Preface

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

Your desire to study mathematics is, I hope, based on the conviction that mathematics will be the most enjoyable of all those disciplines open to you—there can be no better reason. If you enjoy mathematics you will welcome the demands it makes upon you and your studies will be most rewarding. I would like to commend to you the essay on Mathematics by Professor E. C. Zeeman in the book University Choice (edited by Klaus Bochm) 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 modern fact: that mathematics and the use of mathematical language and ideas have a place in all university studies, and are not exclusive to any one area. The best way in which we can do justice to this universality is to exist in a distinct Faculty of Mathematics having intellectual links with all other disciplines.

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

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

Not all the areas of mathematical work which are of importance to the Faculty have the word “mathematics” in their titles. Operations research (“the mathematical description of what actually happens, rather than 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 is being expanded substantially at present, are statistics and computer science. For several years the Faculty has offered a postgraduate Diploma in Computer Science, and in 1977 it introduced the undergraduate subject Computer Science II. Our range of undergraduate studies in computer science was completed in 1978 by the presentation of the new subject Computer Science III. A similar extension of our undergraduate offerings in statistics is being 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.

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 as from them, because this type of interaction allows you to try out on other people with similar concerns your ideas about what you are learning. By “learning” I mean your appreciation of how the material you meet in your formal courses fits into a wider understanding of the world and of its problems. If you see your University education in this light, you can deduce that you should take every opportunity to broaden your outlook while you are here. The various student clubs and associations in the University provide one type of opportunity. There is another opportunity in the wide range of interests of your fellow-students; it is a better policy to find your friends and acquaintances at the University in a variety of studies than to confine yourself to meeting only with people whose courses are the same as yours.

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

R. W. ROBINSON,
Dean, Faculty of Mathematics

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Faculty of Mathematics

The colour band on the spine of this Handbook is the colour of the hood worn by Bachelors of Mathematics of this University

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

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

<table>
<thead>
<tr>
<th>Part I</th>
<th>Part II</th>
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<tbody>
<tr>
<td>Geology</td>
<td>Biology I</td>
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<tr>
<td>Greek</td>
<td>German I or II</td>
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<tr>
<td>History I</td>
<td>Chemistry I</td>
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<td>Latin I</td>
<td>Classical Civilisation I</td>
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<td>Legal Studies I</td>
<td>Economics IIA &amp; IIB</td>
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<td>Linguistics</td>
<td>Education II</td>
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<tr>
<td>Philosophy</td>
<td>Electronics &amp; Instrumentation II</td>
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<tr>
<td>Physics I or II</td>
<td>English IIA</td>
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<tr>
<td>Psychology</td>
<td>French IIA</td>
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<tr>
<td>Sandkrit</td>
<td>Geography IIA, IIB, IIC &amp; IIIB</td>
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<tr>
<td>Sociology</td>
<td>Geology IIA &amp; IIB</td>
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<tr>
<td>Accounting</td>
<td>History IIA, IIB &amp; IIC</td>
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<tr>
<td>Biology</td>
<td>Japanese IIA</td>
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<tr>
<td>Chemistry</td>
<td>Legal Studies I</td>
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<td>Classical Civilisation</td>
<td>Mathematics II</td>
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<td>Drama</td>
<td>Philosophy IIA</td>
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<td>Economics</td>
<td>Physics II</td>
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<tr>
<td>English</td>
<td>Psychology IIA &amp; IIB</td>
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<tr>
<td>French</td>
<td>Biology IIA &amp; IIB</td>
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<td>Geography</td>
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<td>English IIA</td>
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<tr>
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<td>Philosophy IIA &amp; IIB</td>
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<tr>
<td>Physics</td>
<td>Physics II</td>
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<tr>
<td>Psychology</td>
<td>Psychology IIA &amp; IIB</td>
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</tbody>
</table>

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

Accounting I — Students who include this subject in their course as a Part I subject are advised to discuss with the Dean the possibility of including Accounting IIA or Accounting IIB in their Part II subjects. However, both Accounting IIA and Accounting IIB must be passed to gain credit for one Part II subject; in exceptional cases one of these subjects plus additional work, e.g. Mathematics IIB Part (I), may be acceptable.

Economics IIA — Students who include this subject in their course as a Part I subject are advised to discuss with the Dean the possibility of including Economics IIB or Economics IIB in their Part II subjects. However, both Economics IIA and Economics IIB must be passed to gain credit for one Part II subject; in exceptional cases one of these subjects plus additional work, e.g. Mathematics IIB Part (I), may be acceptable.

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 I and Physics IIA in his course.

3. 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 and Exclusion in the Faculty of Mathematics

(1) Under By-law 5.4.2.2(1) it is required that a full-time student shall have passed at least four subjects at the end of the second year of attendance.

(2) Under By-law 5.4.2.2(2) it is required that a part-time student shall have passed at least four subjects at the end of the fourth year of attendance.
(3) The Faculty Board will review all cases of students, who have failed to pass at least four subjects after one full-time and two part-time years, and may take action under By-law 5.4.1.2.

(4) The Faculty Board will review all cases of 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 By-law 5.4.1.2.

(5) Unless there are justifying reasons, failure in a compulsory subject for the second time automatically excludes a student from that subject under By-law 5.4.2.1 and exclusion from a compulsory subject automatically excludes a student from the degree course. The compulsory subjects are Mathematics I, Mathematics IIa, Mathematics IIc and Mathematics IIIa.

Knowledge of Teachers in Specific Subjects
In 1975 the Senate of the University established a number of committees to advise on the level of University studies required to maintain an informed competence in particular disciplines. These enquiries were particularly directed towards secondary school teaching but their application is, in most cases, quite general. The advice tendered by the committees was accepted by Senate and is reproduced below.

<table>
<thead>
<tr>
<th>Disciplines</th>
<th>Level of Study Recommended</th>
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</thead>
<tbody>
<tr>
<td>Classics</td>
<td>A major in Latin or Greek with some studies in both</td>
</tr>
<tr>
<td>Commerce &amp; Economics</td>
<td>Two years (preferably three) of Economics including Economics II or IIa; Accounting I and Legal Studies I.</td>
</tr>
<tr>
<td>English</td>
<td>A major in English, together with one additional subject chosen from English, Drama or Linguistics.</td>
</tr>
<tr>
<td>Geography</td>
<td>Geography IIa, Geography IIb, Geography IIc, Geography IIIa. An Honours Degree in Geography would be of considerable benefit.</td>
</tr>
<tr>
<td>History</td>
<td>At least two, preferably three, courses in History</td>
</tr>
<tr>
<td>Mathematics</td>
<td>Mathematics IIIa as a minimum</td>
</tr>
<tr>
<td>Modern Languages</td>
<td>Ideally an Honours Degree in the foreign language proposed, together with a period of residence in the appropriate foreign country.</td>
</tr>
<tr>
<td>Science</td>
<td>A Part III subject in the relevant science, together with some breadth in scientific disciplines.</td>
</tr>
</tbody>
</table>

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. It will be noted that any graduate holding the degree of Bachelor of Mathematics possesses the prerequisites required for the Diploma in Education and the prerequisites for at least one curriculum and method subject, namely Mathematics. These prerequisites are stated in terms of subjects of the University of Newcastle. Applicants with qualifications from other universities, 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.

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Prerequisites</th>
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<tbody>
<tr>
<td>(a) English</td>
<td>(i) A Part I &amp; Part II subject in English:</td>
</tr>
<tr>
<td>(b) History</td>
<td>(i) A Part II subject in History</td>
</tr>
<tr>
<td>(c) Modern Languages</td>
<td>A Part III subject in a modern language</td>
</tr>
<tr>
<td>(d) Classics</td>
<td>A Part III subject in Greek or Latin</td>
</tr>
<tr>
<td>(e) Geography</td>
<td>A Part III subject in Geography</td>
</tr>
<tr>
<td>(f) Commerce/Economics</td>
<td>B.A. including Economics IIa</td>
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<tr>
<td></td>
<td>or B.Com. including Economics II</td>
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<tr>
<td>(g) Social Science/ Studies</td>
<td>Out of Economics, Geography, History, Psychology,</td>
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<tr>
<td></td>
<td>Sociology, Legal Studies, Economic History</td>
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<tr>
<td></td>
<td>one subject at Part II level</td>
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<td></td>
<td>and</td>
</tr>
<tr>
<td></td>
<td>two other subjects at Part I level</td>
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<tr>
<td>(h) Mathematics</td>
<td>(i) At least four subjects in Mathematics for the degree of</td>
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<td></td>
<td>B.A., B.Math., or B.Sc.</td>
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<td></td>
<td>or</td>
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<td></td>
<td>(ii) A degree in a field of applied science, with experience</td>
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<td></td>
<td>in the application of mathematics</td>
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<tr>
<td>(i) Science</td>
<td>(i) Three subjects from the disciplines of Biology, Chemistry, Geography, Physics, or related fields of applied science, such subjects to be drawn from at least two of the disciplines of Biology, Chemistry, Geography, Physics and</td>
</tr>
<tr>
<td></td>
<td>(ii) at least one other subject drawn from any of the above</td>
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<td></td>
<td>or from Mathematics, Geography, or Psychology</td>
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<tr>
<td>(j) Primary</td>
<td>No specific prerequisites.</td>
</tr>
</tbody>
</table>

Note
A Part II subject cannot be a prerequisite or a pass in a Part I subject in the same discipline. A Part III subject cannot be a pass in a Part I subject and a Part II subject in the same discipline.

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.
8. Withdrawal
A candidate may withdraw from a subject only by notifying the Secretary to the University in writing of his withdrawal within seven days of the date of withdrawal.
(b) A candidate who withdraws after the sixth Monday in second term from a subject in which he has enrolled shall be deemed to have failed in that subject. However, such a candidate may apply to the Dean, who, after consultation with the Head of Department concerned, may allow him to withdraw without penalty.

9. Prerequisites and Corequisites
(a) Except with the permission of the Faculty Board, granted after considering any recommendation made by the Head of the Department offering a subject, a candidate may enrol in that subject unless he has passed the subjects prescribed as its prerequisites at any grade which may be specified and has already passed or concurrently enrols in or is already enrolled in the subjects prescribed as its corequisites.

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

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, to qualify for the ordinary degree a candidate shall pass nine subjects, including:
(a) Mathematics I, Mathematics II, Mathematics III and Mathematics IV; and
(b) at least one of Mathematics H1B, Computer Science III, Statistics III or one Part III subject chosen from the Schedules to the Requirements.

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, 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 diploma 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 proposed his 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.

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 (i) and Division (ii).

21. **Medal**

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

22. **Equivalent Honours**

(a) On the recommendation of the Heads of the Departments concerned and with the permission of the Dean, a graduate may enrol in a Part IV subject as a full-time or a part-time student, provided that:

(i) he has not completed a Part IV subject in the disciplines concerned at this or any other tertiary institution approved for this purpose by the Faculty Board;

(ii) he is not otherwise eligible to enrol in that Part IV subject pursuant to these degree Requirements.

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

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.
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(2) 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 II C, Mathematics III A and one of Mathematics III B, 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 III C shall not be entitled to count either Psychology III A or III B;
(v) a candidate counting Psychology III C shall not be entitled to count either Psychology III A or Psychology III B;
(vi) a candidate counting Economics III C shall not be entitled to count either Economics III A or Economics III B;
(vii) a candidate counting Geology III C shall not be entitled to count either Geology III A or Geology III B.

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 II A, Mathematics II C, Mathematics III A and one of Mathematics III B, Computer Science III, Statistics III or a Part III subject chosen from the Schedules of Subjects approved for the degree of Bachelor of Mathematics
(b) six subjects chosen from the other subjects listed in the Schedule of Subjects approved for the degree of Bachelor of Science

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 II A, Mathematics II C, Mathematics III A and one of Mathematics III B, 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 50 units selected from the Schedule of Subjects approved for the degree of Bachelor of Metallurgy.

27. Commerce/Mathematics

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

28. Engineering/Mathematics

After completing a successful first year of study towards either the degree of Bachelor of Engineering or the degree of Bachelor of Mathematics, a candidate may enrol in an Engineering/Mathematics course. A candidate who has enrolled in such a
combined course shall qualify for admission to the degree of Bachelor of Engineering and the ordinary degree of Bachelor of Mathematics, by passing Mathematics I, Mathematics IIA, Mathematics IIC, Mathematics IIIA and one of Mathematics IIIB, Computer Science III, Statistics III or a Part III subject chosen from the Schedules of Subjects approved for the degree of Bachelor of Mathematics, and by satisfactorily completing other subjects to a minimum value of 50 units taken from the Schedule of Subjects approved for the degree of Bachelor of Engineering (Mechanical), Bachelor of Engineering (Industrial), or Bachelor of Engineering (Electrical), Bachelor of Engineering (Chemical) or Bachelor of Engineering (Civil).

29. Economics/Mathematics

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

SCHEDULE A

Mathematics Subjects

<table>
<thead>
<tr>
<th>Subject</th>
<th>Remarks including Prerequisites and Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part I</td>
<td>Mathematics I</td>
</tr>
<tr>
<td>Mathematics IIA</td>
<td>Prerequisite Mathematics I</td>
</tr>
<tr>
<td>Mathematics IIB</td>
<td>Prerequisite Mathematics I</td>
</tr>
<tr>
<td>Mathematics IIC</td>
<td>The Dean may permit a candidate to take this subject in two parts, each of three terms duration</td>
</tr>
<tr>
<td>Part III</td>
<td>Mathematics IIIA</td>
</tr>
<tr>
<td>Mathematics IIIB</td>
<td>Prerequisites Mathematics IIA</td>
</tr>
<tr>
<td>Mathematics IIIB</td>
<td>Prerequisites Mathematics IIIB</td>
</tr>
<tr>
<td>Part IV</td>
<td>Mathematics IV</td>
</tr>
<tr>
<td>Mathematics IIA &amp; Mathematics IIIB</td>
<td>Prerequisites Mathematics IIA &amp; either Mathematics IIIB or Computer Science III</td>
</tr>
</tbody>
</table>

Prerequisites

Subject

**Part II**

**Computer Science II**

**Part III**

**Computer Science III**

**Statistics III**

**Computer Science Subjects**

**Remarks including Prerequisites and Corequisites**

**Prerequisite Mathematics I**

**Prerequisites Computer Science II, Mathematics IIA & Mathematics IIC**

**Statistics Subject**

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

SCHEDULE B

**Subjects With a Substantial Mathematical Content**

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

A candidate counting Psychology IIA and either Accounting II or Psychology IIA shall qualify for admission to the ordinary degree of Bachelor of Economics.

**Corequisites Mathematics I, Physics IIA**

**Prerequisites Engineering I & Mathematics I**

**Prerequisites Mathematics I, Psychology I.**

A candidate counting Psychology IIA shall not be entitled to count Psychology IIA or Psychology IIB.

**Prerequisites Mathematics IIA & Mathematics IIC & either Accounting II or Accounting III**

**Prerequisites Mathematics IIA & Mathematics IIC & either Biology IIA or Biology IIB**

**Prerequisites Chemical Engineering II, Mathematics IIA & Mathematics IIC (including Topic F)**

**Prerequisites Civil Engineering II, Mathematics IIA & Mathematics IIC**

**Prerequisites Mathematics IIA & Mathematics IIC** (including Topics CO, D)

**Prerequisites Mathematics IIA & Mathematics IIC** (including Topics CO, D)

**Prerequisites Economics IIA, Mathematics IIA & Mathematics IIC**

**Prerequisites Physics IIA, Mathematics IIA, Mathematics IIC & Geology IIA**

**Prerequisites Mathematics IIA & Mathematics IIC**

**Prerequisites Mathematics IIA & Mathematics IIC** (including Topics F & H)

**Prerequisites Physics II, Mathematics IIA & Mathematics IIC**

**Prerequisites Mathematics IIA, Mathematics IIC & either Psychology IIC or Psychology IIA and Psychology IIB**

**Combining Honours Subjects**

**Mathematics/Physics IV**

**Mathematics/Psychology IV**

**Prerequisites Mathematics IIA & Psychology IIC**
NOTES ON COMBINED DEGREE COURSES

ARTS/MATHEMATICS

The details for the combined course follow simply from the Requirements for each degree. Each degree requires nine subjects so the combined degree requires 18 subjects less four subjects for which standing may be given, thus the combined degree should contain 14 subjects. The Bachelor of Mathematics requires Mathematics I, Mathematics II, Mathematics III, Mathematics IIIA and either Mathematics IIIB, Computer Science III, Statistics III or a Part III subject from Schedule B of the Schedule of Subjects approved for the degree of Bachelor of Mathematics. This leaves twelve subjects which must clearly satisfy the Requirements for the 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 II and Mathematics III and another subject which should be a Part I or Part II subject approved for the degree of Bachelor of Arts,
Year III  Mathematics IIIA plus two other subjects which must include at least one Part III subject,
Year IV  either Mathematics IIIB, Computer Science III, Statistics III or a Schedule B subject from the Requirements for Bachelor of Mathematics plus two other subjects which will complete the Requirements for the Arts degree.

