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 Boehm) pp. 261-270, Penguin 1966.

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

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

In Newcastle we have given practical effect to these links by introducing programmes of study which lead to the award of the B.Math degree together with other first degrees of the University. The other fields with which combined degree programmes have been available since 1975 are Arts, Science, Metallurgy and Commerce. More recently, we have put into effect arrangements or preparations 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 is being completed in 1978 by the presentation of the new subject Computer Science III. For the near future, we hope to make similar extensions of our undergraduate courses in statistics. 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. 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.

J. A. CAMPBELL,
Dean, Faculty of Mathematics
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>
</tr>
</thead>
<tbody>
<tr>
<td>Accounting I</td>
<td>Biology I, IIB &amp; IIA</td>
</tr>
<tr>
<td>Biology I</td>
<td>German I, II or IN</td>
</tr>
<tr>
<td>Chemistry I</td>
<td>Greek I</td>
</tr>
<tr>
<td>Classical Civilisation I</td>
<td>History I</td>
</tr>
<tr>
<td>Drama I</td>
<td>Japanese I</td>
</tr>
<tr>
<td>Economics IA</td>
<td>Latin I</td>
</tr>
<tr>
<td>French I</td>
<td>Legal Studies I</td>
</tr>
<tr>
<td>French IN or IS</td>
<td>Linguistics I</td>
</tr>
<tr>
<td>Geography I</td>
<td>Philosophy I</td>
</tr>
<tr>
<td>Physics IA or IB</td>
<td>Psychology I</td>
</tr>
<tr>
<td>Sanskrit I</td>
<td>Sociology I</td>
</tr>
<tr>
<td>Teaching IIA</td>
<td>History II, IIB &amp; IIC</td>
</tr>
<tr>
<td>Teaching IIB</td>
<td>Japanese I</td>
</tr>
<tr>
<td>Teaching IIC</td>
<td>Legal Studies IIA</td>
</tr>
<tr>
<td>Teaching IID</td>
<td>Philosophy IIA &amp; IIB</td>
</tr>
<tr>
<td>Teaching IIIE</td>
<td>Physics II</td>
</tr>
<tr>
<td>Teaching IIIF</td>
<td>Psychology IIA &amp; IIB</td>
</tr>
</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 should also include the Part II Mathematics Topic H, Probability and Statistics, in their course. **Economics IIB** — This subject would not normally be included in the Bachelor of Mathematics course. However if permission is given to include this subject then the content should be discussed with the Dean. A student may not include both Physics IA and Physics IB in his course.

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 II A, Mathematics II B and Mathematics III A.

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>Discipline</th>
<th>Level of Study Recommended</th>
</tr>
</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 Microeconomics; Macroeconomics; 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 III A 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>
</tr>
</thead>
<tbody>
<tr>
<td>(a) English</td>
<td>(i) A Part I &amp; Part II subject in English; and</td>
</tr>
<tr>
<td></td>
<td>(ii) one additional subject from English, Linguistics or Drama</td>
</tr>
<tr>
<td>(b) History</td>
<td>A Part II subject in History</td>
</tr>
<tr>
<td>(c) Modern Languages</td>
<td>A Part III subject in French or German</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 II subject in Geography</td>
</tr>
<tr>
<td>(f) Commerce/Economics</td>
<td>B.A. including Economics IIA, or B. Com. including Microeconomics, Macroeconomics</td>
</tr>
<tr>
<td>(g) Social Science/Studies</td>
<td>Out of Economics, Geography, History, Psychology, Sociology, Legal Studies, Economic History one subject at Part II level and two other subjects at Part I level</td>
</tr>
</tbody>
</table>

(h) Mathematics (i) At least four subjects in Mathematics for the degree of B.A., B.Math., or B.Sc. or (ii) A degree in a field of applied science, with experience in the application of mathematics

(i) Science (i) Three subjects from the disciplines of Biology, Chemistry, Geology, Physics, or related fields of applied science, such subjects to be drawn from at least two of the disciplines of Biology, Chemistry, Geology, Physics and (ii) at least one other subject drawn from any of the above or from Mathematics, Geography, or Psychology

(j) Primary No specific prerequisites.

Note

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

REQUIREMENTS FOR THE DEGREE OF BACHELOR OF MATHEMATICS

Section I — General

1. Definitions

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

2. Grading of Degree

The degree of Bachelor of Mathematics may be conferred either as an ordinary degree or as an honours degree.
3. Approval of First Enrolment
A candidate when enrolling in the Faculty for the first time shall report in person to the Dean, or his nominee, to have his enrolment for that year approved.

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

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

6. Special Examinations
A candidate may be granted a special examination in accordance with the provisions of By-Law 5.9.3.

7. A Subject
(a) To complete a subject qualifying towards the degree, herein-after called a subject, a candidate shall attend such lectures, tutorials, seminars, laboratory classes and field work and submit such written work as the Department concerned shall require.
(b) To pass a subject a candidate shall satisfy the requirements of sub-section 7(a) above and pass such examinations as the Faculty Board concerned shall require.

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

9. Prerequisites and Corequisites
(1) No candidate may enrol in any subject unless he has passed the subjects prescribed as its prerequisites 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 IIA, Mathematics IIC and Mathematics IIIA; and
(b) either Mathematics IIIB or Computer Science III or at least one other Part III subject chosen from the Schedules to these 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 diplomate of another tertiary institution or faculty shall not receive credit for more than four subjects and if granted credit may not include as a qualifying subject any subject equivalent to one counted towards his previous qualification.

(b) Notwithstanding the provision of section (a) (i) of this sub-section, a graduate or undergraduate of another tertiary institution may be given credit for subjects not offered for the degree of Bachelor of Mathematics in the University of Newcastle provided that:

(i) the candidate complies with all other conditions of the Requirements;
(ii) the candidate has his proposed pattern of course approved at the time at which the concession is granted and does not depart from the proposed pattern without the approval of the Dean.

