered in 1983
660122 CS—Combinatorial Designs — See Mathematics IV, page 80
660123 CS—Combinatorics — See Mathematics IV, page 76
660137 CS—Graph Theory and Applications — not offered in 1983

Offered by Department of Mechanical Engineering

544418 ME449 Reliability Analysis for Mechanical Systems — see page 105
544841 ME487 Operations Research — Deterministic Models — see page 104
544842 ME488 Operations Research — Probabilistic Models — see page 104
540137 ME503 Design of Experiments for Engineering Research

1 For details consult the Engineering Faculty Handbook.

Offered by Department of Metallurgy

113393 Me312 Modelling and Control of Metallurgical Processes

1 For details consult the Engineering Faculty Handbook.

Offered by Department of Physics

742201 CS—Instrumentation Techniques — not offered in 1983

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 Instrumentation — 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 28

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, Statistics and Computer Science

MS—Theory of Statistics — see page 55
MS—Regression, Design and Analysis of Experiments — see page 58
MS—Demography and Survival Analysis — see page 72
MS—Generalised Linear Statistical Modelling — see page 69
CS—Programming and Algorithms — see page 113
CS—Data Structures and Programming — see page 114
MS—Survey Sampling Methods — see Topic SS page 56

RUSIAN FOR THE SCIENTIST AND MATHEMATICIAN — C. A. Croxton

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.
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 magneto-acoustic waves in the atmosphere of Ap stars is also being studied.

Biostatistics
Associate Professors A. J. Dobson and R. W. Gibberd are interested in theoretical problems which arise from consulting in medical statistics. Current research includes: measures of agreement between observers, methods for analysing clustered prevalence data, prognostic indicators.

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.

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.

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 working on realtime computer techniques for protection and monitoring of high voltage switchyards. In addition, he is developing concurrent programming systems and techniques for writing software for multiprocessor systems. He is also interested in the development of programming languages and systems.

Integral Geometry
Dr T. K. Sheng studies the powers of distances between random points in convex and non-convex regions in IRn.

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.

Epidemiology
Associate Professor A. J. Dobson and R. W. Gibberd collaborate with the Faculty of Medicine to investigate various problems in epidemiology. 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 surveys of smoking habits of schoolchildren; spatial behaviour of hospital patients in the Hunter Region; doctor patient interactions; use of antibiotics; evaluation of intervention programmes.
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.

<table>
<thead>
<tr>
<th>Computer Number</th>
<th>Subject Name</th>
<th>Computer Number</th>
<th>Names of Components</th>
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<tr>
<td>Part I Subjects</td>
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<tr>
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<td>Accounting I</td>
<td>511108</td>
<td>Che114 Industrial Process Principles</td>
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<td>711100</td>
<td>Biology I</td>
<td>521101</td>
<td>CE111 Statics</td>
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<td>712100</td>
<td>Chemistry I</td>
<td>531203</td>
<td>EE131 Circuit Fundamentals</td>
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<td>314000</td>
<td>Classical Civilisation I</td>
<td>541104</td>
<td>ME111 Graphics and Engineering Drawing</td>
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<td>Drama I</td>
<td>501101</td>
<td>GE112 Introduction to Engineering Design</td>
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<td>Economics IA</td>
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<td>GE151 Introduction to Materials Science</td>
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<td>Part II Subjects</td>
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<tr>
<td>331100</td>
<td>English I</td>
<td>381111</td>
<td>Introduction to Philosophical Problems</td>
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<td>French IN</td>
<td>381106</td>
<td>Moral Problems</td>
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<td>French IS</td>
<td>381112</td>
<td>Psychoanalysis &amp; Philosophy</td>
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<td>351100</td>
<td>Geography I</td>
<td>381109</td>
<td>Philosophy of Religion</td>
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<td>381110</td>
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<td>Biochemistry &amp; Molecular Genetics</td>
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* Not offered in 1983.