COMMERCE/MATHEMATICS

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

Year I  Mathematics I
Year II  Mathematics II
Year III  Mathematics IIIA
Year IV  Mathematics IIIB, Computer Science III, Statistics III or Part III Schedule B subject from the Requirements for Bachelor of Mathematics,
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 II, Mathematics III, Mathematics IIIA and one of Mathematics IIIB, Computer Science III, Statistics III or a Part III subject from Schedule B of the Schedule of Subjects approved for the degree of Bachelor of Mathematics, and all the subjects satisfying the Requirements for the degree of Bachelor of Economics.

The course could be pursued in the following manner:

Year I  Mathematics I
Year II  Mathematics II
Year III  Mathematics IIIA
Year IV  Mathematics IIIB or Part III subject from the Schedules of Subjects for B.Math,
Year V  Chemical Engineering III Projects II Elective I

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

Year I  CE111 Statics
Year II  Mathematics IIIA
Year III  Chemical Engineering I Part I
Year IV  Mathematics IIIB or Part III subject from the Schedules of Subjects for B.Math,
Year V  Chemical Engineering III Projects II

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

Year I  CE111 Statics
Year II  Mathematics IIIA
Year III  Chemical Engineering I Part 2
Year IV  CE215 Mechanics of Solids
Year V  CE221 Properties of Materials

The course could be pursued in the following manner:

Year I  Mathematics I
Year II  Mathematics II
Year III  Mathematics IIIA
Year IV  Mathematics IIIB, Computer Science III, Statistics III or a Part III Schedule B subject from the Requirements for B.Math,
Year V  Three B.E. subjects
(iv) B.E./B.Math. in Industrial Engineering

Year I
Mathematics I
Physics IA
Chemistry IS
CE111 Statics
EE111 Circuit Fundamentals
GE112 Introduction to Engineering Design
ME111 Graphics and Engineering Drawing
ME131 Dynamics
ME121 Workshop Practice

Year II
EE211 Energy Conversion
EE221 Semiconductor Devices
EE232 Electrical Circuits
EE233 Advanced Circuit Analysis
EE241 Automatic Control
EE244 Communications
GE350 Seminar
1 unit from EE300, 400 Electives
4 units of electives outside Engineering

Year III
EE480 Project
EE481 Project or 2 units from EE300, 400 subjects
EE491 Seminar
9 from EE300, 400 subjects
1 unit of elective (Engineering Funct.-non E.E.)

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

Year I
Mathematics I
Physics IA
Chemistry IS
CE111 Statics
EE111 Circuit Fundamentals
GE112 Introduction to Engineering Design
ME111 Graphics and Engineering Drawing
ME131 Dynamics
ME121 Workshop Practice

Year II
ME201 Experimental Methods I
ME202 Dynamics of Engineering Systems
MATHMATICS/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 IIIIB, Computer Science III, Statistics III or a Part III subject from Schedule B of the Requirements. This leaves nine subjects which must clearly satisfy the Requirements for the Science degree.

The course could be pursued in the following manner:

Year I Mathematics I and three other Part I subjects.
Year II three Part II subjects including Mathematics IIA and Mathematics IIC and another Part I subject.
Year III Mathematics IIIA plus two other subjects which must include at least one Part III subject.
Year IV one of Mathematics IIIIB, Computer Science III, Statistics III or a Schedule B subject from the Requirements for Bachelor of Mathematics, plus two other subjects which will complete the Requirements for the Science degree.

MATHMATICS/METALLURGY

A combined course leading to admission to the degrees of Bachelor of Metallurgy and Bachelor of Mathematics as approved by the Faculty Boards of Mathematics and Engineering shall include Mathematics I, Mathematics IIA, Mathematics IIC, Mathematics IIIA and one of Mathematics IIIIB, 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 to a minimum of 50 units taken from the Schedule of Subjects approved for the degree of Bachelor of Metallurgy.

### Subject Units

<table>
<thead>
<tr>
<th>Year I</th>
<th>Mathematics 1 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Physics 1A 4</td>
</tr>
<tr>
<td></td>
<td>Met141 Mechanical Properties of Materials 1</td>
</tr>
<tr>
<td></td>
<td>Met151 Microstructure of Materials 1</td>
</tr>
<tr>
<td></td>
<td>Met181 Atomic Structure of Materials 1</td>
</tr>
<tr>
<td></td>
<td>Met182 Electronic Structure of Materials 1</td>
</tr>
<tr>
<td></td>
<td>Met211 Chemical Metallurgy 1</td>
</tr>
<tr>
<td></td>
<td>ME111 Graphics and Engineering Drawing 1</td>
</tr>
<tr>
<td></td>
<td>GE112 Introduction to Engineering Design 1</td>
</tr>
<tr>
<td></td>
<td>Che101 Industrial Process Principles 1</td>
</tr>
<tr>
<td></td>
<td>MET11 Workshop Practice 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year II</th>
<th>Mathematics IIIA 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mathematics IIIB 4</td>
</tr>
<tr>
<td></td>
<td>Met221 Metallurgical Thermodynamics 1</td>
</tr>
<tr>
<td></td>
<td>Met212 Metallurgical Stoichiometry 1</td>
</tr>
<tr>
<td></td>
<td>Met213 Applied Statistics 1</td>
</tr>
<tr>
<td></td>
<td>Met231 Rate Processes 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year III</th>
<th>Mathematics IIIA 8</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Met301 Communication Skills 4</td>
</tr>
<tr>
<td></td>
<td>Che331 Process Economics 5</td>
</tr>
<tr>
<td></td>
<td>Met361 Extraction Metallurgy 1</td>
</tr>
<tr>
<td></td>
<td>Met391 Physical Metallurgy Laboratory 1</td>
</tr>
<tr>
<td></td>
<td>OR Met392 Chemical Metallurgy Laboratory 1</td>
</tr>
<tr>
<td></td>
<td>Electives—4 units</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year IV</th>
<th>Mathematics IIIIB or a Part III subject from the Schedules of Subjects for B.Math, 8</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6 units from Met300 subjects</td>
</tr>
<tr>
<td></td>
<td>Electives—2 units (see note below)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year V</th>
<th>Met401 Directed Reading 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>11 units from Metallurgy 400 subjects</td>
</tr>
</tbody>
</table>

1—To include Topics A, CO and D.
2—To include Topics F, G, K and L.

Electives

Of the elective units in the combined degree course, no more than four may be taken from the list for Elective I in the Bachelor of Metallurgy degree schedule. Mathematics II Topic B (EM2B) should be included as an elective.

The elective list covering subjects which may be taken in lieu of Mathematics IIIIB is given in the Schedules for the degree of Bachelor of Mathematics.

**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 established to supervise the course of the Diploma in Computer Science.

2. An applicant for registration as a candidate for the Diploma shall:
   (i) have satisfied all the requirements for admission to a degree in the University of Newcastle, or
   (ii) have satisfied all the requirements for admission to a degree in another university or institution approved for this purpose by the Board, or
(iii) hold other qualifications approved for this purpose by the Senate on the recommendations of the Board and the Faculty Board.

3. 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.

4. An applicant for registration as a candidate for the Diploma may be granted standing by the Board for work completed in this University, or in another university or 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 conferral or award.

5. (a) To complete a subject qualifying towards the Diploma, a candidate shall attend such lectures, tutorials, seminars and laboratory classes, and submit such written work as the Board may require.

(b) To pass a subject, a candidate shall complete the subject and pass such examinations as the Board may require.

6. The Board shall approve a programme of studies for each candidate. This programme may be varied only with the approval of the Board.

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

(b) A candidate who after:
the eighth Monday in First Term, in the case of a subject lasting only the first half-year; the sixth Monday in Second Term, in the case of a subject lasting the whole year; the second Monday in Third Term, in the case of a subject lasting only the second half-year; withdraws from a subject in which he has enrolled shall be deemed to have failed in that subject, unless granted permission by the Dean of the Faculty of Mathematics to withdraw without penalty.

8. 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 satisfactorily a course of studies, comprising 11 units of work chosen from the Schedule of Subjects provided that the subjects passed:
(a) shall include all the subjects in Group I, unless, in order to satisfy provisions of sub-section (c) of this Section, the Board has prescribed for the candidate concerned an alternative subject or subjects for one or more of the subjects in this Group;
(b) shall not include more than two units from subjects in Group III;
(c) shall not include a subject which, in the opinion of the Board, substantially overlaps the content of a course completed or work presented for another degree or diploma; and
(d) shall be those prescribed in the programme approved by the Board.

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

10. Group I subjects shall be offered each year, but subjects listed in Groups II and III may not necessarily all be offered in any one year.

11. Notwithstanding the provisions of Section 8, the Board may from time to time approve a subject to be counted as a Group II or Group III subject for one specific year.

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.

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. An applicant for registration as a candidate for the Diploma may be granted standing on conditions to be determined by the Faculty Board, provided that standing may not be granted in respect of any studies for which credit has been given for admission to a degree or for the award of another diploma.

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

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

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

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

**REQUIREMENTS FOR THE DEGREE OF MASTER OF MATHEMATICS**

1. An application to register as a candidate for the degree of Master of Mathematics shall be made on the prescribed form which shall be lodged with the Secretary at least one full calendar month before the commencement of the term in which the candidate desires to register.

2. A person may register for the degree of Master of Mathematics if:---
(a) he is a graduate or graduand of the University of Newcastle or other approved University with Honours in the subject to be studied for that degree; or
(b) he is a graduate or graduand of the University of Newcastle or other tertiary institution approved for this purpose; or
(c) in exceptional cases he produces evidence of such academic and professional attainments as may be approved by the Senate, on the recommendation of the Faculty Board.

3. In the case of applicants desiring to register under provision 2(b), and (c), the Faculty Board may require the candidates to carry out such work and sit for such examinations as the Board may determine before registration as a candidate for the degree of Master of Mathematics is confirmed.

4. In every case, before permitting an applicant to register as a candidate, the Faculty Board shall be satisfied that adequate supervision and facilities are available.

5. An applicant approved by the Faculty Board shall register in one of the following categories:—
(i) Student in full-time attendance at the University.
(ii) Student in part-time attendance at the University.

6. (i) Every candidate for the degree shall be required to submit a thesis embodying the results of research carried out by him during his candidature, to take such examination and to perform such other work as may be prescribed by the Faculty Board. The candidate may submit also for examination any work he has published, whether or not such work is related to the thesis.
(ii) The research and other work as provided in paragraph 6 (i) shall be conducted under the direction of a supervisor appointed by the Faculty Board or under such conditions as the Faculty Board may determine.
(iii) A part-time candidate shall, except in special circumstances:—
i. conduct the major proportion of his research in the University; and
ii. take part in research seminars within the Department in which he is working.
(iv) Every candidate shall submit annually a report on his work to his supervisor for transmission to the Higher Degree Committee.
(v) Every candidate shall submit three copies of the thesis as provided under paragraph 6(i). All copies of the thesis shall be in double-spaced typescript, shall include a summary of approximately 200 words, and a certificate signed by the candidate to the effect that the work has not been submitted for a higher degree to any other University or institution. The ORIGINAL copy of the thesis for deposit in the Library shall be prepared and bound in a form approved by the University. The other two copies of the thesis shall be bound in such manner as allows their transmission to the examiners without possibility of their disarrangement.
(vi) It shall be understood that the University retains the three copies of the thesis and is free to allow the thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act (1968) the University may issue the thesis in whole or in part in photostat or microfilm or other copying medium.
7. No candidate shall be considered for the award of the degree until the lapse of six complete terms from the date from which the registration becomes effective, save that in the case of a candidate who has obtained the degree of Bachelor with Honours or a qualification deemed by the Faculty Board to be equivalent or who has had previous research experience, this period may, with the approval of the Faculty Board, be reduced by up to three terms.

8. For each candidate there shall be two examiners appointed by the Senate, one of whom shall be an external examiner.

9. A candidate who fails to satisfy the examiners may be permitted to resubmit his thesis in an amended form. Such a resubmission must take place within twelve months from the date on which the candidate is advised of the result of the first examination. No further resubmission shall be permitted.

A separate sheet on the preparation and binding of higher degree theses is available on application.

**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 enroll 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** — see note on progressive assessment below.

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

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

**DEGREE OF BACHELOR OF MATHEMATICS**

**SCHEDULE A**

**Preliminary Notes**

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

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

**Progressive Assessment**

From time to time during the year students will be given assignments, tests, etc. The student's performance in this work will be taken into account in the following manner.

(a) For the implementation of By-law 5.4.1.1 which deals with unsatisfactory progress. A copy of this By-law appears in the General Supplement supplied with this Handbook.

(b) Where a student's performance during the year has been better than his performance in the final examination, then the former will be taken into account in determining his final result. On the other hand, when a student's performance during the year has been worse than his performance in the final examination, then his performance during the year will be ignored in determining his final result.

(i) **MATHEMATICS SUBJECTS**

**PART I SUBJECTS**

**661100 Mathematics I**

**Prerequisites** Nil

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

**Examination** Two 3-hour papers

**Content**

Topics

*AL* — Algebra

*AN* — Real Analysis

*CA* — Calculus

*SC* — Statistics and Computing
PART I TOPICS

Algebra (Topic AL)—R. B. Eggleton

Prerequisites  Nil

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

Content

Text
Anton, H.  Elementary Linear Algebra 2nd edn  (Wiley 1977)
Brisley, W.  A Basis for Linear Algebra  (Wiley 1973)
Kolman, B.  Elementary Linear Algebra (Macmillan 1977)
Liebeck, H.  Algebra for Scientists and Engineers (Wiley 1971)
Lipschutz, S.  Linear Algebra (Schaum 1974)
Tropper, M. A.  Linear Algebra (Nelson 1973)

Real Analysis (Topic AN)—R. F. Berghout

Prerequisites  Nil

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

Content

Text
Apostol, T.  Calculus Vol. 1 2nd edn (Blaisdell 1967)
Giles, J. R.  Real Analysis: An Introductory Course (Wiley 1973)
Spivak, M.  Calculus (Benjamin 1967)

Calculus (Topic CA)—M. J. Hayes

Prerequisites  Nil

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

Content

Text
Ayres, F.  Calculus (Schaum 1974)
Apostol, T.  Calculus Vol. 1 2nd edn (Blaisdell 1967)
Hille, E. & Salas, S.  First Year Calculus Internat. Textbook Series (Blaisdell 1968)
Spivak, M.  Calculus (Benjamin 1967)

Statistics & Computing (Topic SC)—A. J. Dobson

Prerequisites  Nil

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

Content

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

Summaries and booklists for these topics are given on page 34 et seq. of this handbook.

The Department of Mathematics also offers jointly with the Department of Electrical Engineering, the subject Computer Science II. No student taking this subject may choose the Mathematics Topic I as a component of another Part II subject. A description and course outline of Computer Science II will be found on page 72 et seq.

When selecting topics for Part II subjects, students are advised to consider the prerequisites needed for the various Part III subjects offered in the Faculty of Mathematics (Mathematics IIIA, Mathematics IIIB, Statistics III and Computer Science III).

**List of Topics for Part II Mathematics subjects**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Corequisite or Pre-requisite Topic</th>
<th>Part III Topic Requiring this Part II Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Complex Analysis</td>
<td>CO or C*</td>
</tr>
<tr>
<td>B</td>
<td>Vector Calculus &amp; Differential Equations</td>
<td>CO or C*</td>
</tr>
<tr>
<td>C</td>
<td>Linear Algebra</td>
<td>M, N, P, PD, Q, S, TC, Y, Z</td>
</tr>
<tr>
<td>D</td>
<td>Numerical Analysis &amp; Computing</td>
<td>T, X, Z</td>
</tr>
<tr>
<td>E</td>
<td>Mathematical Models</td>
<td>PI, TC</td>
</tr>
<tr>
<td>F</td>
<td>Differentia Equations</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>Finite Mathematics</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>Probability &amp; Statistics</td>
<td>R, U, Y</td>
</tr>
<tr>
<td>I</td>
<td>Applied Statistics</td>
<td></td>
</tr>
<tr>
<td>J</td>
<td>e.g. Dynamics</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>e.g. Group Theory</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>Analysis of Metric Spaces</td>
<td></td>
</tr>
</tbody>
</table>

*No longer offered.