**Section III — The Honours Degree**

17. **Admission to Candidature for the Honours Degree**

In order to be admitted to candidature for the Honours degree a candidate shall:

(a) have completed the requirements for admission to the ordinary degree;
(b) have completed any additional work prescribed by the Head of each Department concerned;
(c) have satisfactorily completed the prerequisites prescribed in one of the Schedules of Subjects for a Part IV subject; and
(d) have obtained the approval of the Head of each Department concerned. Application must be made by the date specified in the Faculty Handbook.

18. **Time Requirements**

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

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

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

19. **Honours**

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

20. **Classes of Honours**

There shall be three classes of Honours, namely Class I, Class II and Class III. Class II shall have two divisions, namely Division (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.

**Section IV — Combined Degree Courses**

23. **General**

A candidate may complete the Requirements for the degree of Bachelor of Mathematics in conjunction with another Bachelor's degree by completing a combined course approved by the Faculty Board of the Faculty of Mathematics and the other Faculty Board concerned provided that:

(i) admission to a combined course shall normally be at the end of the first year and shall be subject to the approval of the Deans of the two Faculties concerned;
(ii) admission to combined courses will be restricted to students with an average of at least Credit level;
(iii) the Deans of both Faculties shall certify that the work in the combined degree course is no less in quantity and quality than if the two courses were taken separately;
(iv) the Requirements for both degrees shall be satisfied except as provided below.

24. **Arts/Mathematics**

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

(b) To qualify for admission to the ordinary degrees of Bachelor of Arts and Bachelor of Mathematics, a candidate shall pass fourteen subjects, five of which shall be Mathematics I, Mathematics IIA, Mathematics IIC, Mathematics IIIA and either Mathematics IIIIB or Computer Science III or another 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 IIIC shall not be entitled to count either Psychology IIA or IIB;
(v) a candidate counting Psychology IIIC shall not be entitled to count either Psychology IIA or Psychology IIB;
(vi) a candidate counting Economics IIIC shall not be entitled to count either Economics IIA or Economics IIB;
(vii) a candidate counting Geology IIIC shall not be entitled to count either Geology IIIA or Geology IIB.

25. **Mathematics/Science**

After completing the first year of study towards either the degree of Bachelor of Mathematics or the degree of Bachelor of Science including a pass at a satisfactory level in the subject Mathematics I, a candidate may enrol in a combined Mathematics/Science course. A candidate who has enrolled in such a combined course shall qualify for admission to the ordinary degrees of Bachelor of Mathematics and Bachelor of Science by passing fourteen subjects as follows:

(a) five subjects, being Mathematics I, Mathematics IIA, Mathematics IIC, Mathematics IIIA and either Mathematics IIIIB or Computer Science III or another Part III subject chosen from the Schedules of Subjects approved for the degree of Bachelor of Mathematics and
(b) six subjects chosen from the other subjects listed in the Schedule of Subjects approved for the degree of Bachelor of Science and

26. **Mathematics/Metallurgy**

After completing a successful first year of study towards either the degree of Bachelor of Mathematics or the degree of Bachelor of Metallurgy, a candidate may enrol in a Mathematics/Metallurgy course. A candidate who has enrolled in such a combined course shall qualify for admission to the ordinary degree of Bachelor of Mathematics and the degree of Bachelor of Metallurgy by passing Mathematics I, Mathematics IIA, Mathematics IIC, Mathematics IIIA and either Mathematics IIIIB or Computer Science III or another 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 IIA, Mathematics IIC, Mathematics IIIA and either Mathematics IIIIB or Computer Science III or another 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 IIB, Mathematics IIC, Mathematics IIA and either Mathematics IIB or Computer Science III or another 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 either Mathematics IIB or Computer Science III or another 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>Pre-or Corequisite Mathematics IIA</td>
</tr>
<tr>
<td>Part II</td>
<td>Mathematics IIIB, Mathematics IIC</td>
</tr>
<tr>
<td>Mathematics IIIA</td>
<td>Prerequisites Mathematics IIA &amp; Mathematics IIC</td>
</tr>
<tr>
<td>Mathematics IIB</td>
<td>Pre-or Corequisite Mathematics IIIA</td>
</tr>
<tr>
<td>Mathematics IIIA</td>
<td>Prerequisites Mathematics IIIA &amp; Mathematics IIIA</td>
</tr>
</tbody>
</table>

Computer Science Subjects

<table>
<thead>
<tr>
<th>Remarks including Prerequisites and Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisite Mathematics I</td>
</tr>
<tr>
<td>Prerequisite Computer Science II, Mathematics IIA &amp; Mathematics IIC</td>
</tr>
</tbody>
</table>

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 Mathematics or Physics at the two-unit level and Chemistry at the two-unit level. It is assumed that students have studied a Higher School Certificate Science subject at two-unit level or higher.

Corequisites Mathematics I, Physics IA

Prerequisites Engineering I & Mathematics I

Prerequisites Mathematics I, Psychology I. A candidate counting Psychology IIC shall not be entitled to count Psychology IA or Psychology IIB

Prerequisites Mathematics IIA & Mathematics IIC & either Accounting IIA or Accounting IIB

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

Prerequisites Chemical Engineering II & Mathematics IIA & Mathematics IIC & Computer Science II (including Topics E & F)

Prerequisites Civil Engineering IIM, Mathematics IIA & Mathematics IIC (including Topic E)

Prerequisites Mathematics IIA & Mathematics IIC (including Topics C, D & E)

Prerequisites Mathematics IIA & Mathematics IIC (including Topics C, D & E)

Prerequisites Economics IIA, Mathematics IIA & Mathematics IIC

Prerequisites Physics IA, 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 1977—Mathematics IIA, Mathematics IIC, one of Psychology IIA or Psychology IIB.

Prerequisites Physics II, Mathematics IIA & Mathematics IIC

Remarks: A candidate with better than pass level in Physics I and Chemistry I and the ability to write real situations in mathematical terms and to read around his subject, could complete the components of Chemical Engineering IIC without Chemical Engineering I, and may, after interview, be granted exemption by the Head of the Department of Chemical Engineering.

SCHEDULE C

Combined Honours Subjects

<table>
<thead>
<tr>
<th>Mathematics/Physics IV</th>
<th>Mathematics/Physics IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics IIA &amp; Physics IIA</td>
<td></td>
</tr>
<tr>
<td>Mathematics IIA &amp; Psychology IIC</td>
<td></td>
</tr>
</tbody>
</table>
NOTES ON COMBINED DEGREE COURSES

ARTS/MATHEMATICS

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 IA and Mathematics IC and another subject which should be a Part I or Part II subject approved for the degree of Bachelor of Arts
Year III Mathematics IIA plus two other subjects which must include at least one Part III subject
Year IV either Mathematics IIB or a Schedule B subject from the Requirements for Bachelor of Mathematics plus two other subjects which will complete the Requirements for the Arts degree.

Commerce/Mathematics

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

Year I Mathematics I
Introduction Quantitative Methods
Economics I
Accounting I
Year II Mathematics IIA
Mathematics IIC
One B.Com. subject
Year III Mathematics IIIA
Three B.Com. subjects
Year IV Mathematics IIB or Computer Science III or another Part III Schedule B subject from the Requirements for Bachelor of Mathematics,

Two B.Com. subjects
Year V Three B.Com. subjects.

Economics/Mathematics

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

The course could be pursued in the following manner:

Year I Mathematics I
Introduction Quantitative Methods
Economics I
One B.Ec. subject
Year II Mathematics IIA
Mathematics IIC
One B.Ec. subject
Year III Mathematics IIIA
Economics II
Two B.Ec. subjects
Year IV Mathematics IIB or Computer Science III or another Part III Schedule B subject from the Requirements for B.Math.

Two B.Ec. subjects
Year V Three B.Ec. subjects.

Engineering/Mathematics

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

The course could be pursued in the following manner:

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

Year I Chemistry I
Engineering I
Mathematics I
Physics IA or IB
MEI21 Workshop Practice
Year II Mathematics IIA
Mathematics IIC
Chemistry IIA
Chemical Engineering I Part 1
Year III Mathematics IIIA
Chemical Engineering I Part 2
Chemical Engineering IIA Part 1
Year IV Mathematics IIB or Part III Schedule B subject
Chemical Engineering IIA Part 2
Chemical Engineering IIB
Year V Chemical Engineering III
Projects II
Elective I

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

Year I CE111 Statics
ME111 Graphics
ME112 Engineering Drawing & Elementary Design
ME131 Dynamics
Mathematics I
Physics IA
Chemistry IS
CE171 Engineering Surveying I
Year II CE121 Mechanics of Solids
CE221 Properties of Materials
CE222 Materials Technology
CE231 Fluid Mechanics I
CE241 Water Resources Engineering
CE223 Engineering Geology
EE203 Introduction to Electrical Information
EE204 Introduction to Electrical Energy
ME121 Workshop Practice
ME271 Thermodynamics
### Year III
- Mathematics 1C
- Structural Analysis & Design
- Civil Engineering Systems I
- Transportation Engineering
- Computing Computations

### Year IV
- Mathematics IIIA
- Structural Analysis & Design II
- Earth & Rock Engineering
- Engineering Construction
- Engineering Economics

### Year V
- Mathematics IIIB
- Project
- Electives

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

<table>
<thead>
<tr>
<th>Year I</th>
<th>Mathematics I</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Engineering I</td>
</tr>
<tr>
<td></td>
<td>Physics IA</td>
</tr>
<tr>
<td></td>
<td>Chemistry IS</td>
</tr>
<tr>
<td>Met181</td>
<td>Electronic Structure of Materials</td>
</tr>
<tr>
<td>ME131</td>
<td>Dynamics</td>
</tr>
<tr>
<td>ME121</td>
<td>Workshop Practice</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year II</th>
<th>EE211 Energy Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE223</td>
<td>Semiconductor Devices</td>
</tr>
<tr>
<td>EE252</td>
<td>Electrical Circuits</td>
</tr>
<tr>
<td>MEB21</td>
<td>Electromagnetics &amp; Quantum Mechanics</td>
</tr>
<tr>
<td></td>
<td>Mathematics IIA</td>
</tr>
<tr>
<td></td>
<td>Mathematics IIC</td>
</tr>
<tr>
<td></td>
<td>Electives</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year III</th>
<th>Mathematics IIIA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mathematics IIIB or Schedule B</td>
</tr>
<tr>
<td></td>
<td>Part III subject</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year IV</th>
<th>EE313 Power Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE314</td>
<td>Electrical Machines</td>
</tr>
<tr>
<td>EE315</td>
<td>Power Electronics</td>
</tr>
<tr>
<td>EE323</td>
<td>Linear Electronics</td>
</tr>
<tr>
<td>EE325</td>
<td>Introduction to Digital Technology</td>
</tr>
<tr>
<td>EE333</td>
<td>Advanced Circuit Analysis</td>
</tr>
<tr>
<td>EE341</td>
<td>Automatic Control</td>
</tr>
<tr>
<td>EE344</td>
<td>Communications</td>
</tr>
<tr>
<td>EE361</td>
<td>Introduction to Logic &amp; Assembly Language</td>
</tr>
<tr>
<td>GE350</td>
<td>Seminar</td>
</tr>
<tr>
<td></td>
<td>2 from EE300, 400 Electives</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year V</th>
<th>EE480 Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE491</td>
<td>Seminar</td>
</tr>
<tr>
<td></td>
<td>9 from EE300, 400 or 500 Electives</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year I</th>
<th>Engineering I</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mathematics I</td>
</tr>
<tr>
<td></td>
<td>Physics IA</td>
</tr>
<tr>
<td></td>
<td>Chemistry IS</td>
</tr>
<tr>
<td>ME121</td>
<td>Workshop Practice</td>
</tr>
<tr>
<td>ME122</td>
<td>Process Technology</td>
</tr>
<tr>
<td>M151</td>
<td>Microstructure of Materials</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year II</th>
<th>Mathematics IIA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mathematics IIC</td>
</tr>
<tr>
<td></td>
<td>Electives</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Year III</th>
<th>Laboratory Measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME201</td>
<td>Dynamics of Engineering Systems</td>
</tr>
<tr>
<td>ME202</td>
<td>Mechanics of Solids</td>
</tr>
<tr>
<td>ME223</td>
<td>Mechanical Technology</td>
</tr>
<tr>
<td>ME232</td>
<td>Dynamics of Machines</td>
</tr>
<tr>
<td>ME241</td>
<td>Properties of Materials</td>
</tr>
<tr>
<td>ME251</td>
<td>Fluid Mechanics</td>
</tr>
<tr>
<td>ME271</td>
<td>Thermodynamics</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year IV</th>
<th>Mathematics IIIB or Part III Schedule B Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME313</td>
<td>Engineering Design</td>
</tr>
<tr>
<td>ME313</td>
<td>Engineering Design</td>
</tr>
<tr>
<td>ME203</td>
<td>Intro to Elect Info.</td>
</tr>
<tr>
<td>ME204</td>
<td>Intro to Elect Energy</td>
</tr>
<tr>
<td>ME342</td>
<td>Engineering Computations</td>
</tr>
<tr>
<td>ME342</td>
<td>Properties of Materials</td>
</tr>
<tr>
<td>ME361</td>
<td>Automatic Control</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year V</th>
<th>ME481 Engineering Administration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ME482 Engineering Economics</td>
</tr>
<tr>
<td></td>
<td>ME496 Project &amp; Seminar</td>
</tr>
<tr>
<td></td>
<td>ME381 Methods Engineering</td>
</tr>
<tr>
<td></td>
<td>ME381 Quality Engineering</td>
</tr>
<tr>
<td></td>
<td>ME413 Design of Crankshafts etc.</td>
</tr>
<tr>
<td></td>
<td>ME414 Design of Hydraulic Systems etc.</td>
</tr>
<tr>
<td></td>
<td>ME419 Design of Conveyors etc.</td>
</tr>
<tr>
<td></td>
<td>ME449 Reliability Analysis</td>
</tr>
<tr>
<td></td>
<td>ME487 O.R. -- Deterministic Models Electives</td>
</tr>
</tbody>
</table>