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

**662100 Mathematics IA**

**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 topic from A, F, G, or H may be substituted for B. Additional substitutions may be allowed in the case of candidates who have passed the subject Mathematics IIIB. In addition, students taking Mathematics IA will be required to prepare a report on some aspect of the history of the mathematics studied in this subject.

**662200 Mathematics IIIB**

**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, I, J, K or L may be included. Students in the Faculty of Mathematics may, with the consent of the Dean, take Mathematics IIIB in two parts, each consisting of two topics.

**662300 Mathematics IIC**

**Prerequisite**
Mathematics I

**Pre- or Corequisite**
Mathematics IA

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

**Examination**
Each topic is examined separately

**Content**
Topics K, L and one of the pairs of topics G and J, H and I or G and H. Students who may wish to proceed to Statistics III as a Part III subject should select topics H and I. Subject to the consent of the Head of the Department one topic from A to J may be substituted for one of the topics I or J.

**Notes**
1. Students whose course includes a Schedule B subject may have their choice of topics restricted further than is set out in the rules above.
2. Students whose courses include Physics IIIA are advised to include topics CO, H & one of B, D or F in their Mathematics Part II subjects; this may require the use of the substitution rules.

3. Students who passed a Part II Mathematics subject prior to 1974 and who wish to take further Part II Mathematics subjects should note that the topic coded “L” in 1974-1978 corresponds to the topic coded “A” in previous years. Such students may require special permission for their selection of Part II topics, and should consult with the Head of the Department.

4. Topics C & E existing before 1978 are no longer offered as separate topics.

PART II TOPICS

662101 Topic A—Mathematical Models—R. J. Vaughan

Prerequisite

or Corequisite
Topic C
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
Haberman, R. Mathematical Models (Prentice-Hall 1977)
Kemeny, J. G. & Snell, J. L. Mathematical Models in Social Sciences (Blaisdell 1963)
Noble, B. Applications of Undergraduate Mathematics in Engineering (M.A.A./Collier-Macmillan 1967)
Rapoport, A. & Channah, A. M. Prisoner’s Dilemma (Michigan U.P. 1965)
Smith, J. M. Mathematical Ideas in Biology (Cambridge 1971)

662103 Topic B—Complex Analysis—M. J. Hayes

Prerequisite

or Corequisite
Topic C
Topic CO

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

Examination
One 2-hour paper

Content

Text

References
Paliouras, J. D. Complex Variables for Scientists and Engineers (Macmillan 1975)

662109 Topic CO — Vector Calculus & Differential Equations — J. G. Cooper/W. Brisley

Prerequisites
Nil

Hours
2 lecture hours per week and 1 tutorial hour per week

Examination
One 3-hour paper

Content

Text
Either
or both
and

References
Courant, R. *Differential and Integral Calculus* Vol. II (Wiley 1968)
Sneddon, I. N. *Fourier Series* (Routledge 1961)

662104 Topic D—Linear Algebra — R. B. Eggleton

Prerequisites
Nil

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

Examination
One 2-hour paper

Content

Texts
Lipschutz, S. *Linear Algebra* (Schaum 1974)
Rorres, C. & Anton, H. *Applications of Linear Algebra* (Wiley 1977)

References
Ayres, F. *Matrices* (Schaum 1962)
Brisley, W. *A Basis for Linear Algebra* (Wiley 1973)
Lang, L. H. *Elementary Linear Algebra* (Wiley 1968)
Nering, E. D. *Linear Algebra and Matrix Theory* (Wiley 1964)
Noble, B. *Applications of Undergraduate Mathematics in Engineering* (M.A.A. 1967)

662202 Topic E—Numerical Analysis & Computing—R. J. Vaughan

Prerequisites
Nil

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

Examination
One 2-hour paper

Content

Text

References
Balfour, A. & Beveridge, W. T. *Basic Numerical Analysis with Fortran* (Heinemann 1973)
Kreitzberg, C. B. & Shneiderman, B. *The Elements of Fortran Style* (Harcourt, Brace & Jovanovich 1972)

662203 Topic G—Finite Mathematics—W. D. Wallis

Prerequisites
Nil

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

Examination
One 2-hour paper

Content
This course will be an introduction to finite mathematics and its application to operations research and behavioural mathematics. The
content will include linear programming, theory of games, graph-theoretic models, Markov processes, inventory and storage models and queueing theory.

References
Owen, G. Finite Mathematics (Saunders 1970)
Santy, T. L. Topics in Behavioural Mathematics (M.A.A. 1973)

662204 Topic III—Probability & Statistics—P. K. Smrz

Prerequisite Nil

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

Examination One 2-hour paper

Text
Freund, J. E. Mathematical Statistics 2nd edn (Prentice-Hall 1971)
Mendenhall, W. & Scheaffer, R. L. Mathematical Statistics with Applications (Duxbury 1973)

References

Gnedenko, B. V. The Theory of Probability Chapters I & II (Chelsea 1962)
Kolmogorov, A. N. Foundations of the Theory of Probability (Chelsea 1950)
Lipschutz, S. Theory and Problems of Probability (Schaum 1968)
Loève, M. Probability Theory pp.1-18 (Van Nostrand 1960)

662301 Topic I—Applied Statistics—R. W. Gibberd

Prerequisite or Corequisite Topic H

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

Examination One 2-hour paper

Text
Freund, J. E. Mathematical Statistics 2nd edn (Prentice-Hall 1971)

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

Mathematical Statistics 2nd edn (Prentice-Hall 1971)

Introduction to Mathematical Statistics 4th edn (Wiley 1971)

Applied Regression Analysis (Wiley 1966)

Finite Markov Chains (Van Nostrand 1967)

Introduction to Statistics: A Nonparametric Approach 2nd edn (Houghton/Mifflin 1976)
662302 Topic J — Topic in Applied Mathematics
  e.g. Dynamics — C. A. Croxton

Prerequisites
  Topics C and E

or Corequisite
  Topic CO

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

Examination
  One 2-hour paper

Content

Text
  Nil

References
  Chorlton, F.  Textbook of Dynamics (Van Nostrand 1961)
  Goodman, L. E.  Dynamics (Blackie 1963)
  Marion, J. B.  Classical Dynamics (Academic 1970)

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

Prerequisites
  Nil

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

Examination
  One 2-hour paper

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

Text
  Nil

References
  Budden, F. J.  The Fascination of Groups (Cambridge U.P. 1972)
  Coxeter, H. S. M.  Introduction to Geometry (Wiley 1961)
  Herstein, I. N.  Topics in Algebra 2nd edn (Wiley 1975)
  Weyl, H.  Symmetry (Princeton U.P. 1952)

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

Prerequisites
  Nil

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

Examination
  One 2-hour paper

Content
  Examples of metric and normed linear spaces; the topology of metric spaces. Convergence of sequences, completeness. Cluster points and closure. Continuity of mappings and of linear mappings on normed linear spaces, uniform continuity. Uniform convergence of sequences and series of real mappings, applications to differentiation and integration of sequences and series of real mappings, power series. Compactness, the equivalence of the various forms of compactness for metric spaces; finite dimensional normed linear spaces.

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

References
  Dieudonné, J.  Foundations of Modern Analysis (Academic 1960)
  Giles, J. R.  Real Analysis—an Introductory Course (Wiley 1973)
  Goldberg, R. R.  Methods of Real Analysis (Ginn Blaisdell 1964)
  Mendelson, B.  Introduction to Topology (Blackie 1963)
  Simmons, G. F.  Introduction to Topology and Modern Analysis (McGraw-Hill 1963)
  White, A. J.  Real Analysis (Addison-Wesley 1968)

PART III SUBJECTS

The Mathematics Department offers two Part III Mathematics subjects, each comprising four topics chosen from the list below. It also offers Part III subjects in Computer Science and Statistics which are described on page 75 et seq.

Students wishing to proceed to Honours in Mathematics are required to take both Mathematics subjects. Students wishing to proceed to Combined Honours are required to take Mathematics IIIA together with the approp-
rial 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.

Passes in both Mathematics IIA and IIC are prerequisite for entry to Mathematics IIIA, and Mathematics IIA is pre or corequisite for Mathematics IIIB. It will be assumed that students taking a third-year subject in 1979 have already studied topics C0, D, K and L in 1978 (or C, D, E, K and L if passed prior to 1978) in their Part II subjects.

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

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

Summaries of these topics, together with texts and references, appear on page 43 et seq. of this handbook.

**List of Topics for Part III Mathematics**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Prerequisite</th>
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</thead>
<tbody>
<tr>
<td>FM</td>
<td>K, L</td>
</tr>
<tr>
<td>M</td>
<td>C, E</td>
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<tr>
<td>N</td>
<td>C, E</td>
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<td>O</td>
<td>K, L</td>
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<tr>
<td>P</td>
<td>CO, D, L</td>
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<tr>
<td>PD</td>
<td>E</td>
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<td>PL</td>
<td>F</td>
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<td>P2</td>
<td>B, C, E</td>
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<tr>
<td>R</td>
<td>H</td>
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<tr>
<td>S</td>
<td>C</td>
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<td>T</td>
<td>D, K</td>
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<td>TC</td>
<td>C, F</td>
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<td>U</td>
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<td>W</td>
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<td>X</td>
<td>D, K</td>
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<tr>
<td>Y</td>
<td>CO, H</td>
</tr>
<tr>
<td>Z</td>
<td>C, D, E</td>
</tr>
</tbody>
</table>

*This topic will not be offered in 1979.*

*No longer offered. From 1978 will be replaced by Topic CO.*

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

663100 Mathematics IIIA

**Prerequisites**

Mathematics IIA & IIC

**Hours**

4 lecture hours and 2 tutorial hours per week

**Examination**

Each topic is examined separately

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Content

A subject comprising four topics, which must include O or FM and both and at least one of P, PD, Q, R, U or Y. In addition, students taking this subject will be required to complete an essay on a topic chosen from the history or philosophy of Mathematics.

663200 Mathematics IIIB

**Prerequisites**

Mathematics IIIA

or Corequisite

**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 starred topics listed above,

Notes

1. In order to take both Mathematics IIA and Mathematics IIIB, a student must study eight topics from the above with the restriction that Topic O or Topic FM, and at least one of P, PD, Q, R, U or Y must be included in these eight topics.
2. Students whose course includes a subject from Schedule II 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.

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PART III TOPICS

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

**Prerequisites**

Topics K & L

**Hours**

1 lecture hour per week and 1 tutorial hour per fortnight

**Examination**

One 2-hour paper plus several assignments and short tests

Content

First and second year topics have introduced the real numbers axiomatically. But what reasons do we have for assuming the existence of a unique real number system? Where do the axioms come from? Why stop with the real, or complex, numbers? This topic is aimed at answering such questions. In the process some set theory, logic and the algebraic properties of various number systems will be studied. So will issues of cardinality. ("Are there more rationals than integers? More reals than rationals?") The foundations of geometry will also be investigated.

**Text**

Enderston, H. B. *Elements of Set Theory* (Academic 1977)
References
Birkhoff, G. & MacLane, S. A Survey of Modern Algebra 3rd edn (Macmillan 1965)
Burlill, C. W. Foundations of Real Numbers (McGraw-Hill 1967)
Cohen, I. & Ehrlich, G. The Structure of the Real Number System (Van Nostrand 1963)
Courant, R. & Robbins, H. What is Mathematics? (Oxford 1961)
Häfstrom, J. E. Introduction to Analysis and Abstract Algebra (Saunders 1967)
Halmo, P. Naive Set Theory (Van Nostrand 1960)
Landau, E. Foundations of Analysis (Chelsea 1951)
Wilder, R. Introduction to the Foundation of Mathematics (Wiley 1965)

663101 Topic M-General Tensors-W. T. F. Lau
Prerequisite Topic C or CO
Hours 1 lecture hour per week and 1 tutorial hour per fortnight
Examination One 2-hour paper
Content Vector spaces; basis, change of basis; dual spaces; dual basis; contravariant and covariant components. Point spaces. Tensor algebra. Tensor calculus; derivatives and differentials; Christoffel symbols; differential operators in curvilinear coordinates. Riemannian spaces; tangential and osculating Euclidean metrics; Geodesics; curvature tensor; Riemann-Christoffel tensor. Applications: dynamics; continuum mechanics.

References
Lichtenowicz, A. Elements of Tensor Calculus (Methuen 1962)
Sokolinikoff, I. S. Tensor Analysis—Theory and Applications to Geometry and Mechanics of Continua (Wiley 1964)
Willmore, T. J. An Introduction to Differential Geometry (Oxford 1972)

663102 Topic N—Variational Methods—T. K. Sheng
Prerequisite Topic CO
Hours 1 lecture hour per week and 1 tutorial hour per fortnight
Examination One 2-hour paper

References
Arthurs, A. M. Complementary Variational Principles (Pergamon 1964)
Elsgolc, L. E. Calculus of Variations (Pergamon 1963)
Hadley, G. & Kemp, M. C. Variational Methods in Economics (North-Holland 1971)
Mikhlin, S. G. Variational Methods in Mathematical Physics (Pergamon 1964)
Weinstock, R. Calculus of Variations (McGraw-Hill 1952)

663103 Topic O—Mathematical Logic—R. W. Robinson
Prerequisites Topics K & L
Hours 1 lecture hour per week and 1 tutorial hour per fortnight
Examination One 2-hour paper
Content Introduction: inference rules as a formalisation of deductive processes; sets; axiomatic theories; predicates. The sentential calculus, predicate calculus and predicate calculus with equality. First order theories; consistency, independence and completeness. Examples will be taken from the usual axiomatically defined Mathematical systems, and Gödel’s undecidability theorem will be discussed.
Text
Mendelson, E. *Introduction to Mathematical Logic* (Van Nostrand 1964)

References
Enderton, H. B. *A Mathematical Introduction to Logic* (Academic 1972)

663104 Topic P — Ordinary Differential Equations — J. G. Couper
Prerequisites
Topics CO, D & L
Hours
1 lecture hour per week and 1 tutorial hour per fortnight
Examination
One 2-hour paper

Content

Text

References
Coppel, W. A. *Stability and Asymptotic Behaviour of Differential Equations* (Heath 1965)
Hale, J. K. *Ordinary Differential Equations* (Wiley 1969)

663108 Topic PD — Partial Differential Equations — W. T. F. Lao
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 second 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
Hunt, E. B. *Artificial Intelligence* (Academic 1975)
McCameron, F. A. *COBOL Logic and Programming* (Irwin-Dorsey 1974)
McCarthy, J.  
Sammet, J. E.  
Siklossy, L.  
Tucker, A. B.  
van Rijsbergen, C. J.  

**LISP 1.5 Programmer's Manual** (MIT 1965)  
**Programming Languages: History and Fundamentals** (Prentice-Hall 1969)  
**Let's Talk LISP** (Prentice-Hall 1975)  
**Information Retrieval** (Methuen 1975)  

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**663105 Topic Q — Fluid Dynamics — Not offered in 1979**

**Prerequisites**  
Topics B, CO

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

**Examination**  
One 2-hour paper

**Content**  
Basic concepts: continuum, density, pressure, viscosity. Derivation of governing equations for the motion of an ideal (non-viscous) fluid. Investigation of simple flows; particularisation to cases where motion irrotational, and further, to instances where the flow can also be considered two dimensional (e.g., surface wave motion). Introduction to the powerful complex variable method of solution for the latter type of motion. Comparison between ideal and real fluid flows; boundary layers.

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**663106 Topic R — Theory of Statistics — P. K. Smrz**

**Prerequisite**  
Topic H

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

**Examination**  
One 2-hour paper

**Content**  

**Text**  
Nil

**References**  
Blumenthal, L. M.  
Coxeter, H. S. M.  
Fishback, W. T.  
Meschkowski, H.  
Tuller, A.  

**Studies in Geometry** (Freeman 1970)  
**Introduction to Geometry** (Wiley 1969)  
**Projective and Euclidean Geometry** (Wiley 1962)  
**Unsolved and Unsolvable Problems in Geometry** (Oliver & Boyd 1966)  
**A Modern Introduction to Geometries** (Van Nostrand 1967)

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**663201 Topic T — Group Theory — W. Brisley**

**Prerequisites**  
Topics D & K

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

**Examination**  
One 2-hour paper

**Content**  
Structure of groups: Sylow theorems for finite groups; Series decomposition of groups; soluble groups; nilpotent groups. Finite and infinite abelian groups. Free groups, and presentation of groups in terms of generators and relations.
Text
Baumslag, B. & Chandler, B.

OR
Macdonald, I. D.
The Theory of Groups (Oxford U.P. 1968)

Reference
Rotman, J. J.
The Theory of Groups (Allyn & Bacon 1966)

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

Prerequisites
Topics CO & F.

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

Examination
One 3-hour paper and assignments throughout the year

Content
This course will interest science, mathematics and engineering students who are interested in the theoretical foundations of computer science. 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
Hopcroft, J. E. & Ullman, J. D. Formal Languages and Their Relation to Automata (Addison-Wesley 1969)
Wirth, N. Algorithms + Data Structures = Programs (Prentice-Hall 1976)

663202 Topic U — Design and Analysis of Experiments — W. D. Wallis

Prerequisite
Topic H(*)

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

Examination
One 2-hour paper

Content
Concepts of experiments: the hypothesis, and hypothesis testing. Revision of the $\chi^2$ and $F$ distributions. One-way and two-way arrangements, and their analysis. Randomized blocks. The following will be discussed where appropriate: orthogonality; the general linear model; a posteriori analysis.

Text
Nil

References
Fisher, R. A. The Design of Experiments Any edn (Oliver & Boyd)
Peng, K. C. The Design and Analysis of Scientific Experiments (Addison-Wesley 1967)

(*) A knowledge of Fortran will be assumed.
While there is no corequisite topic, students are advised to study Topic R also.

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

Prerequisite
Topic L — Analysis of Metric Spaces

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

Examination
One 2-hour paper

Content
Sets and classes of sets: rings, algebras, $\sigma$-rings, $\sigma$-algebras, generated rings and generated $\sigma$-rings. Measures and outer measures: extension of measures, Lebesgue measure, measurable functions, combinations of measurable functions. Integration, integrable simple functions, integrable functions, Lebesgue integral, convergence theorems. $L^p$ spaces, Fubini's theorem.

Text
Nil

References
Bartle, R. G. The Elements of Integration (Wiley 1966)
de Barra, G.  Introduction to Measure Theory (Van
Nostrand 1974)
Halmos, P. R.  Measure Theory (Van Nostrand 1950)

663204  Topic W — Analysis of Normed Linear Spaces — J. R. Giles

Prerequisite  Topic L

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

Examination  One 2-hour paper

Content
Banach spaces; continuous linear mappings; topological and isometric isomorphisms. Finite dimensional spaces and their special properties. Dual spaces; the form of continuous linear functionals on example spaces. Hilbert space; the representation of continuous linear functionals. Hahn-Banach theorem; reflexivity. Category and Baire’s theorem; the open mapping, closed graph and uniform boundedness theorems. Conjugate mappings; adjoint and self-adjoint operators in Hilbert space. Complete orthonormal sets in Hilbert space.

Text
Giles, J. R.  Analysis of Normed Linear Spaces (University of Newcastle 1976)
References
Banach, S.  Théories des Opérations Linéaires 2nd edn (Chelsea)
Giles, J. R.  Analysis of Metric Spaces (University of Newcastle 1975)

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

Prerequisites  Topics D & K

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

Examination  One 2-hour paper

Content

Text  Nil

References
Birkhoff, G. D. & MacLane, S.  A Survey of Modern Algebra (Macmillan 1953)
Herstein, I. N.  Topics in Algebra (Wiley 1975)
Kaplansky, I.  Fields and Rings (Chicago U.P. 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, extension of probabilities, random variables, integration of random variables, various types of convergence of random variables, conditional expectations, independence of random variables and products of probability spaces.

Text  Nil

References
Burdill, C. W.  Measure, Integration and Probability (McGraw-Hill 1972)
Loève, M.  Probability Theory (Van Nostrand 1960)
663207  Topic Z — Mathematical Principles of Numerical Analysis —
C. A. Croxton

Prerequisites:  Topics C and D

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 multi-
step 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. Some analysis background
and some experience in programming computers is assumed but no
prerequisites of numerical analysis courses will be expected.

Text:  Nil

References:
Daniel, J. W. & Moore, R. E.  *Computation and Theory in Ordinary
   Differential Equations* (Freeman 1970)
Desai, C. & Abel, J.  *Introduction to the Finite Element Method*
   (Van Nostrand 1972)
Lambert, J. D.  *Computational Methods in Ordinary Differential Equations* (Wiley 1973)
Phillips, G. M. & Taylor, P. J.  *Theory and Applications of Numerical Analysis*
   (Academic 1973)

664109  Mathematics IV

Prerequisites:  Mathematics IIIA and either Mathematics IIIB or Computer Science III, and additional work
as prescribed by the Head of the Department of Mathematics.

A student desiring admission to this subject must apply in writing to the Head of Department before 7th December of the preceding
year.

Students who have passed Computer Science III may, with the permission of the Head of
the Department of Mathematics, select not more than half of their topics of study from a
supplementary list of courses related to computer science and given in other departments.
This list is printed on page 72.

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

Examination:  At least eight 2-hour final papers

A thesis, i.e., a study under direction of a
special topic using relevant published material
and presented in written form. The topics
offered may be from any branch of Mathemati-
ces including Pure Mathematics, Applied
Mathematics, Statistics, Computing Science
and Operations Research as exemplified in
the publication Mathematical Reviews.

Content:  A selection of topics, each of about 27 lectures, will be offered.
Summaries of topics which may be offered in 1979 follow.

PART IV TOPICS

664137  Introduction to Category Theory — R. F. Bergounioux

Prerequisite:  Topic X

Hours:  About 27 lecture hours

Examination:  One 2-hour paper

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

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

References
Dickson, S. An Introduction to Categorical Algebra (Obtainable from Mathematics Department)

664151 Radicals & Annihilators — R. F. Berghout
Prerequisites Nil
Hours About 27 lecture hours
Examination One 2-hour paper

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

Text Nil

References
Cohn, P. Algebra Vol.2 (Wiley 1977)
Divinsky, N. Rings and Radicals (Allen-Unwin 1964)
Herstein, I. N. Non-commutative Rings (Wiley 1968)
Kaplansky, I. Fields and Rings (Chicago 1969)
McCoy, N. The Theory of Rings (McMillan 1965)
Wagner, R. The Ring of the Nibelungen (Philips 1973)

664133 Concrete Group Theory—W. Brusley
Prerequisite Topic K
Hours About 27 lecture hours
Examination One 2-hour paper

Content
A course on some aspects of group construction, which will include discussion of: presentation of a group by generators and relations; presentation of a group as a group of permutations, and as a symmetry group or structure-preserving group; relations between groups and some geometrical objects; representation of a group as a group of matrices; construction of groups in various ways from known groups; constructions preserving varietal and categorical properties; construction of “generating” groups for certain classes.

Text Nil

References
Burrow, M. Representation Theory of Finite Groups (Academic 1965)
Coxeter, H. S. M. & Moser, W. O. J. Generators and Relations for Discrete Groups (Springer 1957)
Feit, W. J. Characters of Finite Groups (Benjamin 1969)
Magnus, W. et al, Combinatorial Group Theory (Interscience 1966)
Scott, W. R., Group Theory (Prentice-Hall 1964)
and other articles and books mentioned during the course.

664111 Fluid Statistical Mechanics—C. A. Croxton
Prerequisites Nil
Hours About 27 lecture hours
Examination One 2-hour paper

Content
Cluster-diagrammatic expansions—low density solutions; integro-differential 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.

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

664120 Quantum Mechanics—C. A. Croxton
Prerequisite Topic G
Hours About 27 lecture hours
Examination One 2-hour paper

Content
Operators; Schrödinger 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; Schrödinger equations of motion; Heisenberg equation of motion. Quantum molecular orbitals; hybridization; LCAO theory; MO theory.

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

664140 Dynamical Systems—J. G. Cooper
Prerequisites Topics I and P
Hours About 27 lecture hours
Examination One 2-hour paper

Content
This course will be concerned with the orbit structure of differential equations and diffeomorphisms, with an orientation towards their stable and generic properties.

Text Nil

References
Nitecki, Z. Differentiable Dynamics (M.I.T. 1971)

664152 Linear Statistical Models—A. J. Dobson
Prerequisite Topic R
Hours About 27 lecture hours
Examination One 2-hour paper

Content
Multivariate distributions, General Linear Model, Regression, Analysis of Variance, Analysis of covariance, Variance components, Experimental Design.

Text Nil

References
Graybill, F.A. Theory and Application of the Linear Model (Duxbury 1976)
Rao, C. R. Linear Statistical Inference and Its Applications (Wiley 1973)
Searle, S. R. Linear Models (Wiley 1971)
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)

Lancaster, P.  
Theory of Matrices (Academic 1969)

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

664142 Topological Graph Theory — R. B. Eggleton

**Prerequisite**  
Topic CO

**Hours**  
About 27 lecture hours

**Examination**  
One 2-hour paper

**Content**

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

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

**Text**

Nil

664141 Introduction to Number Theory — R. B. Eggleton

**Prerequisite**  
Topic CO

**Hours**  
About 27 lecture hours

**Examination**  
One 2-hour paper

**Content**

Several areas of elementary number theory will first be examined at an introductory level. These will include the Euclidean algorithm, Farey fractions, Diophantine equations, linear congruences and Euler's theorem. A rather detailed study of several major theorems will follow: these will be the Prime Number Theorem, the Quadratic Reciprocity Theorem, and Dirichlet's Theorem on primes in arithmetic progressions.

**Text**

Nil

**References**

Blackett, D. W.  
Elementary Topology: Combinatorial and Algebraic Approach (Academic 1967)

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

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

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

Ringel, G.  
Map Colour Theorem (Springer 1974)

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

Wilson, R. J.  
Introduction to Graph Theory (Oliver & Boyd 1972)
**664143 Families of Sets — V. Ficker**

**Prerequisite**
Topic V

**Hours**
About 27 lecture hours

**Examination**
One 2-hour paper

**Content**

**Text**
Nil

**References**
Dinculeanu, N. *Vector Measures* (Pergamon 1967)
Halmos, P. R. *Measure Theory* (Van Nostrand 1950)

**664154 Quantitative Aspects of Social Phenomena — R. W. Gibberd**

**Prerequisites**
Topics B, D & H

**Hours**
About 27 lecture hours

**Examination**
One 2-hour paper

**Content**
This topic will discuss a collection of mathematical models of social phenomena and introduce a number of strategies which might be considered when attempting to model complex phenomena. Areas covered will be selected from population dynamics, models of urban structure and urban development, man-power planning, social mobility, disequilibrium economics and the stock market.

**Text**
Nil

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

**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. Commutative Banach algebras; the Gelfand theory and the Gelfand representation theorem. Weak topologies, the Banach-Alaoglu theorem, the Gelfand topology. Involutions in Banach algebras; hermitian involutions; the Gelfand-Naimark representation theorem for commutative \( B^* \) algebras. Numerical range of an element in a normed algebra; relation of the numerical range to the spectrum; \( B^* \) algebras are symmetric, discussion of the Gelfand-Naimark representation theorem for \( B^* \) algebras. Applications of Banach algebra theory.

**Text**
Bonsall, F. F. & Duncan, J.

**References**
Bachman, G. & Narici, L.
Bonsall, F. F. & Duncan, J.
Gelfand, I. M., Raikov, D. A. & Shilov, G. E.
Naimark, M. A.
Rickart, C. E.
Simmons, G. F.
Wilansky, A.

*Complete Normed Algebras* (Springer 1973)


*Numerical Ranges of Operators on Normed Spaces and Elements of Normed Algebras* (Cambridge U.P. 1970)

*Commutative Normed Rings* (Chelsea 1964)

*Normed Rings* (Noordhoff 1959)

*General Theory of Banach Algebras* (Van Nostrand 1960)

*Introduction to Topology and Modern Analysis* (McGraw-Hill 1963)

*Functional Analysis* (Blaisdell 1964)
664158 Convex Analysis—J. R. Giles

Prerequisite or Corequisite: Topic W

Hours: About 27 lecture hours

Examination: One 2-hour paper

Content

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

The convex functions we study are defined on normed linear spaces. The course will cover the following subject matter: basic set theory relating to convex sets and functions, and topological properties relating to convex sets and functions, differentiability of convex functions, duality theory for convex sets and functions; extreme points of convex sets, the Krein-Milman theorem, the Brouwer and Schauder fixed point theorems; Asplund’s averaging technique for norms; convex functions and optimization.

Text

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

References

Bonnesen, T. & Fenchel, W. *Theorie der Konvexen Körper* (Springer 1934)

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

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

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


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

Prerequisite: Topic P

Hours: About 27 lecture hours

Examination: One 2-hour paper

Content


Text

Thompson, C. J. *Mathematical Statistical Mechanics* (Macmillan 1971)

References

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


664144 High Level Software Development—A. J. Guttmann

Prerequisite: Programming experience in a high-level language is assumed

Hours: About 27 lecture hours

Examination: One 2-hour paper
We discuss the theory of compact linear operators and the Riesz-Schneider Theory for such operators. The course concentrates on spectral theory for different types of operator on Hilbert space: compact normal, self-adjoint and normal operators.

Text
Brown, A. & Page, A.
Elements of Functional Analysis (Van Nostrand 1970)

References
Batchelor, G. K.
An Introduction to Fluid Dynamics (Cambridge 1967)
Landau, L. D. & Lifshitz, E. M.
Fluid Mechanics (Pergamon 1959)
Langlois, W. E.
Slow Viscous Flow (Macmillan 1964)
Pai, S. I.
Viscous Flow Theory Vol. 1 (Van Nostrand 1956)
Rosenhead, L. (ed.)
Laminar Boundary Layers (Oxford 1963)
Schlichting, H.
Boundary Layer Theory (McGraw-Hill 1968)
<table>
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<th>Course Code</th>
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<th>Prerequisites</th>
<th>Hours</th>
<th>Examination</th>
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<td>Nayfeh, A. H. <em>Perturbation Methods</em> (Wiley 1973)</td>
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References

664160 Lie Algebras—P. K. Smrz

Prerequisite
Topic D

Hours
About 27 lecture hours

Examination
One 2-hour paper

Content
This topic will give a moderately detailed survey of the properties of this important class of non-associative algebras.

References
Jacobson, N. *Lie Algebras* (Interscience 1966)
pontryagin, L. S. *Topological Groups* (Gordon & Breach 1966)

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.

References
van Lint, J. H. *Coding Theory* (Springer-Verlag 1971)

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
Hall, M. Jr. *Combinatorial Theory* (Blaisdell 1967)
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)
SUPPLEMENTARY LIST

(Courses available for choice as Part IV topics by students who have passed Mathematics IIIA and Computer Science III. Not all of these courses are necessarily offered in any one year.)

Department of Commerce
Social Implications of Computers

---see page 133

Department of Electrical Engineering
EE443 Optimization Techniques
---see page 105
EE447 Digital Communications
---see page 136
EE566 Automata and Computing Machinery
EE567 Computer Process Control
EE568 Advanced Computer Architecture

Department of Mechanical Engineering
ME404 Mathematical Programming
---see page 118
ME487 Operations Research—Deterministic Models
---see page 117
ME488 Operations Research—Probabilistic Models
---see page 118

Additionally, students permitted to select courses from this list should also select any of the following topics which they have not studied in Computer Science III:

Compiler Construction
Computer Operating Systems
Programming Languages and Advanced Applications

in Computing 1

For details consult the Faculty of Engineering Handbook.

COMPUTER SCIENCE SUBJECTS

PART II SUBJECT

662400 Computer Science II

Prerequisite Mathematics I

Hours 168 hours of lectures, tutorials and practical work as listed below

Examination See component descriptions below

Content

Topics

SP—Introduction to Structuring of Information
ML—Introduction to Logic and Assembly Languages
F—Numerical Analysis and Computing

PART II TOPICS

662401 Topic SI—Introduction to Structuring of Information—A. J. Guttmann & P. J. Moylan

Prerequisite Mathematics I

Corequisite Topic SP

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

Examination One 2-hour paper

Content

Influence of structuring of information on design of programming languages.

Data structures: lists, trees, queues, deques and stacks. Examples of and methods for implementing these structures. Storage allocation for complex data items. Scatter storage and hash addressing. Elementary string processing, and list processing. Searching and sorting. A description of several sorting algorithms and comparison of their efficiencies.

Text


References

Elsom, M. Data Structures (Science Research Associates 1975)
Horowitz, E. & Sahni, S. Fundamentals of Data Structures (Pitman 1976, 1977)
Katzan, H. Jr Introduction to Computer Science (Petrocelli-Charter 1975)
I—Fundamental Algorithms,
II—Semi-numerical Algorithms,
Wirth, N. Algorithms + Data Structures = Programs (Prentice-Hall 1976)

662402 Topic SP—Systematic Programming—A. J. Guttmann & P. J. Moylan

Prerequisite Mathematics I

Hours 1 lecture hour and ½ tutorial or practical work hour per week
Content
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, ALGOL 60, PL/I and COBOL. Comparison of compiler languages and interpretive languages. A brief introduction to list processing languages and macrogenerators.
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. The virtues and faults of existing programming languages.
Procedures, co-routines, re-entrancy, Recursive programming. Appropriate and inappropriate uses of recursion.