* Includes 3 units of Department Technical Electives.
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 conferment 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
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.
(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.

1 A separate sheet on the preparation and binding of higher degree thesis 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 A, II B, II C there is some choice available to students; for Mathematics III A and III B 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.
### MATHEMATICS SUBJECTS

**PART I SUBJECT**

<table>
<thead>
<tr>
<th>66f100 Mathematics I</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prerequisites</strong></td>
<td>Nil</td>
</tr>
<tr>
<td><strong>Hours</strong></td>
<td>4 lecture hours and 2 tutorial hours per week</td>
</tr>
<tr>
<td><strong>Examination</strong></td>
<td>Two 3-hour papers</td>
</tr>
</tbody>
</table>

**Content**

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

**PART I TOPICS**

**Algebra (Topic AL) — R. B. Eggleton**

<table>
<thead>
<tr>
<th><strong>Prerequisites</strong></th>
<th>Nil</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hours</strong></td>
<td>1 lecture hour per week and 1 tutorial hour per fortnight</td>
</tr>
</tbody>
</table>

**Content**

Introduction to basic algebraic objects and ideas. Induction, Binomial Theorem. Matrices, algorithms for solution of equations. Complex numbers. Permutations. Vector spaces, basis and dimension, subspaces, Homomorphisms, matrix representation, rank and nullity, determinants. Eigenvectors and eigenvalues. Applications are illustrated throughout the course.

**Text**

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

**References**

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)

McCoy, N. *Introduction to Modern Algebra* (Allyn & Bacon 1968)

Tropper, M. A. *Linear Algebra* (Nelson 1973)

**Real Analysis (Topic AN) — M. J. Hayes**

<table>
<thead>
<tr>
<th><strong>Prerequisites</strong></th>
<th>Nil</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hours</strong></td>
<td>1 lecture hour per week and 1 tutorial hour per fortnight</td>
</tr>
</tbody>
</table>

**Content**


**Text**

**References**


Spivak, M. *Calculus* (Benjamin 1967)

**Calculus (Topic CA) — R. F. Bughout**

<table>
<thead>
<tr>
<th><strong>Prerequisites</strong></th>
<th>Nil</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hours</strong></td>
<td>1 lecture hour per week and 1 tutorial hour per fortnight</td>
</tr>
</tbody>
</table>

**Content**


**Text**

Ayres, F. *Calculus* (Schaum 1974)

**References**


Hille, E. & Salas, S. *First Year Calculus Internat. Textbook Series* (Blaisdell 1968)


Spivak, M. *Calculus* (Benjamin 1967)

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

<table>
<thead>
<tr>
<th><strong>Prerequisites</strong></th>
<th>Nil</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hours</strong></td>
<td>1 lecture hour per week and 1 tutorial hour per fortnight</td>
</tr>
</tbody>
</table>
Content


A requirement is the writing of successful computer programmes to solve problems in statistical and numerical analysis.

Text


References


Hoel, P. G. *Introduction to Mathematical Statistics* (Wiley 1971)


Spiegel, M. R. *Statistics* (Schaum 1968)

Wilkes, M. V. *A Short Introduction to Numerical Analysis* (Cambridge U.P. 1971)

PART II SUBJECTS

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

Summaries and booklists for these topics are given on page 32 et seq. of this handbook.

The Department of Mathematics also offers jointly with the Department of Electrical Engineering, the subject Computer Science II. No student taking this subject may choose the Mathematics Topic F as a component of another Part II subject. A description and course outline of Computer Science II will be found on page 68 et seq.