Text
Elson, M.

References
Bates, F., & Douglas, M. I.
Dahl, O. J., et al.
Guttmann, A. J.

International Computers Ltd
International Computers Ltd
Kazan, H. Jr
Kernighan, B. W. & Plauger, P. J.
Kreitzberg, C. B. & Shneiderman, B.
Wirth, N.
Yourdon, E. J.

662202 Topic P — Numerical Analysis and Computing — see page 37

PART III SUBJECT

663400 Computer Science III

Prerequisites
Computer Science II, Mathematics II A and Mathematics II C

Hours
Not less than 110 hours of lectures plus any other required tutorials and practical work, from the list of topics given below, provided that at least two of the three topics numbered 1, 3 and 7 are included. (It is recommended that a student should include all three of these topics in his programme)

Examination
See information given in descriptions of individual topics

Content
A selection, limited by the considerations under Hours above, from the following topics:

Topics
1. Compiler Construction (EE464)
2. Commercial Programming (CS — Diploma course)


**PART III TOPICS**

534137 Compiler Construction—R. J. Evans

*Prerequisite*  
EE264 Introduction to Logic & Assembly Languages

*Hours*  
3 hours per week for the 1st 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.

*Text*  
Gries, D. Compiler Construction for Digital Computers (Wiley)

*References*  

Donovan, J. J. Systems Programming (McGraw-Hill)

410103 Commercial Programming — I. R. Beaman

*Prerequisite*  
Mathematics I Topic SC or Commercial E.D.P.

*Hours*  
2 lecture hours per week for 1st half year

*Examination*  
Two 3-hour papers (i) Theory—at mid year (ii) COBOL at end of year

**References**


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)

**534138 Computer Operating Systems — A. Cantoni**

*Prerequisite*  
EE264 Introduction to Logic & Assembly Languages

*Hours*  
Three hours per week for the 2nd half of the year.

*Examination*  
Progressive assessment and final examination

*Content*  
Views of an operating system. Multiprogramming, interacting con-
current processes, process control primitives. Processor management, memory management, name management. Protection.

**Text**

Shaw, A. C. *The Logical Design of Operating Systems* (Prentice-Hall)

**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

**Hours**

3 hours of lectures, tutorials and practical work per week for 1st half year

**Content**

Introduction to Set Theory. Boolean Algebra, Data representation codes, error detection and correction. Minimization technique for combinational logic, Post’s Theorem. Synchronous and asynchronous sequential machines. State reduction and secondary state assignments, Logic subsystems, registers, adders, counters, etc. μ-Programming (minimization and coding techniques). Lecturers will be supplemented by practical assignments using Logic Trainers and PDP-11.

**Text**

Friedman, A. D. *Logical Design of Digital Systems* (Computer Science 1975)

**References**


Mano, M. M. *Computer Logic Design* (Prentice-Hall 1972)

Mano, M. M. *Computer System Architecture* (Prentice-Hall)

Prather, R. E. *Introduction to Switching Theory: A Mathematical Approach* (Allyn & Bacon)

663401 *Mathematical Logic* — R. W. Robinson

**Prerequisites**

Topics K & L

**Hours**

1 lecture hour per week and 1 tutorial hour per fortnight

**Examination**

One 2-hour paper

**Content**

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 multi-step 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. Some analysis background and some experience in programming computers is assumed but no prerequisites of numerical analysis courses will be expected.

**Text**

Nil

**References**


Hours

2 lecture hours per week for the 1st half year and associated practical work

Examination

An examination at mid-year

Content

This course seeks to fill a wide range of goals depending on the experience of the student. Systems Analysis covers the activities which occur early in the life cycle of a computer-based business system. Individual topics include systems concepts, the systems analyst, the techniques of systems analysis, project control methods, report standards and structures.

Texts

The National Computing Centre Systems Analysis and Design Student Notes will be supplied

Gore, M. & Stubbe, J.

References

Chandor, A. et al. Practical Systems Analysis (Rupert, Hart & Davis)
Clifton, H. D. Systems Analysis for Business Data Processing (Wiley)
Daniels, A. & Yeates, D.
Glans, T. B. et al. Management Systems (Holt, Rinehart & Winston)
Harc, Van Court Systems Analysis: A Diagnostic Approach (Harcourt, Brace & World)
Kindred, A. R. Data Systems and Management (Prentice-Hall)
Optner, S. L. Systems Analysis for Business Management (Prentice-Hall)
Weiss, E. A. Computer Usage/Applications (McGraw-Hill)

(iii) Systems Design

Prerequisites

CS—Commercial Programming, Systems Analysis

Hours

2 lecture hours per week for the 2nd half year and associated practical work

Examination

An examination at end of year

Text

As for Systems Analysis

References

STATISTICS SUBJECT

663300 Statistics III

Prerequisites

Mathematics IA and IC (including topics H, I and CO)

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, Y and one other Part III Mathematics topic. Before selecting a particular topic as the optional fourth topic in Statistics III, students should seek advice from a lecturer giving one of the compulsory topics, or from the Head of the Department.

SCHEDULE B

PART I

541100 Engineering I

Prerequisites

2-unit Mathematics & multistrand Science at the 4-unit level (advisory)

Corequisite

Mathematics I

Hours

4 lecture hours & 2 tutorial laboratory hours per week

Examination

To be advised

Content

Four of the following units to be chosen.

(i) CEIII Statics

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<th>Text</th>
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<tr>
<td>ME111</td>
<td>Dynamics</td>
<td>Nil</td>
<td>42</td>
<td>Progressive Assessment</td>
<td>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.</td>
<td>Principles of Statics (Uni. of N.S.W. Students Union 1966)</td>
<td>Levens, A. S. Graphics (Wiley) Luzadder, W. J. Basic Graphics (Prentice-Hall)</td>
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<tr>
<td>EE131</td>
<td>Circuit Fundamentals</td>
<td>Nil</td>
<td>42</td>
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<tr>
<td>ChE101</td>
<td>Industrial Process Principles</td>
<td>Nil</td>
<td>42</td>
<td></td>
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</tr>
</tbody>
</table>
The preparation of process flowsheets, engineering calculations, introduction of tonnage balancing, chemical equations, steel production, cement manufacture, fullance.

Content

Text

Baldwin, C. T.  
*Electrical Measurements* 2nd edn (Harrop)

Reference

Balabanian, N.  
*Fundamentals of Circuit Theory* (Allyn & Bacon)

Hayt, W. H. & Kemmerly, J. E.  
*Engineering Circuit Analysis* (McGraw-Hill)

Content

Text  

Baldwin, C. T.  
*Electrical Measurements* 2nd edn (Harrop)

References

Balabanian, N.  
*Fundamentals of Circuit Theory* (Allyn & Bacon)

Hayt, W. H. & Kemmerly, J. E.  
*Engineering Circuit Analysis* (McGraw-Hill)

(vi) **511101** ChE101 Industrial Process Principles

Hours  
1½ hours per week

Examination  
One 3-hour paper

Content

The preparation of process flowsheets, engineering calculations illustrating material and energy balances, together with pressure, temperature and volume conditions involved in physical or chemical changes. Balancing chemical equations and elementary stoichiometry. Phase rule applications, graphical methods. These principles will be illustrated from such processes as water treatment, metallurgical ore smelting and steel production, cement manufacture, combustion of coal and oil, production of tonnage oxygen, ammonia and acids.

Texts

Mayhew, T. R. & Rogers, G. F. C.  
*Thermodynamic and Transport Properties of Fluids* (S.I. units) 2nd edn (Blackwell 1972)

Wall, T. F.  
*An Outline of Industrial Process Principles* (Dept of Chemical Engineering, Univ. of Newcastle)

References

Mayhew, T. R. & Rogers, G. F. C.  
*Thermodynamic and Transport Properties of Fluids* (S.I. units) 2nd edn (Blackwell 1972)

Wall, T. F.  
*An Outline of Industrial Process Principles* (Dept of Chemical Engineering, Univ. of Newcastle)

(vii) **111100** Materials Science I

Prerequisites  
One Science 2-unit subject

Corequisites  
Mathematics I & Physics I

Hours  
3 lecture hours & 3 tutorial/laboratory hours per week

Examination  
Four 1½-hour papers plus assignments

Content

(i) Mechanical Properties of Materials

(ii) Microstructure of Materials

(iii) Atomic Structure of Materials

(iv) either Chemical Metallurgy or Electronic Structure of Materials

(i) **111142** Mechanical Properties of Materials

Prerequisites  
Nil

Hours  
About 21 hours of lectures & 21 hours of tutorial, demonstration & practical classes

Examination  
1½ hour paper

Content

Macroplasticity. The tension test, engineering stress and strain, true stress and strain, theories of strength, complex stresses, yielding, flow and fracture, effect of metallurgical variables. Visco-elastic behaviour of materials, classical models. Hering a cold worked metal, recrystallization, hot working.

Microplasticity. Slip in single crystals, work hardening, multiple slip, deformation bands in polycrystals. Theoretical strength anomaly and dislocations, edge and screw types, their interaction, multiplication and pile ups.

Fracture. Types of fracture under static loading, ductile, brittle, creep dynamic loading fatigue. Ductile-Brittle transition in mild steel, the effects of variables, Mn/C ratio. Creep Test, shape of curve, microstructural aspects, creep rupture. Fatigue Test, S-N curve, effect of variables.

Text

Wulff, J. et al.  
*Structure and Properties of Materials* Vol. 3 (Wiley)

References

Dieter, G.  
*Mechanical Metallurgy* (McGraw-Hill)

Polacowski, N. H. & Ripling, E.  
*Strength and Structure of Engineering Materials* (Prentice-Hall)

Wyatt, O. H. & Dew-Hughes, D.  
*Metals, Ceramics and Polymers* (Cambridge U.P.)
(ii) 111152 Microstructure of Materials

**Prerequisites**
Nil

**Hours**
About 21 hours of lectures & 21 hours of tutorial, demonstration & practical classes

**Examination**
1½ hour paper

**Content**
The generation of microstructure and its relationship with material properties. States of matter, bonding in solids, crystal structure, phases, surfaces, grain boundaries and interfaces, atom development. Phase rule and microstructures in binary systems for equilibrium conditions and for nonequilibrium transformations including: isomorphous, eutectic, peritectic and eutectoid types, the lever rule. Microstructures of ceramics and polymers. Technically important systems including iron-carbon, copper-zinc, aluminium-silicon, aluminium-copper. Modification of eutectics, normalizing and annealing. Non-equilibrium microstructures, quenching, Martensite and bainite, TTT diagrams, age hardening tempering.

**Text**

**References**
Cracknell, A. P. *Crystals and their Structure* (Pergamon)
Van Vlack, L. H. *Elements of Materials Science* (Addison-Wesley)

(iii) 111183 Atomic Structure of Materials

**Prerequisites**
Nil

**Hours**
About 21 hours of lectures & 21 hours of tutorial, demonstration & practical classes

**Examination**
1½ hour paper

**Content**

**Text**

**References**
Cracknell, A. P. *Crystals and their Structure* (Pergamon)
Van Vlack, L. H. *Elements of Materials Science* (Addison-Wesley)

(iv) 111123 Chemical Metallurgy

**Prerequisites**
Nil

**Hours**
About 21 hours of lectures & 21 hours of tutorial, demonstration & practical classes

**Examination**
1½ hour paper

**Content**
Introduction to chemical thermodynamics and the rates of homogeneous and heterogeneous chemical reactions. Extension to electrochemical and photochemical reactions, thermodynamics and kinetics of chemical change illustrated by reference to the environmental degradation of materials. Wet and dry corrosion of metals. Chemical attack on refractories, ceramics and cement. Photochemical breakdown of polymers, stress corrosion of metals and plastics. Internal chemical breakdown of materials.

**Texts**
Ives, D. J. G. *Principles of Extraction of Metals* (Chem. Soc.)
Chilton, J. P. *Principles of Metallic Corrosion* (Chem. Soc.)
Guggenheim, E. A. *Elements of Thermodynamics* (Chem. Soc.)

**Reference**
Guy, A. G. *Introduction to Materials Science* or

111184 Electronic Structure of Materials

**Prerequisites**
Nil

**Hours**
About 21 hours of lectures & 21 hours of tutorial, demonstration & practical classes

**Examination**
1½ hour paper
Content
Atomic bonding and electron mobility. Electrons in a potential box, free electron model of a metal, effects of the lattice, alkali, noble and transition metals, insulators and semi conductors.
Specific heat and thermal conductivity of electrons and lattices. Thermal and Electronic properties of metals, insulators and semi conductors.
Magnetic properties of metals and insulators. Optical properties of metals, insulators and semi conductors.

Text
Wulff, J. et al. The Structure and Properties of Materials
Vol. 4 (Wiley)

References
To be advised

PART II

522700 Civil Engineering HM

Prerequisites
Mathematics I & Engineering I

Hours
5 lecture hours & 2½ tutorial & laboratory hours per week

Examination
Five 3-hour papers

Content
(i) CE212 Mechanics of Solids I or ME214 Mechanics of Solids I
(ii) CE231 Fluid Mechanics I or ME251 Fluid Mechanics I
(iii) CE221 Properties of Materials or ME241 Properties of Materials I
(iv) CE222 Materials Technology

(i) 522107 CE212 Mechanics of Solids

Prerequisites
CEII & Maths I

Hours
1½ lecture hours & ¼ tutorial hour per week

Examination
One 3-hour paper

Content
Uniaxial loading, states of stress and strain, stress and strain relationships; internal forces, internal stresses, deflexion of beams, torsion, buckling.

Text
Hall, A. S. An Introduction to the Mechanics of Solids
S.I. edn (Wiley 1973)

References
Crandall, S. H. et al. An Introduction to the Mechanics of Solids
2nd edn (McGraw-Hill 1972)

542105 ME214 Mechanics of Solids I

Prerequisites
Maths I, ME111, ME131, CE111, GE112

Hours
42

Examination
Progressive assessment & examination

Content
Uniaxial loading, states of stress and strain, stress and strain relationships; internal forces, internal stresses, deflexion of beams, torsion, buckling.

Text
Hall, A. S. An Introduction to the Mechanics of Solids
(Wiley 1973)

References
Crandall, S. H. et al. An Introduction to the Mechanics of Solids
2nd edn (McGraw-Hill 1972)


Popov, E. P. Introduction to Mechanics of Solids
(Prentice-Hall 1968)


(ii) 522202 CE231 Fluid Mechanics I

Prerequisites
Maths I and ME131 Dynamics

Hours
1 lecture hour & ½ hour of tutorials & laboratory work per week

Examination
One 3-hour paper

Content
Fluid properties and definitions. Fluid statics:—statics of moving systems, forces on surfaces, buoyant forces, stability of floating and submerged bodies. Fluid flow concepts:—Types of flow, continuity equations, Euler’s equation of motion along a streamline, Bernouilli equation, energy equation, Linear momentum equation, The moment of Momentum equation, Linear and angular momentum applications. Introduction to dimensional analysis. Viscous effects:—Fluid resistance, laminar and turbulent flow, flow in pipes and conduits. Fluid measurement.

Text
References

or
542204 ME251 Fluid Mechanics I

Prerequisites Maths I, ME131

Hours 42

Examination Progressive assessment & examination

Content

Text

References
Streeter, V. L. Fluid Mechanics 5th edn (McGraw-Hill)

(iii) 522106 CE221 Properties of Materials

Prerequisite Engineering I

Hours 1 lecture hour & ½ lab tutorial hour per week

Examination One 3-hour paper

Content

Suggested Preliminary Reading

References
McClintock, F. A. & Mechanical Behaviour of Materials (Addison-Wesley 1966)

or
542102 ME241 Properties of Materials I

Prerequisites Maths I, ME111, GE112, CE111

Hours 42

Examination To be advised

Content

Text Nil

References
D’Isa, F. Mechanics of Metals (Addison-Wesley 1968)
McClintock & Argon Mechanical Behaviour of Materials (Addison-Wesley 1966)

(iv) 522105 CE222 Materials Technology

Hours 14 lecture hours & 1½ laboratory & tutorial hours per week

Examination Two 3-hour papers, the first at mid-year.
Content
Metallurgy: basic structure of metals.
Ceramics: basic structure of ceramics.
Concrete technology: materials in concrete; concrete mix design; properties of plastic and hardened concrete; manufacturing and field control.