<table>
<thead>
<tr>
<th>List of Topics for Part II Mathematics subjects</th>
<th>Corequisite or Prerequisite Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Topic</strong></td>
<td></td>
</tr>
<tr>
<td>A Mathematical Models</td>
<td>CO or C°</td>
</tr>
<tr>
<td>B Complex Analysis</td>
<td>CO or C°</td>
</tr>
<tr>
<td>C° Vector Calculus &amp; Differential Equations</td>
<td></td>
</tr>
<tr>
<td>D Linear Algebra</td>
<td></td>
</tr>
<tr>
<td>E Numerical Analysis &amp; Computing</td>
<td></td>
</tr>
<tr>
<td>F Finite Mathematics</td>
<td>C</td>
</tr>
<tr>
<td>G Probability &amp; Statistics</td>
<td>CO or C°</td>
</tr>
<tr>
<td>H Topic in Statistics e.g. Applications of Statistics</td>
<td>H</td>
</tr>
<tr>
<td>I Topic in Applied Mathematics e.g. Dynamics</td>
<td>CO or C°, E°</td>
</tr>
<tr>
<td>J Topic in Pure Mathematics e.g. Group Theory</td>
<td></td>
</tr>
<tr>
<td>K Real Analysis</td>
<td></td>
</tr>
</tbody>
</table>

*No longer offered.

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

662100 Mathematics IIA

**Prerequisite** Mathematics I

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

**Examination** Each topic is examined separately

**Content**

Topics B, CO and D. In exceptional circumstances and with the consent of the Head of the Department, one 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 IIB.

662200 Mathematics IIB

**Prerequisite** Mathematics I

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

**Examination** Each topic is examined separately

**Content**

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

662300 Mathematics IIC

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

Content
Topics K, L and one of the pairs of topics G and J, H and I or G and H. 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 II subject may have their choice of topics restricted further than is set out in the rules above.
2. Students whose courses include Physics IIA are advised to include topics C, I & 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, 1975, 1976 and 1977 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 1977 are no longer offered as separate topics.

### PART II TOPICS

<table>
<thead>
<tr>
<th>Topic</th>
<th>Mathematical Models</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>662101</strong></td>
<td><strong>662101 Topic A—Mathematical Models—D. L. S. McElwain</strong></td>
</tr>
<tr>
<td><strong>Prerequisite</strong></td>
<td><strong>Topic C</strong></td>
</tr>
<tr>
<td><strong>or Corequisite</strong></td>
<td><strong>Topic CO</strong></td>
</tr>
<tr>
<td><strong>Hours</strong></td>
<td>1 lecture hour per week and 1 tutorial hour per fortnight</td>
</tr>
<tr>
<td><strong>Examination</strong></td>
<td>One 2-hour paper</td>
</tr>
</tbody>
</table>

**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**

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

<table>
<thead>
<tr>
<th>Topic</th>
<th>Complex Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>662102</strong></td>
<td><strong>662102 Topic B—Complex Analysis—W. P. Wood</strong></td>
</tr>
<tr>
<td><strong>Prerequisite</strong></td>
<td><strong>Topic C</strong></td>
</tr>
<tr>
<td><strong>or Corequisite</strong></td>
<td><strong>Topic CO</strong></td>
</tr>
<tr>
<td><strong>Hours</strong></td>
<td>1 lecture hour per week and 1 tutorial hour per fortnight</td>
</tr>
<tr>
<td><strong>Examination</strong></td>
<td>One 2-hour paper</td>
</tr>
</tbody>
</table>

**Content**

**Text**

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

<table>
<thead>
<tr>
<th>Topic</th>
<th>Vector Calculus &amp; Differential Equations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>662109</strong></td>
<td><strong>662109 Topic CO—Vector Calculus &amp; Differential Equations—J. G. Couper/W. Summerfield</strong></td>
</tr>
<tr>
<td><strong>Prerequisite</strong></td>
<td>Nil</td>
</tr>
<tr>
<td><strong>Hours</strong></td>
<td>2 lecture hours per week and 1 tutorial hour per week</td>
</tr>
<tr>
<td><strong>Examination</strong></td>
<td>One 3-hour paper</td>
</tr>
</tbody>
</table>
Content
Differential and integral calculus of functions of several variables: partial derivatives, total differentials, chain rule, Jacobians, multiple integrals, Green's, Gauss' and Stokes' theorems, gradient, divergence and curl.

Taylor's polynomial; Fourier series.
First and second order linear differential equations: general solution, initial and boundary value problems, solution by Laplace transform. A little on Sturm-Liouville systems if time permits.
Second order linear partial differential equations: Laplace, Wave and Diffusion equations.

Text
Either
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

Linear programming. Functions of matrices, and matrix manipulations. Attention is paid to applications and algorithms throughout.

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

References
Ayres, F. *Matrices* (Schaum 1962)
Brisley, W. *A Basis for Linear Algebra* (Wiley 1973)
Lange, 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)
Reza, F. *Linear Spaces in Engineering* (Ginn 1971)


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)
The lectures will include discussions of the error propagation, Chebichev's inequality, and the weak law of large numbers. Elementary random variables, Poisson's theorem; conditional probability; Bayes' theorem, tree diagrams. Continuous random variables, frequency function, expectation, joint frequency function, moments. Normal variates. Classification of experimental data, histograms, empirical moments, measures of location and scatter. Statistical inference, hypothesis testing, types of error, power function, sampling theory, maximum likelihood estimation; frequency functions of the mean (\( \bar{X} \)), difference of two means (\( X_1 - X_2 \)), and the statistics \( X^2 \), \( S^2 \), \( T \) and \( F \) with applications.

Text

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

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

Mendenhall, W. & Scheaffer, R. L.  
Mathematical Statistics with Applications (Duxbury 1973)

References

Allendoerfer, C. B. & Oakley, C. O.  
Principles of Mathematics Chapter 12 (McGraw-Hill 1955)

Feller, W.  

Gnedenko, B. V.  
The Theory of Probability Chapters I & II (Chelsea 1967)

Hine, J. & Wetherill, G. B.  
A Programmed Text in Statistics Vol. 1--Summarising Data; Vol. 2--Basic Theory; Vol. 3--The t-test and \( X^2 \) Goodness of Fit; Vol. 4--Tests on Variance and Regression (Chapman & Hall 1975)

Kolmogorov, A. N.  
Foundations of the Theory of Probability (Chelsea 1950)

Lipschutz, S.  
Theory and Problems of Probability (Schaum 1968)

Loève, M.  
Probability Theory pp.1-18 (Van Nostrand 1960)

Moran, P. A. P.  
An Introduction to Probability Theory (Oxford U.P. 1968)

662301 Topic I -- Topic in Statistics

e.g., Applications of Statistics -- R. W. Gibberd

Prerequisite or Corequisite  
Topic II

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

One 2-hour paper

Content

This topic is an introduction to some methods of statistics and its applications. The lectures will include the following topics—descriptive statistics, standardization of data, linear regression and correlation, introductory multiple linear regression, Markov chains, analysis of categorized data, rank statistics, goodness of fit tests and non-parametric statistics.