Texts
- As for CE221 Properties of Materials plus Design Control and Characteristics of Concrete (Cement & Concrete Assn)
- Methods for Sampling and Testing Aggregates AS1141 (Standards Assn of Australia)
- Dense Natural Aggregates for Concrete AS1465

References
- Concrete Technology and Practice (Angus & Robertson)
- Basic Guide to Concrete Construction (Cement & Concrete Assn)

752300 Psychology IIC

Prerequisites
Psychology I & Mathematics I

Hours
3 lecture hours, one 2-hour practical session & 1 tutorial hour per week.

Examination
Two 3-hour papers plus an assessment of practical work.

Content
2. Two other topics chosen from those topics available in Psychology IIA and Psychology IIB.
3. Mathematical Psychology

Texts
To be advised

References

PART III

413900 Accounting IIBC

Prerequisites
Mathematics IIA & IIC & either Accounting IIA or IIB

Hours
4 lecture hours & 1 tutorial hour per week.

Examination
Two 3-hour & two 2-hour papers

Content
Either Accounting IIA or Accounting IIB and two appropriately chosen Part III topics (e.g. topics U and R) offered by the Department of Mathematics and approved by the Head of the Department, either

(i) 413100 Accounting IIA

Prerequisites
Accounting IIA or IIB

Hours
2 lecture hours per week

Examination
Two 3-hour papers.

Content
Selected contemporary problems in the theory and practice of financial accounting, company financial reporting and public practice including a study of current approaches to the formulation of accounting theory; governmental and institutional accounting.

Texts
Nil

References
Journal articles and extracts from relevant accounting monographs including the following:
American Institute of Objectives of Financial Statements
Certified Public Accounts
Barradell, M. Ethics and the Accountant (Gec 1969)
Chambers, R. J. Accounting Evaluation and Economic Behaviour (Prentice-Hall 1966)
Dean, G. W. & Current Cost Accounting: Identifying the Issues
Wells, M. C. (eds) Readings in Accounting Theory (Houghton Millin 1968)
Garner, P. & An Inquiry into the Nature of Accounting
Goldberg, L. Concepts of Depreciation (Law Book Co. 1960)
Hendriksen, E. S. Accounting Theory (Irwin 1970)
Jay, W. R. C. & Government Accounting in Australia
Mathews, R. L. (Cheshire 1967)
Jager, M. O. et al. Company Financial Statements: Form and
Content (Butterworths)
Moonitz, M. *The Basic Postulates of Accounting* (A.I.C.P.A.)

Parker, R. H. & Harcourt, G. C. *Readings in the Concept of Measurement of Income* (Cambridge U.P.)


Vatter, W. J. *The Fund Theory of Accounting* (Chicago U.P. 1951)

(ii) 413200 Accounting III B

**Prerequisite**
Accounting II B

**Hours**
2 lecture hours per week

**Examination**
One 3-hour paper

**Content**
Selected contemporary problems in the theory and practice of managerial accounting. Topics studied include the introduction of uncertainty into managerial accounting models such as cost-volume-profit analysis; the use of simple linear statistical models in cost estimation; an introduction to the variance investigation decision; disaggregation of net income variances; behavioral perspectives on managerial accounting.

**Texts**
To be advised. Articles are selected from *Abacus, The Accounting Review, Journal of Accounting Research, Journal of Business, etc.*

**References**

Beanston, G. J. *Contemporary Cost Accounting and Control* (Dickenson 1970)


Mintzberg, H. *Impediments to the Use of Management Information* (N.A.A.)

Rush, H. M. *Behavioural Science: Concepts and Management Application* (The Conf. Board)

713200 Biology III B — B. Boettcher/B. A. Conroy/R. C. Jones/J. W. Patrick

**Prerequisites**
Mathematics IIA & IIC or either Biology IIA or IIB

**Hours**
4 lecture hours & 8 tutorial & laboratory hours per week & a field excursion

**Examination**
Two 3-hour papers

**Content**
**Fundamentals of Population and Quantitative Genetics**

**Community Analysis**
Structure and dynamics of biological communities.

**Environmental Physiology**
Functional adaptations (homeostatic and developmental) of organisms to their environments.

**Texts**
Falconer, D. S. *Introduction to Quantitative Genetics* (Oliver & Boyd 1975)


Milthorpe, F. L. & Moorby, J. *An Introduction to Crop Physiology* (Cambridge U.P.)

Nalbandov, A. V. *Reproductive Physiology* 2nd edn (Freeman)

Zar, J. H. *Biostatistical Analysis* (Prentice-Hall)

**References**
Bannister, P.


Daubenmire, R. F. *Plants and Environment* 3rd edn (Wiley 1974)

Ford, E. B. *Ecological Genetics* (Methuen 1975)


Poole, R. W. *Evolutionary Ecology* (Harper & Row)

*Ecological Energetics* (Arnold)

**Introduction to Quantitative Ecology** (McGraw-Hill)
cascade control with applications to control of temperature, flow pressure and composition.

Text

References
(v) 513107 ChE322 Particulate Systems — J. Roberts

Examination
1½ hours per week

Content
Definition of size and shape of solid particles, laws of breakage, analytical description of size distributions, matrix description of breakage and classification operations, crushing and grinding equipment, separation of solids; partition curves; pressure and flow of granular material. Drying operations, movement of moisture in solids; drying systems, drying equipment; design methods. Furnace and kiln analysis by heat and mass balance on well-stirred and parallel flow reactors. Size and solids separation in gas or liquids; action of gravitational and centrifugal fields, design and performance of separation and pollution control equipment under these conditions — settling chambers, gas and liquid cyclones, centrifuges; flocculation, hindered settling, sludge thickening; Flow through fixed beds— Fluidisation—Filtration—analytical and design methods. Agitation and mixing—scale-up and shape considerations; Evaporation and crystallisation. Dust and gas removal for environmental control.

Text

References

(vi) 513221 ChE331 Process Economics — B. D. Henry

Examination
1½ hours a week for ½ year

Content

2. Cost estimation procedures — cost indices — six tenths rule and economy of scale.

3. Economic production charts (break even analysis). Capacity factors, incremental costs.

4. Depreciation — Purpose of depreciation studies in process costs — types and requirements of depreciation methods — taxation allowances in process plant and equipment — economic life — depletion.

5. Project profitability — Concept of equivalence and discounted cash flows — methods for measuring project profitability including rate of return, payout time, interest rate of return (DCF) net present value, annual cost and capitalised cost — continuous discounting.

6. Economic Balances — General considerations for economic balance— brief introduction to optimisation — Economic balances applied to selected operations, i.e. mass transfer, cyclic operation, yield and recovery operation.

7. Feasibility studies — selected examples.

Text

References

(vii) 514115 — ChE412 Radiant Heat Transfer — T. Wall

Examination
To be advised

Content

Text
Hottel, H. C. & Sarofim, A. C. Radiative Transfer (McGraw-Hill 1968)

52700 Civil Engineering HM

Prerequisite
Civil Engineering IM, Mathematics IIA & HC

Hours
7 lecture hours & 3½ tutorial/laboratory hours per week

Examination
Four 3-hour papers
(i) 523102 CE324 Soil Mechanics

**Corequisite**
CE332 Fluid Mechanics II

**Examination**
One 3-hour paper

**Text**

**References**
- SAA *Methods of Testing Soils for Engineering Purposes* A.S.A. 89

(ii) 523105 CE313A Structural Analysis I

**Prerequisites**
CE212, Maths I

**Examination**
One 3-hour paper

**Text**
As for CE313 (Analysis Component)

**References**

(iii) 523301 CE332 Fluid Mechanics II

**Prerequisite**
CE231

**Examination**
One 3-hour paper

**Content**
Similitude; flow nets, boundary layers; closed conduit flow; pipe networks; unsteady flow; waterhammer, hydraulic machinery, open channel hydraulics, backwater curves.

**Preliminary Reading**
Rouse, H. & Ince, S. *History of Hydraulics* (Dover 1963)

**Texts**
Henderson, F. M. *Open Channel Flow* (Collier-Macmillan 1966)

**References**
- Davis, C. V. & Sorenson, Morris, H. M. *Applied Hydraulics in Engineering* (Ronald 1963)
- Rouse, H. *Engineering Hydraulics* (Wiley 1951)
- Vallentine, H. R. *Applied Hydrodynamics* (Butterworths)

(iv) 523107 CE351 Civil Engineering Systems I

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

**Examination**
Two ½-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 modeling, 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)
Prerequisites Mathematics IA & IIB (including Topics CO, D)

Hours 6 lecture, tutorial & laboratory hours per week

Examination Progressive assessment & final examination

Content
(i) 533110 EE341 Automatic Control
(ii) 531110 EE342 Linear System Theory
(iii) 534132 EE443 Optimization Techniques
(iv) 534136 EE434 Communications

(i) 533110 EE341 Automatic Control — G. C. Goodwin

Hours 3 lecture, tutorial & laboratory hours per week for 1st ½ year

Examination Progressive assessment & final examination

Content

Text
Fortmann, T. E. & Hitz, K. L. Introduction to Linear Control System Theory (Dekker 1976)

References
Chen, C. T. Introduction to Linear System Theory (Holt, Rinehart & Winston 1970)
Desoer, C. A. Notes for a Second Course on Linear Systems (Van Nostrand 1970)
Ogata, K. Modern Control Engineering (Prentice-Hall 1969)

(ii) 533110 EE342 Linear System Theory — K. L. Hitz

Hours 3 lecture, tutorial & laboratory hours per week for 2nd ½ year

Examination Progressive assessment & final examination

Content

Text
Rosenbrock, H. H. State, Space and Multivariable Theory (Nelson 1970)

Reference
As for EE341 Automatic Control

(iii) 534132 EE443 Optimization Techniques — J. B. Moore

Hours 3 hours per week for 2nd ½ 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)
Luenberger, D. G. Optimisation via Vector Space Methods (Wiley 1969)

(iv) 534136 EE434 Communications — G. C. Goodwin

Hours 3 hours per week for 2nd ½ 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.

Text
Reference
Taub, H. & Schilling, D. L.
Principles of Communication Systems
(McGraw-Hill 1971)

533901 Digital Computers and Automatic Control
Prerequisites
Mathematics IA & IC (including Topics CO, D)
Hours
6 lecture, tutorial & practical hours per week
Examination
Progressive assessment & final examination

Content
(i) 533213 EE341 Automatic Control—see page 104
(ii) 533110 EE342 Linear System Theory—see page 105
(iii) 5321F1 EE364 Introduction to Logic & Assembly Languages—see CS topic, page 127
(iv) 533229 EE362 Switching Theory & Logical Design—see CS topic, page 128

423806 Economics IIC
Prerequisite
Mathematics IA & IC & Economics IIA
Hours
As indicated in the description of the components
Examination
To be advised

Content
Two of the following so as to include Econometrics I or Mathematical Economics or both:
(i) 423208 Econometrics I
(ii) 423204 Mathematical Economics
(iii) 423104 Growth and Development
(iv) 423103 International Economics
(v) 423103 Public Economics

(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

Text
Johnston, J.
Econometric Methods (McGraw-Hill 1972)

References
Fox, K. A.
Intermediate Economic Statistics (Wiley)
Goldberger, A.
Econometrics (Wiley)
Hadley, G.
Linear Algebra (Addison-Wesley)
Huang, D. S.
Regression and Econometric Methods (Wiley)
Kmenta, J.
Elements of Econometrics (Macmillan)
Koutsoyiannis, A.
Theory of Econometrics (Macmillan)
Wonnacott, R. J. & T. H.

(ii) 423204 Mathematical Economics—C. J. Aistliebic/K. M. Lamb
Hours
3 lecture hours per week
Examination
One 3-hour paper

Content
1. A review of the necessary mathematics at a level accessible to the interested student. Particular attention will be paid to explaining the role of mathematics in economic theory and applied economics.
2. An in-depth treatment of the key mathematical concepts used in the mathematical reformulation and interpretation of traditional micro and macro-economic theory.
3. A number of “case studies” chosen to cover areas in which the role of mathematics in illuminating and integrating material in micro and macro-economic theory and applied economics is of particular interest.

Text
Archibald, O. C. & Lipsey, R. G.
An Introduction to a Mathematical Treatment of Economics 3rd edn (Weiden & Nicholson 1977)

References
Benavie, A.
Mathematical Techniques for Economic Analysis (Prentice-Hall 1972)
Chiang, A. C.
Fundamental Methods of Mathematical Economics 2nd edn (McGraw-Hill)
Dernburg, T. F.
Macroeconomic Analysis: An Introduction to Comparative Statics and Dynamics (Addison-Wesley 1969)
Gandolfo, G.
Mathematical Methods and Models in Economic Dynamics (North-Holland 1971)
Growth and Development — N. J. Dickinson/C. W. Stahl

Hours
3 lecture hours per week

Content
The first half of this course will deal with the dynamics of fluctuations and growth in the framework of an advanced economy. A critical appraisal is undertaken of leading contributions in this field. Topics such as the production function, technical progress and various models of growth are dealt with in detail.

The second half of the course will study some underdeveloped countries with specific focus upon their dualistic nature. The structure of the rural and urban economies of the typical underdeveloped country will be investigated in order to understand underdevelopment and hence design development strategies. Theoretical models will be supplemented with case studies from Asia.

Preliminary Reading
Bober, S. The Economics of Cycle and Growth (Wiley 1968)
Hicks, J. R. A Contribution to the Theory of the Trade Cycle (Clarendon 1961)

Text
Hamberg, D. Models of Economic Growth (Harper Inter. 1973)

References
Bauer, P. T. Dissent on Development (Weidenfeld & Nicolson 1971)
Enke, S. Economics for Development (Dobson 1963)

Myrdal, G. Asian Drama (Twentieth Century Fund 1968)
Myint, H. The Economics of Developing Countries 3rd edn (Hutchinson)
Szentes, T. The Political Economy of Underdevelopment (Akademiai Kiado 1973)

International Economics

Hours
2 lecture hours per week & 1 seminar hour per fortnight

Content
(i) The pure theory of international trade. Comparative costs, the Heckscher-Ohlin theorem. Critical assessment of these and other theories of trade. The theory of protection; tariffs and quota restrictions on imports. Australian protection policy. Customs union theory. Relationships between economic growth and trade.


Details about books will be announced in the first lecture of the course.

Texts
Grubel, H. C. International Economics (Irwin 1977)
Snape, R. H. International Trade and the Australian Economy 2nd edn (Longman 1973)
544418 ME449 Reliability Analysis for Mechanical Systems—see page 120
544105 ME482 Engineering Economics I
544104 ME483 Production Engineering

(i) 543501 ME381 Methods Engineering

Hours 1½ hours per week

Examination Progressive assessment

Content

Text
Niebel, B. W. *Motion and Time Study* (Irwin)

References
Barnes, R. M. *Motion and Time Study* (Wiley)
Krick, E. V. *Methods Engineering* (Wiley)

(ii) 543802 ME383 Quality Engineering

Hours 1½ hours per week

Examination Progressive assessment & examination

Content

Text
Nil

References
Amer. Soc. of Tool & Mfg Engs *Handbook of Industrial Metrology* (Prentice-Hall)
Duncan, A. J. *Quality Control and Industrial Statistics* (Irwin)
Grant, E. L. *Statistical Quality Control* (McGraw-Hill)
Juran, J. M. & Gryna, F. M. *Quality Planning and Analysis* (McGraw-Hill)
Kirkpatrick, E. G. *Quality Control for Managers and Engineers* (Wiley)

(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

References
Kempster, M. H. A. *Principles of Jig and Tool Design* (English U.P.)

(iv) 544425 ME419 Bulk Materials Handling Systems Analysis and Design

— A. W. Roberts

Hours 42

Examination Progressive assessment

Content

Texts
Nil

References
Brook, N. *Mechanics of Bulk Materials Handling* (Butterworths 1971)
The time value of money, economic criteria for decision making, purchase and replacement economics, cost benefit analysis, evaluation of accounting data for various operating environments.

Decision making under risk and uncertainty.

Texts

References

54104 ME483 Production Engineering — J. W. Hayes

Hours 42
Examination Progressive assessment and examination

Content
Production systems; job shop, line production, group technology; Computer aided manufacture, numerically controlled systems; Material handling, Production Planning and control; forecasting, inventory, scheduling and sequencing.

Text Nil

References

553806 Mechanical Engineering IIC

Prerequisites
- Mathematics IIA & IIC (including Topics F & H)

Hours 6 hours per week
Examination Progressive assessment

Content
Students may choose one of the following alternatives (a), (b), (c), or (d) but all 4 alternatives may not be available each year.