Text

Nil

References

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

662302 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 $\mathbb{R}^2$ or $\mathbb{R}^3$.

Text

Nil

References

Baumslag, B. & Chandler, B. Group Theory (Schaum 1968)
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)

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


Text

Nil

References

Chorlton, F. Textbook of Dynamics (Van Nostrand 1963)
Goodman, L. E. Dynamics (Blackie 1963)
Marion, J. B. Classical Dynamics (Academic 1970)
References
Barle, R. G.  
Goldberg, R. R.  
Simmons, G. F.  
White, A. J.

Elements of Real Analysis (Wiley 1976)  
Methods of Real Analysis (Blaisdell 1964)  
Introduction to Topology and Modern Analysis (McGraw-Hill 1963)  
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 a Part III subject in Computer Science, which is described on page 71.

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 appropriate subject from Schedule B. Students proceeding to Honours will also be required to study additional topics as prescribed by the Heads of the Departments concerned.

Passes in both Mathematics IIIA and IIIC are prerequisite for entry to Mathematics IIIIB. It will be assumed that students taking a third-year subject in 1978 have already studied topics C, D, E, K, L 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.

Summaries of these topics, together with texts and references, appear on page 41 of this handbook.

List of Topics for Part III Mathematics

<table>
<thead>
<tr>
<th>Topic</th>
<th>Prerequisite</th>
</tr>
</thead>
<tbody>
<tr>
<td>FM</td>
<td>Foundations of Mathematics</td>
</tr>
<tr>
<td>GM</td>
<td>General Tensors</td>
</tr>
<tr>
<td>N</td>
<td>Variational Methods</td>
</tr>
<tr>
<td>O</td>
<td>Mathematical Logic</td>
</tr>
<tr>
<td>P</td>
<td>Ordinary Differential Equations</td>
</tr>
<tr>
<td>PD</td>
<td>Partial Differential Equations</td>
</tr>
<tr>
<td>PL</td>
<td>Programming Languages &amp; Advanced Applications in Computing</td>
</tr>
<tr>
<td>Q</td>
<td>Fluid Dynamics</td>
</tr>
<tr>
<td>R</td>
<td>Theory of Statistics</td>
</tr>
<tr>
<td>S</td>
<td>Geometry</td>
</tr>
<tr>
<td>T</td>
<td>Group Theory</td>
</tr>
<tr>
<td>TC</td>
<td>Theory of Computing</td>
</tr>
<tr>
<td>U</td>
<td>Operations Research</td>
</tr>
<tr>
<td>V</td>
<td>Measure Theory &amp; Integration</td>
</tr>
<tr>
<td>W</td>
<td>Analysis of Normed Linear Spaces</td>
</tr>
<tr>
<td>X</td>
<td>Rings &amp; Fields</td>
</tr>
<tr>
<td>Y</td>
<td>Topic in Applied Probability</td>
</tr>
<tr>
<td>Z</td>
<td>Mathematical Principles of Numerical Analysis</td>
</tr>
</tbody>
</table>

Topics K, L, and Q, R, U, Y must be included in these eight topics.

Notes
1. In order to take both Mathematics IIIA 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 B may have their choice of topics further restricted.
3. Students aiming to take Mathematics IV may be required to undertake study of more topics than the eight comprising the two Part III subjects.

PART III TOPICS

663100 Mathematics IIIA

Prerequisites  
Mathematics IIIA & IIIC

Hours  
4 lecture hours and 2 tutorial hours per week

Examination  
Each topic is examined separately

Content  
A subject comprising four topics, which must include O or FM or 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

Prerequisite/Or Corequisite  
Mathematics IIIA

Hours  
4 lecture hours and 2 tutorial hours per week

Examination  
Each topic is examined separately

Content  
A subject comprising four topics chosen from the unstarred topics listed above.

Notes
1. In order to take both Mathematics IIIA 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 B may have their choice of topics further restricted.
3. Students aiming to take Mathematics IV may be required to undertake study of more topics than the eight comprising the two Part III subjects.

PART III TOPICS

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

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?")

Text Nil

References
Birkhoff, G. & MacLane, S. A Survey of Modern Algebra 3rd edn (Macmillan 1965)
Cohen, L. & Ehrlich, G. The Structure of the Real Number System (Van Nostrand 1963)
Courant, R. & Robbins, H. What is Mathematics? (Oxford 1961)
Enderton, H. B. Elements of Set Theory (Academic 1977)
Hafstrom, J. E. Introduction to Analysis and Abstract Algebra (Saunders 1967)
Halmos, 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 — Not offered in 1978

Prerequisite Topic C
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.

663102 Topic N — Variational Methods — T. K. Sheng

Prerequisites Topics C & E
Hours 1 lecture hour per week and 1 tutorial hour per fortnight
Examination One 2-hour paper

Content

Text Nil

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
Crossley, J. et al. What is Mathematical Logic? (Oxford 1972)
Enderton, H. B. A Mathematical Introduction to Logic (Academic 1972)
Hayden, G. E. & Kennison, J. F. Zermelo-Fraenkel Set Theory (Merrill 1968)
Kleene, S. C. Mathematical Logic (Wiley 1967)

663104 Topic P — Ordinary Differential Equations — J. G. Couper
Prerequisites Topic E and 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)

663106 Topic PD — Partial Differential Equations — W. T. F. Lau
Prerequisite Topic E
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
Nil

References
Croxton, C. A. Introductory Eigenphysics (Wiley 1974)
Kellogg, O. D. Foundations of Potential Theory (Dover 1953)
Smith, M. G. Introduction to the Theory of Partial Differential Equations (Van Nostrand 1967)

663211 Topic PL — Programming Languages & Advanced Applications in Computing — J. A. Campbell
Prerequisite Topic F
Hours 1 lecture hour per week and 1 tutorial hour per fortnight
Examination One 2-hour paper

Content
Classification of the principal types of programming languages, with detailed comparisons of the properties of representative languages of each type. Review of the mutual influences between the design of languages and the nature of the applications for which the languages have originally been intended. Presentation of the current state of mathematical and computational work in selected advanced topics, e.g. artificial intelligence, information retrieval and handling of large data bases, computation with symbolic expressions.