(a) (i) ME361 Automatic Control
(ii) ME401 Systems Analysis
(iii) ME505 Systems Planning, Organisation & Control
(iv) ME487 Operations Research—Deterministic Models
(b) (i) ME505 Systems Planning, Organisation & Control
(ii) ME487 Operations Research—Deterministic Models
(iii) ME488 Operations Research—Probabilistic Models
(c) (i) ME505 Systems Planning, Organisation & Control
(ii) ME484 Mathematical Programming
(iii) ME488 Operations Research—Probabilistic Models
(d) (i) ME361 Automatic Control
(ii) ME434 Advanced Kinematics & Dynamics of Machines
(iii) ME448 Introduction to Photomechanics
(iv) ME449 Reliability Analysis for Mechanical Systems

(i) 543204 ME361 Automatic Control — G. C. Goodwin

Hours 11 hours per week
Examination Progressive assessment & examination

Content
and transient response by algebraic, root-locus and frequency response methods. Introduction to compensation techniques. Description of components of servo-mechanisms and process control systems.

Text
Fortmann, T. E. & Hitz, K. L. Introduction to Linear Control Systems Theory (Dekker 1976)

References
Desoer, C. A. Notes for a Second Course in Linear Systems (Van Nostrand-Reinhold 1970)


(ii) 544451 ME401 Systems Analysis

Hours
1½ hours per week

Examination
Progressive assessment & examination

Content
System concepts and system classification. Mathematical modelling Deterministic and probabilistic models, Stochastic models. Deterministic systems—Linear Graph theory and Network Analysis; Classical time and frequency domain analysis of continuous and discrete systems; Matrix methods in systems modelling and analysis. Stochastic Processes—Random data and signal analysis; Response of systems to random excitation; System identification.

Text
Nil

References
Busacker, R. G. & Saaty, T. L. Finite Graphs and Networks (McGraw-Hill 1965)


(iii) 540126 ME505 Systems Planning, Organization & Control

Hours
1½ hours per week

Examination
Progressive assessment & examination

Content

Text
Nil

References
Ackoff, R. L. A Concept of Corporate Planning (Wiley 1970)
Battersby, A. Network Analysis for Planning Scheduling (Macmillan 1970)
Citron, S. J. Elements of Optimal Control (Holt, Rinehart & Winston 1969)


(iv) 544441 ME487 Operations Research—Deterministic Models

—G. D. Butler

Hours
1½ hours per week

Examination
Progressive assessment

Content
Concept of optimisation; optimisation approaches; formulation of models; linear programming; allocation and assignment; simplex method; duality; theory of games, parametric programming; integer programming; zero-one programming; quadratic programming; decomposition principle. Network theory; dynamic programming. Geometric programming. Applications.
Texts
Ackoff, R. L. & Sasienji, M. W.
Introduction to Operations Research (Holden-Day)

Hillier, I. S. & Lieberman, G. J.
Operations Research (Macmillan)

Taha, H. A.
Operations Research (Macmillan)

References
McMillan, C.
Mathematical Programming (Wiley)

McMillan, C. & Gonzalez, P. F.
Systems Analysis—A Computer Approach to Decision Models (Irwin-Dorsey)

Wagner, H. W.
Principles of Operations Research (Prentice-Hall)

(v) 544833 ME433 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
Saaty, T. L.
Elements of Queueing Theory (Prentice-Hall)

References
Brown, R. G.
Smoothing, Forecasting and Prediction of Time Series (Prentice-Hall 1963)

Dychman, T. R. et al.
Management Decision Making under Uncertainty (Macmillan 1969)

Hadley, G. & Whitin, T. M.
Analysis for Inventory Systems (Prentice-Hall 1963)

Taha, H. A.
Operations Research (Macmillan 1971)

(vi) 544417 ME404 Mathematical Programming—K. L. Hitz

Hours
1½ hours per week

Examination
Progressive assessment

Content
Introduction to the solution of static optimisation problems. Dynamic programming; computational refinements of the basic algorithm. Linear programming; the Simplex algorithm and its revised form; duality theory; sensitivity analysis; decomposition algorithms. Transportation and assignment problems.

Texts
Gass, S. I.

Nemhauser, G. L.
Introduction to Dynamic Programming (Wiley 1966)

References
Bellman, R. E. & Dreyfus, S. E.

Kunzi, H. P. et al.
Non-Linear Programming (Blaisdell 1966)

Macmillan, C.
Mathematical Programming (Wiley 1970)

Taha, H. A.
Operations Research (Macmillan 1971)

Note
This subject is identical with the first part of ME581G.

(vii) 544419 ME434 Advanced Kinematics and Dynamics of Machines—E. Betz

Hours
1½ hours per week

Examination
To be advised

Content

Text
Hirschorn, J.
Mechanics of Plane Motion (McGraw-Hill 1962)

References
Hall, A. S.
Kinematics and Linkage Design (Prentice-Hall 1960)

Holowenko, A. R.
Dynamics of Machines (Wiley 1955)

(viii) 544420 ME444 Introduction to Photomechanics—D. R. A. Budney

Hours
1½ hours per week

Examination
Progressive assessment

Content

118
Calibration of material and solution of disc problem.

References

Dally, J. W. & Riley, W. F. *Experimental Stress Analysis* (McGraw-Hill 1965)

Text

Nil

Examination

Assessment to the equivalent of 10 hours 25 minutes 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. Modern 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

A list is available from the Physics Department office. Students should retain their Physics II texts.

753300 Psychology III C

Prerequisites

Mathematics IIA, IIC & Psychology IIC

Hours

4 lecture hours & 3 laboratory hours per week

Examination

To be advised

Content

Linear Statistical Models
Personality Assessment
Mathematical Models in Perception and Learning
Cognition
Perception and Physiological Psychology.

One or more additional topics to be selected from Psychology IIIA or IIIB. Students will also be required to complete an independent investigation in mathematical psychology under supervision.

Text


References

Flavell, J. H. *The Developmental Psychology of Jean Piaget* (Van Nostrand 1963)
### Schedule C

**664300 Mathematics/Physics IV**

**Prerequisites**
Mathematics IIIA & Physics IIIA & such additional work as is required for combined honours students by the Dept of Mathematics. A student desiring admission to this subject must apply in writing to the Dean of the Faculty of Mathematics before 7th December of the preceding year.

**Hours**
To be prescribed by the Heads of the Depts of Mathematics & Physics. Project work will normally begin in the first week of February.

**Examination**
Examinations in the Mathematics & Physics topics selected by the student.

**Content**
The student shall complete four topics from Mathematics IV, chosen for their application to Physics; he must also attend selected topics in Physics IV. A project of mathematical and physical significance supervised jointly by the Department of Mathematics and the Department of Physics is also required.

**References**
- Atkinson, R. C. (ed.) *Studies in Mathematical Psychology* (Stanford U.P. 1964)
- Campbell, N. R. *Foundations of Science: The Philosophy of Theory and Experiment* (Dover 1957)
- Lord, F. M. & Novick, M. R. *Statistical Theories of Mental Test Scores* (Addison-Wesley 1968)
- Ross, S.  *Logical Foundations of Psychological Measurements* (Aarhuus Stiftsbogtrykkerie A-S 1964)
- Torgerson, W. S. *Theory and Methods of Scaling* (Wiley 1958)

(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 perception and learning. Use of a real-time computer.

**References**
- Cox, D. R., & Miller, H. D. *The Theory of Stochastic Processes* (Methuen 1965)
<table>
<thead>
<tr>
<th>Department Offering Subject</th>
<th>Assumed Standard of Attainment</th>
<th>No. of Units</th>
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<tbody>
<tr>
<td><strong>Group I</strong></td>
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<tr>
<td>Core Subjects</td>
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<td>CS—Commercial Programming</td>
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<td>CS—Introduction to Logic &amp; Assembly Languages</td>
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<td><strong>Group II</strong></td>
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<td>Subjects in the main-stream of computer science</td>
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<td>Quantitative Business Analysis II</td>
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<td>Social Implications of Computers</td>
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<td>EE341—Autonamic Control</td>
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<td>EE345—Sample Data &amp; Digital Control</td>
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<td>EE325—Introduction to Digital Technology</td>
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<td>EE447—Digital Communications</td>
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<td>EE463—Computer Operating Systems</td>
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<td>EE464—Compiler Construction</td>
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<td>EE462—Topics in Switching Theory</td>
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<td>BS456—Pattern Recognition</td>
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<td>BS566—Automata &amp; Computing Machines</td>
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<td>BS567—Computer Process Control</td>
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<td><strong>Group III</strong></td>
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<td>Subjects which have some application to computer science</td>
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<td>CE315—Elastic Continuum</td>
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<td>EE323—Linear Electronics</td>
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<td>EE324—I—Electronics Laboratory</td>
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<td>EE342—I—Linear System Theory</td>
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<td>EE344—Communications</td>
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<td>EE421—I—Electronic Design A</td>
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<td>EE443—Optimization Techniques</td>
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<td>BS516—Computer Aided Analysis of Power-Systems</td>
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<td>CS—Mathematical Logic</td>
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<td>CS—Theory of Statistics</td>
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<td>CS—Asymptotic Methods in Analysis</td>
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<td>CS—Random &amp; Restricted Walks</td>
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<td>EE360—I—Advanced Computer Architecture &amp; Assembly Languages</td>
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<td>EE360—I—Formal Languages &amp; Automata</td>
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<td>CS—Theory of Computing</td>
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<td>CS—Mathematical Principles of Numerical Analysis</td>
<td>Mathematics I</td>
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<tr>
<td>CS—Programming Languages &amp; Advanced Applications in Computing</td>
<td>Mathematics I</td>
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<tr>
<td>CS—Concurrent Programming Techniques</td>
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<tr>
<td>ME505—Systems Planning, Organization &amp; Control</td>
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<td>ME404—I—Mathematical Programming</td>
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<td>ME514—I—Mathematical Programming</td>
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**Department of Electrical Engineering**

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<td>Electrical Engineering</td>
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<tr>
<td>EE364—I—Introduction to Logic &amp; Assembly Languages</td>
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<td>EE366—I—Switching Theory &amp; Logical Design</td>
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<td>EE362—I—Switching Theory &amp; Logical Design</td>
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<td>EE344—I—Linear System Theory</td>
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<td>EE342—I—Electronic Design A</td>
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<td>EE443—Optimization Techniques</td>
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**Department of Computer Engineering**

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</table>
The Board may approve the inclusion in a student's programme of a project. This project would be in lieu of Group III subjects and may not count more than two units.

A student may suggest to the Dean for consideration by the Board the inclusion in his programme of a subject not listed in the Schedule of Subjects.

Students interested in positions as Computer Systems Officers in the Australian Public Service are strongly advised to include the subjects Systems Analysis and Systems Design in their course.

**Assumed Standard of

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<td>CS—Quantitative Aspects of Social Phenomena</td>
<td>Mathematics</td>
<td>Part II Mathematics, Topics B, D &amp; H</td>
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<tr>
<td>CS—Graph Theory</td>
<td>Mathematics</td>
<td>Part II Mathematics, Topics D, R</td>
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<tr>
<td>ME449—Reliability Analysis for Mechanical Systems</td>
<td>Mechanical Engineering</td>
<td>Part II Mathematics, Topic H</td>
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<tr>
<td>ME447—Operations Research — Deterministic Models</td>
<td>Mechanical Engineering</td>
<td>Part II Mathematics, Topics CO, D, H</td>
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<tr>
<td>ME488—Operations Research — Probabilistic Models</td>
<td>Mechanical Engineering</td>
<td>Part II Mathematics, Topics D, R</td>
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<tr>
<td>ME503G—Design of Experiments for Engineering Research</td>
<td>Mechanical Engineering</td>
<td>Part II Mathematics, Topics CO, D</td>
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<tr>
<td>Met 312—Optimization &amp; Control</td>
<td>Physics</td>
<td>Physics IA or IB</td>
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<tr>
<td>CS—Instrumentation Techniques</td>
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**DESCRIPTION OF SUBJECTS**

**GROUP I — CORE SUBJECTS**

410136 CS--Commercial Programming — I. R. Beaman

**Assumed Standard of

<table>
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<th>Mathematics I Topic SC or Commercial E.D.P. Attainment</th>
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**Hours**

2 lecture hours per week for 1st ½ year

**Examination**

Two 3-hour papers (i) Theory—at mid year (ii) COBOL at end of year

**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.

**COBOL** as a business data processing and file organisation language. Extensive practical work in COBOL, including case studies.

**References**

Feingold, C. 

Fundamentals of COBOL Programming (W. C. Brown)

I.C.L. 

1900 Series COBOL Manual

Chai, W. A. & H. W. 

Programming Standard COBOL (Academic)

Clifton, H. D. 

Systems Analysis for Business Data Processing (Business Books)

Davis, G. B. & Litecky, C. R. 

Elementary Cobol Programming (McGraw-Hill)

DeRossi, C. J. 

Learning COBOL Fast (Reston)

Kapur, G. K. 

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

Laden, H. N. & Gildersleeve, T. R. 

System Design for Computer Applications (Wiley)

McCracken, D. D. et al. 

Programming Business Computers (Wiley)

Murach, M. 

Standard COBOL (S.R.A.)

Sanders, D. H. 

Computers in Business (McGraw-Hill)

Sprowls, R. C. 

Computing with COBOL (Harper & Row)

Stern, N. B. & R. A. 

Cobol Programming (Wiley)

Waters, J. L. 

Cobol Programming (Heinemann)

532112 CS—Introduction to Logic & Assembly Languages—K. K. Saluja

Assumed Standard of

| Mathematics I |

**Hours**

1½ hours of lectures & practical work per week for whole year
**Examination**
Progressive assessment & final examination

**Content**

**Number Systems:**
Representation Arithmetic

**Boolean Algebra:**
Combinational logic, Karnaugh Maps, flip flops, sequential logic, counters

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.

**References**
Friedman, A. D.  *Logical Design of Digital Systems* (Computer Science 1975)


Mano, M. M.  *Computer Logic Design* (Prentice-Hall 1972)

Mano, M. M.  *Computer System Architecture* (Prentice-Hall)

Prather, R. E.  *Introduction to Switching Theory: A Mathematical Approach* (Allyn & Bacon)

569411  CS—Programming and Algorithms — D. W. Blatt

**Assumed Standard of Attainment**
Mathematics I

**Hours**
2 lecture hours & 1 tutorial hour per week for the 1st ½ year

**Examination**
One 3-hour paper. Programming assignments are an integral part of the course.

**Content**

**Text**
Guttmann, A. J.  *Programming and Algorithms* (Heinemann 1977)

**References**

Day, A. C.  *Fortran Techniques: with Special Reference to Non-numerical Applications* (Cambridge U.P. 1972)


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

660112 CS—Data Structures and Programming — D. W. Blatt

**Assumed Standard of Attainment**  
CS—Programming & Algorithms

**Hours**  
2 lecture hours & 1 tutorial hour per week for 2nd 1/2 year

**Examination**  
One 2-hour paper

**Content**  
Introduction to data structures: lists, strings, arrays, trees, graphs, searching and sorting; list processing.

Higher level programming languages: Syntax and semantics. Backus normal form. Polish notation. Declarations, storage allocation, subroutines and linkage. Compilation, interpretation and translation. Study and comparison of data structures in several languages, e.g. ALGOL 60, ALGOL 68, COBOL, FORTRAN, LISP, etc.

**Text**  
Nil

**References**

Berztiss, A. T.  
*Data Structures: Theory and Practice*  
(Academic 1971)

Day, A. C.  
*Fortran Techniques: with Special Reference to Non-numerical Applications*  
(Cambridge U.P. 1972)

Galler, B. A. & Perlis, A. J.  
*A View of Programming Languages*  
(Addison-Wesley 1970)

Gear, W.  
*Computer Organization and Programming*  
(McGraw-Hill 1969)

Knuth, D. E.  
*The Art of Computer Programming*  
(Addison-Wesley)

McCameron, F. A.  
*COBOL Logic and Programming*  
(Irwin-Dorsey 1974)

Page, E. S. & Wilson, L. B.  
*Information Representation and Manipulation in a Computer*  
(Cambridge U.P. 1973)

Sammet, J. E.  
*Programming Languages: History and Fundamentals*  
(Prentice-Hall 1969)

660113 CS—Numerical Analysis — R. W. Gibberd

**Assumed Standard of Attainment**  
Part II Mathematics Topics CO, D, F

**Hours**  
1 lecture hour & 1 tutorial hour per week

**Examination**  
One 2-hour paper

**Content**  

**Text**  
Nil

**References**

Forsythe, G. & Moler, C. B.  
*Computer Solution of Linear Algebraic Systems*  
(Prentice-Hall 1967)

Ralston, A.  
*A First Course in Numerical Analysis*  
(McGraw-Hill 1965)

Steinberg, D. I.  
*Computational Matrix Algebra*  
(McGraw-Hill 1974)

Additional references to be advised

**GROUP II**

Subjects in the main-stream of Computer Science

Offered by the Department of Commerce

413611 Information Systems

**Note**  
Candidates who passed the subject Accounting Systems and Computer Applications or Management Studies prior to 1974 will not be permitted to enrol in this subject.

**Assumed Standard of Attainment**  
Commercial Electronic Data Processing (or Management Studies if passed in 1974)

**Hours**  
2 lecture hours per week

**Examination**  
Progressive assessment/group assignments

**Structure**  
Students will, at the beginning of the course, indicate the level of attainment that they intend to maintain i.e. distinction, credit or pass.
Thereupon students will be grouped into threes. Each of the three will have the same attainment level intention. Most assignments will be set for group completion. Groups will meet together and allocate work.

**Content**

General consideration of information systems. Detailed consideration and practice in programming. Programming languages are COBOL for batch processing and DIBOL for direct access. Analysts of business information systems.

**Texts**

Texts obtained by the group, not necessarily by each student.

International Computers Ltd.  
*Introduction to COBOL. I.C.L. Student Edition* (International Computers Ltd.)

Digital Equipment Corp.  
*DIBOL Manual (PDP 11/70)* (Digital Equipment Corp.)

The University of Newcastle  
*Computing Centre Handbook*

Li, David H.  
*Design and Management Information Systems* (Science Research Associates)


Dock, V. T. & Essick, E.  
*Principles of Business Data Processing* (Science Research Associates)

Murach, M.  
*Business Data Processing with COBOL* (Science Research Associates)

**References**

Elison, A. J. & Kitts, K. D.  
*Business Computer Systems and Applications* (Science Research Associates)

Harman, W., Matthes, H., Proeme, A.  

Johnson, R. A. et al.  
*The Theory and Management of Systems* (McGraw-Hill)

Murdich, R. G. & Ross, J. E.  
*Information Systems for Modern Management* (Prentice-Hall)

Schoderbeck, P. P.  
*Management Systems* (Wiley)

Stern, Nancy  
*Flowcharting: A Tool for understanding computer logic* (Wiley)

**412601 Quantitative Business Analysis II**

**Assumed Standard of Attainment**

Nil

**Hours**

2 lecture hours per week

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**Examination**

One 2-hour paper; progressive assessment & project

**Content**

Quantitative methodology; BASIC programming; mathematics review; decision theory; demography and its applications; CPM/PERT; inventory modelling; linear programming in practice; game theory; Markov analysis; queueing theory; dynamic programming; business forecasting; elements of simulation; management of quantitative analysis projects in real life.

**Texts**

Anderson, J. et al.  
*Thesis and Assignment Writing* (Wiley)

Levin, R. I. & Kirkpatrick, C. A.  
*Quantitative Approaches to Management* 3rd edn (McGraw-Hill)

Pollard, A. H. et al.  
*Demographic Techniques* (Pergamon)

Starr, M. K. & Stein, I.  
*The Practice of Management Science* (Prentice-Hall)

**References**

Baumol, W. J.  
*Economic Theory and Operations Analysis* (Prentice-Hall)

Hillier, F. S. & Lieberman, G. J.  
*Introduction to Operations Research* (Holden Day)

Taha, H. A.  
*Operations Research: An Introduction* (Macmillan)

Wagner, H. M.  
*Principles of Operations Research* 2nd edn (Prentice-Hall)

**410135 Social Implications of Computers**

**Assumed Standard of Attainment**

Mathematics I or Commercial E.D.P.

**Hours**

2 hours per week for 2nd 4 year

**Examination**

One 3-hour paper

**Content**

The spectrum of political, legal, managerial, philosophical, ethical and social issues; human variables associated with strategies of change; impact upon organisation structures; socio-technical systems; effects upon communication, privacy, public justification.

**Texts**

To be advised

**References**


Assumed Standard of Attainment

Ni1

Hours

2 lecture hours per week for the 1st ½ year & associated practical work

Examination

An examination at mid-year

Content

This course seeks to fill a wide range of goals depending on the experience of the student. Systems Analysis covers the activities which occur early in the life cycle of a computer-based business system. Individual topics include systems concepts, the systems analyst, the techniques of systems analysis, project control methods, report standards and structures.

Texts

The National Computing Centre Systems Analysis & Design Student Notes will be supplied.

Gold, M. & Stubbe, J.

Elements of Systems Analysis (W. C. Brown)

References

Chandor, A. et al. Practical Systems Analysis (Rupert, Hart & Davis)

Clifton, H. D. Systems Analysis for Business Data Processing (Wiley)

Daniels, A. & Yeates, D. Basic Training in Systems Analysis (Pitman)

Gans, T. B. et al. Management Systems (Holt, Rinehart & Winston)

Hare, Van Court Systems Analysis: A Diagnostic Approach (Harcourt, Brace & World)

Kindred, A. R. Data Systems and Management (Prentice-Hall)

Optner, S. L. Systems Analysis for Business Management (Prentice-Hall)


Weiss, E. A. Computer Usage/Applications (McGraw-Hill)

Offered by Department of Electrical Engineering

533213 EE341 Automatic Control --- see page 104

533412 EE345 Sample Data and Digital Control

Assumed Standard of Attainment EE341 or ME361 Automatic Control

Hours

3 hours of lectures & tutorials per week

Examination Progressive assessment & final examination

Content


Text

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

References

Further references will be given in class.

534148 EE462—Topics in Switching Theory

Assumed Standard of EE362 Switching Theory & Logical Design

Attainment

Hours

Three hours per week for the 1st 1/2 year

Content

Complete set of logic primitives, strong and weak complete sets. Post's theorem. Equivalence classes of functions. Decomposition
Cellular realization of combinational and sequential logic functions. Universal Logic Modules, Finite and infinite cellular arrays and their
Testing. Programmable cellular logic.

Text

To be determined

References

Mukhopadhyay, A. (ed.) Recent Developments in Switching Theory

Friedman, A. D. & Menon, P. R. Fault Detection in Digital Circuits

Kohavi, Zvi Switching and Finite Automata Theory

530106 EE565 Pattern Recognition

530119 EE566 Automata & Computing Machines

530123 EE567 Computer Process Control

530121 EE568 Advanced Computer Architecture

530122 EE569 Formal Languages & Automata

not offered in 1979

530127 CS—Theory of Computing

660126 ME505 Systems Planning, Organization & Control—see page 117

544417 ME404 Mathematical Programming—see page 118

GROUP III

Listed below are a number of subjects which the Board regards as suitable for Group III. This list is not, however, intended to be
exhaustive and other subjects will be considered.

Offered by Department of Civil Engineering

520115 CES15 Elastic Continua—For details consult the Engineering

Faculty Handbook

Offered by Department of Commerce

413612 Theories of Organisation

Assumed Standard of Organisational Behaviour

Attainment

Hours

2 lecture hours per week

Examination

Two 3-hour papers

Content

The influence of politics, power and conflict: topics include organisa-
tions and the rationalisation of work; organisational structures;
bureaucracies as working communities; the scientific management
movement; Mayo and the Hawthorne experiments; Kurt Lewin and
field theory; group membership and intergroup conflict; search for
principles of management; worker participation models; organisational
development; and propositions of organisational behaviour.

Texts

Lupton, T. Management and the Social Sciences

Poole, M. Worker Participation in Industry (Routledge

Kegan & Paul)

Sofer, C. Organisation in Theory and Practice

Mouzelis, N. P. Organisation and Bureaucracy—An Analysis

of Modern Theories (Routledge Kegan &

Paul)

References

Argyle, M. The Psychology of Interpersonal Behaviour

(Penguin)

Offered by Department of Mathematics

660127 CS—Theory of Computing

660128 CS—Mathematical Principles

660132 CS—Programming Languages

664403 CS—Concurrent Programming

Techniques

Mathematics III Topic TC, see page 50

Mathematics III Topic Z, see page 54

Mathematics III Topic PL, see page 47

Mathematics IV, see page 56

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Offered by Department of Electrical Engineering

533107 EE323 Linear Electronics
533108 EE324 Electronic Laboratory
533110 EE325 Linear System Theory
533113 EE334 Communications
534109 EE412 Electronic Design A
534110 EE422 Electronic Design B
534140 EE432 Non-Linear Optimal Control—not offered in 1979
534143 EE443 Optimization Techniques
530100 EE516 Computer-aided Analysis of Power Systems—not offered in 1979

Offered by Department of Mathematics

660114 CS—Mathematical Logic
660129 CS—Theory of Statistics
660118 CS—Asymptotic Methods
660119 CS—Random and Restricted Walks
660120 CS—Signal Detection
660121 CS—Stochastic Processes
660122 CS—Combinatorial Designs
660123 CS—Combinatorics
660125 CS—Graph Theory
660131 CS—Quantitative Aspects of Social Phenomena

Offered by Department of Mechanical Engineering

544416 ME349 Reliability Analysis for Mechanical Systems
544417 ME347 Operations Research — Deterministic Models
544422 ME418 Operations Research — Probabilistic Models
540101 ME593G Design of Experiments for Engineering Research

1 For details consult the Engineering Faculty Handbook.

Offered by Department of Metallurgy

113312 Met 312 Optimization and Control

1 For details consult the Engineering Faculty Handbook.
RESEARCH IN THE
DEPARTMENT OF MATHEMATICS

Algebra
Associate Professor W. Brisley is working on some problems relating to the lattices of subvarieties of certain varieties of groups, and on some applications of algebra to some data-processing problems.

Biomedicaliniatics
Dr W. Summerfield is currently studying fluid mechanical features of the cardiovascular circulatory system. He is interested in the mathematical modelling of all functions of the human body.

Chemical Kinetics
Dr D. J. S. McElwain is working on the mathematical modelling of non-equilibrium phenomena in gases, using the Master Equation approach.

Combinatorial Theory and Operations Research
Dr R. B. Eggleton is interested in all aspects of combinatorial mathematics, particularly graph theory.
Professor R. W. Robinson is applying combinatorics to the counting of various structures, such as graphs and search trees.
Dr R. J. Vaughan is interested in the application of optimisation methods to industrial production problems.
Associate Professor W. D. Walls is carrying out research on block designs and graph theory.

Computer Science and Numerical Analysis
Dr D. W. E. Blatt is working on models of programme referencing behaviour and studying performance of memory management systems. He is also interested in analysis of algorithms and computational complexity, and the development of programming languages and systems.

Chemical Physics
Dr R. G. Blakely is working on the study of wave propagation, particularly in some problems of families of sets.

Combinatorial Theory and Operations Research
Dr R. W. Brasky is working on some problems relating to the lattices of subvarieties of certain varieties of groups, and on some applications of algebra to some data-processing problems.

Dynamical Systems
Dr J. G. Cooper is working on stable and generic properties of flows and diffeomorphisms.

Environmental and Urban Studies
Dr R. W. Gibberd is studying the art of population projections and various models of urban structure and urban development. He is also interested in urban sociology, voting patterns and urban demographic models.

Dr R. J. Vaughan is investigating mathematical models in urban geography.

Dr J. Dobson is working on mathematical models in urban geography and urban sociology.

Fluid Mechanics
Associate Professor A. J. Guttman is studying the problem of extrapolating regular perturbation series in fluid mechanics.
Dr W. T. F. Lau is concerned with potential flow and viscous flow problems. Meniscus profiles are also of current interest.

Fluid Dynamics
Dr W. Summerfield is interested in all phenomena in which fluid dynamics plays a significant role; for example, ocean waves, turbulence, estuariedynamics, weather prediction, sailing vessels, surfing, animal propulsion.

Functional Analysis
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between languages by statistical analysis of their vocabularies. Stochastic models of language evolution are developed.

**Mathematical Models of Tumour Growth**

Dr D. I. S. McElwain is investigating models for the growth of solid isolated tumours.

**Medical Statistics, Epidemiology**

Dr R. W. Gibberd and Dr A. J. Dobson are collaborating with the Medical Faculty in analysing mortality data in Australia and smaller areas in New South Wales, as well as data coming from the Hunter Valley heart attack study.

**Models of Learning**

Dr A. J. Dobson works on the mathematical formulation of learning theories and on the statistical analysis of experimental data.

**Number Theory**

Dr R. B. Eggleton is interested in number theory, particularly in combinatorial aspects of the subject.

Dr T. K. Sheng studies the structure of humanly manageable numbers, 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.

**Statistical Mechanics**

Associate Professor C. A. Croxton is working on the statistical mechanics of liquids, polymers and liquid interfaces.

Dr R. W. Gibberd is interested in most aspects of statistical mechanics.

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.

Dr W. P. Wood is investigating the conformational properties of long chain molecules.

**Statistics**

Dr A. J. Dobson is interested in circular distributions, non-linear estimation problems and the application of statistics to psychology.

Associate Professor W. D. Wallis is working on the theory and application of Room square designs and paired comparison designs.

**Transportation Problems**

Dr R. J. Vaughan is continuing his work on the application of mathematics to traffic engineering, traffic accidents and transportation planning.

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**Computer Numbers for 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>
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<th>Computer Number</th>
<th>NAMES OF COMPONENTS</th>
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<td>544104 ME483 Production Engineering</td>
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Assign topics with Department

Computer Number  SUBJECT NAME  Computer Number  NAMES OF COMPONENTS

533900  Mechanical Engineering IIC  543204  ME361 Automatic Control
540126  ME305 Systems Planning, Organisation & Control
544417  ME404 Mathematical Programming
544419  ME436 Advanced Kinematics & Dynamics of Machines
544420  ME448 Introduction to Photomechanics
544418  ME449 Reliability Analysis for Mechanical Systems
544841  ME487 Operations Research—Deterministic Models
544842  ME488 Operations Research—Probabilistic Models

743100  Physics IIIA
753300  Psychology IIIC
663300  Statistics III

Part IV Subjects
664100  Mathematics IV
664300  Mathematics/Physics IV
664200  Mathematics/Psychology IV

Diploma in Computer Science Course

410136  CS—Commercial Programming
533112  CS—Introduction to Logical & Assembly Languages
533221  CS—Switching Theory & Logical Design
660111  CS—Programming & Algorithms
660112  CS—Data Structures & Programming
660113  CS—Numerical Analysis
412601  Information Systems
412601  Quantitative Business Analysis II
410135  Social Implications of Computers
410127  Systems Analysis
410128  Systems Design
533213  EE341 Automatic Control
533112  EE345 Sample Data & Digital Control
533115  EE345 Introduction to Digital Technology
534134  EE437 Digital Communications
534124  EE463 Computer Operating Systems
534143  EE464 Compiler Construction
534145  EE466 Topics in Switching Theory
530108  EE467 Pattern Recognition
530119  EE468 Automatic & Computing Machines
530125  EE467 Computer Process Control

530121  EE568 Advanced Computer Architectures
530122  EE569 Formal Languages & Automata
660127  CS—Theory of Computing
660128  CS—Mathematical Principles of Numerical Analysis
660132  CS—Programming Languages & Advanced Applications in Computing
664403  CS—Concurrent Programming Techniques
540126  ME505 Systems Planning, Organisation & Control
544417  ME404 Mathematical Programming
540119  ME581G Mathematical Programming
520115  CE515 Elastic Continua
413612  Theories of Organisation
533107  EE323 Linear Electronics
533108  EE324L Electronics Laboratory
533110  EE342 Linear Systems Theory
533113  IR344 Communications
534109  EE421 Electronic Design A
534110  EE422 Electronic Design B
534140  EE442 Nonlinear Optimal Control
534132  EE443 Optimization Techniques
530100  Computer-aided Analysis of Power Systems
660114  CS—Mathematical Logic
660129  CS—Theory of Statistics
660118  CS—Asymptotic Methods in Analysis
660119  CS—Random & Restricted Walks
660120  CS—Signal Detection
660121  CS—Stochastic Processes
660131  CS—Quantitative Aspects of Social Phenomena
660122  CS—Combinatorial Designs
660123  CS—Combinatorics
660125  CS—Graph Theory
544418  ME449 Reliability Analysis for Mechanical Systems
544481  ME487 Operations Research—Deterministic Models
544482  ME488 Operations Research—Probabilistic Models
540101  ME500G Design of Experiments for Engineering Research
113312  Met312 Optimization & Control
742201  CS—Instrumentation Techniques

Not offered in 1979