Text
Nil

References
663105 **Topic Q — Fluid Dynamics** — W. Summerfield

**Prerequisites**
Topic B, C & E

**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.

**Text**
Nil

**References**
Batchelor, G. K. *An Introduction to Fluid Dynamics* (Cambridge U.P. 1967)
Coulson, C. A. *Waves* (Oliver & Boyd 1958)
Milne-Thompson, L. M. *Theoretical Hydrodynamics* (Macmillan 1962)
Rutherford, D. E. *Fluid Dynamics* (Oliver & Boyd 1959)
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.

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

Prerequisites
Topics C & F

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

Examination
One 2-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 its properties are studied. Three equivalent models of computation are then introduced and compared. These models are Turing machines, computer 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)

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

Text
Nil
References
Bartle, R. G.
The Elements of Integration (Wiley 1966)
Burkill, J. C.
The Lebesgue Integral (Cambridge U.P. 1961)
de Barra, G.
Introduction to Measure Theory (Van Nostrand 1974)
Halmos, P. R.
Measure Theory (Van Nostrand 1950)
Kolmogorov, A. N. & Fomin, S. V.
Introductory Real Analysis (Prentice-Hall 1970)

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

References
Banach, S.
Théories des Opérations Linéaires 2nd edn (Chelsea)
Giles, J. R.
Analysis of Metric Spaces (University of Newcastle)
Kolmogorov, A. N. & Fomin, S. V.
Elements of the Theory of Functions and Functional Analysis Vol. I (Grayloch 1957)
Liusternik, L. A. & Sobolev, U. J.
Elements of Functional Analysis (Frederick Unger 1961)
Simmons, G. F.
Introduction to Topology and Modern Analysis (McGraw-Hill 1963)
Taylor, A. E.
Introduction to Functional Analysis (Wiley 1958)
Wilansky, A.
Functional Analysis (Blaisdell 1964)

663205 Topic X — Rings and Fields — M. J. Hayes
Prerequisites
Topics D & K
Hours
1 lecture hour per week and 1 tutorial hour per fortnight
Examination
One 2-hour paper
Content

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 — Topic in Applied Probability
e.g. Information Theory — W. P. Wood
Prerequisites
Topics C, D & H
Hours
1 lecture hour per week and 1 tutorial hour per fortnight
Examination
One 2-hour paper
Content
This topic is an introduction to that theory of information which originated in the work of C.E. Shannon in 1948. The uniqueness theorem for the information content H will be proved followed by proof of several inequalities involving this function. The concept of a channel and its capacity will be introduced and Shannon's fundamental theorem for discrete channels without memory will be proved. If time permits some other aspects of information theory, e.g., Wiener prediction and filtering, will be discussed.

Text
Nil

References
Ash, R.
Information Theory (Wiley 1965)
Brillouin, L.
Science and Information Theory (Academic 1962)
Feinstein, A.  Foundations of Information Theory (McGraw-Hill 1958)
Gallagher, R. G.  Information Theory and Reliable Communications (Wiley 1968)
Khinchill, A.  Mathematical Foundations of Information Theory (Dover 1957)
Kotz, S.  Recent Results in Information Theory (Methuen 1966)
Reza, F. M.  An Introduction to Information Theory (McGraw-Hill 1961)

663207  Topic 2 — Mathematical Principles of Numerical Analysis —
W. Summerfield

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)
Lambert, J. D.  Computational Methods in Ordinary Differential Equations (Wiley 1973)

Ortega, J. M.  Numerical Analysis — A Second Course (Academic 1972)

PART IV SUBJECT

664100  Mathematics IV

Prerequisites  Mathematics IIIA & IIB, 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.

Hours  At least 8 lecture hours per week over one full-time year or 4 lecture hours per week over two part-time years
Examination  At least eight 2-hour final papers

A thesis, i.e., a study under direction of a special topic using relevant published material and presented in written form. The topics offered may be from any branch of Mathematics including Pure Mathematics, Applied Mathematics, Statistics, 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 1978 follow.

PART IV TOPICS

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

References
- 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)

664139 Mathematics for Classification & Numerical Taxonomy — J. A. Campbell

Prerequisite
- Topic I

Hours
- About 27 lecture hours

Examination
- One 2-hour paper

Content
The course will deal with the mathematical techniques presently in use for classification or ranking of objects in terms of their attributes. Topics covered will include measures of similarity and dissimilarity, correlation and weighting of attributes, cluster analysis, multidimensional scaling, and mathematical models for the process of simplification of data concerning attributes. Fields in which applications will be considered include archaeology, pattern recognition, biology and information retrieval.

References
- Sneath, P. H. A. & Sokal, R. R. *Principles of Numerical Taxonomy* 2nd edn (Freeman 1973)
- van Rijsbergen, C. J. *Information Retrieval* (Butterworth 1975)
- Sneath, P. H. A. & Sokal, R. R. *Principles of Numerical Taxonomy* 2nd edn (Freeman 1973)

664140 Dynamical Systems — J. G. Couper

Prerequisites
- Topics L 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.

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

References
- Graybill, F.A. *Theory and Application of the Linear Model* (Duxbury 1976)
- 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
Harary, F. Graph Theory (Addison-Wesley 1969)
Lancaster, P. Theory of Matrices (Academic 1969)
Wilson, R. J. Introduction to Graph Theory (Longman 1972)

664141 Introduction to Number Theory — R. B. Eggleton

Prerequisite
Topic C

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 Gauss’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
Apostol, T. M. Introduction to Number Theory (Springer 1976)
Davenport, H. The Higher Arithmetic 3rd edn (Hillary 1968)
Nagell, T. Introduction to Number Theory 2nd edn (Chelsea 1964)

Rademacher, H. Lectures on Elementary Number Theory (Blaisdell 1964)

664142 Topological Graph Theory — R. B. Eggleton

Prerequisite
Topic C

Hours
About 27 lecture hours

Examination
One 2-hour paper

Content
This topic deals with drawings of graphs on various surfaces. It will begin with a brief introduction to the theory of graphs, to be followed by a fairly detailed introduction to the topology of surfaces, with particular attention to the classification of surfaces. The main graph-theoretic areas to be treated are: Kuratowski’s Theorem characterising graphs which can be embedded in the plane; genus, thickness, coarseness and crossing numbers of graphs; chromatic number of a surface and the proof of the Four Colour Theorem by Appel and Hakin.

Text
Nil

References
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
Quantitative Aspects of Social Phenomena — R. W. Gibberd

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

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

General & Algebraic Topology — M. J. Hayes

Prerequisite
Topic L

Hours
About 27 lecture hours

Examination
One 2-hour paper

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

Text
References
Bachman, G. & Narici, L. Functional Analysis (paperback Academic 1966)
Dunford, N. & Schwartz, J. Linear Operators (Interscience 1958)
Lorch, E. Spectral Theory (Oxford 1962)
Schmeidler, W. Linear Operators on Hilbert Space (Academic 1954)
Taylor, A. Functional Analysis (Wiley 1958)
Prerequisite

Hours

Examination

Content

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

References

Cramér, H.

Mathematical Methods of Statistics (Princeton U.P. 1946)

Davenport, W. B. & Root, W. L.

Introduction to the Theory of Random Signals and Noise (McGraw-Hill 1958)

Franks, L. E.

Signal Theory (Prentice-Hall 1969)

Hancock, J. C.

An Introduction to the Principles of Communication Theory (McGraw-Hill 1961)

Hancock, J. C. & Wintz, P. A.

Signal Detection Theory (McGraw-Hill 1966)

Helstrom, C. W.

Statistical Theory of Signal Detection (Permagon 1960)

Middleton, D.

Introduction to Statistical Communication Theory (McGraw-Hill 1960)

Middleton, D.

Topics in Communication Theory (McGraw-Hill 1965)

Papoulis, A.

Probability, Random Variables and Signal Processes (McGraw-Hill 1965)

Rowe, H. E.

Signals and Noise in Communication Systems (Van Nostrand 1965)

Selin, I.

Detection Theory (Princeton U.P. 1965)

Thomas, J. B.

Introduction to Statistical Communication Theory (Wiley 1969)

Van Trees, H. L.

Detection, Estimation & Modulation Theory (Wiley 1967)

Wax, N. (ed.)

Selected Papers on Noise and Stochastic Processes (Dover 1954)

Wong, E.

Stochastic Processes in Information and Dynamical Systems (McGraw-Hill 1971)

Woodward, P. M.

Probability and Information Theory with Application to Radar (Pergamon 1960)

Stochastic Processes

Prerequisite

Hours

Examination

Content

This topic will cover the theory of stochastic processes and some of its applications. The topic will include the concepts of stationarity, covariance function, regular process, mean square continuity, differentiation, integration, ergodicity, spectrum, processes with uncorrelated or orthogonal increments, Wiener process, Poisson process, Ito integral. Applications to prediction, filtering or signal detection, will also be studied.

References

Bartlett, M. S.

Stochastic Processes (Cambridge U.P. 1965)

Cramér, H.

Mathematical Methods of Statistics (Princeton U.P. 1946)

Doob, J. L.

Stochastic Processes (Wiley 1953)

Feller, W.


Gikhman, I. I. & Skorokhod, A. V.

Introduction to the Theory of Random Processes (Saunders 1969)

(tr. Scripta-technica)

Grenander, U. & Rosenblatt, M.

Statistical Analysis of Stationary Time Series (Wiley 1957)

Hannan, E. J.

Time Series Analysis (Methuen 1960)

Laning, J. H. & Battin, R. H.

Random Processes in Automatic Control (McGraw-Hill 1956)

Loève, M.

Probability 3rd edn (Van Nostrand 1963)

Parzen, E.

Stochastic Processes (Holden-Day 1962)

Phabu, N. U.

Stochastic Processes (Macmillan 1965)

Solodovnikov, V. V.

Introduction to the Statistical Dynamics of Automatic Control (Dover 1960)

Wong, E.

Stochastic Processes in Information and Dynamical Systems (McGraw-Hill 1971)

Yaglom, A. M.

Theory of Stationary Random Functions (Prentice-Hall 1965)
664145  Viscous Flow Theory — W. T. F. Lau

Prerequisite  Topic Q
Hours       About 27 lecture hours
Examination One 2-hour paper
Content     Basic equations. Some exact solutions of the Navier-Stokes equations. Approximate solutions: theory of very slow motion, boundary layer theory, etc.

Text       Nil
References Batchelor, G. K.  An Introduction to Fluid Dynamics (Cambridge 1967)
           Langlois, W. E.  Slow Viscous Flow (Macmillan 1964)
           Schlichting, H.  Boundary Layer Theory (McGraw-Hill 1968)

664118 Perturbation Theory — D. L. S. McElwain

Prerequisites  Topics C and E
Hours       About 27 lecture hours
Examination One 2-hour paper

Text       Nil
References Cole, J. D.  Perturbation Methods in Applied Mathematics (Blaisdell 1968)
           Nayfeh, A. H.  Perturbation Methods (Wiley 1973)

664106 Combinatorics — R. W. Robinson

Prerequisite  Topic K
Examination
One 2-hour paper

Content
Properties and distributions of rational numbers. Approximation by rationals. Rational polygons. Linear operators over rationals. Dispersive and explosive mappings, super catastrophe. Lines determined by lattice points in $\mathbb{R}^n$.

Text
Nil

664107 Dynamic Oceanography — W. Summerfield

Prerequisites
Nil

Hours
About 27 lecture hours

Examination
One 2-hour paper

Content
Structure and physical properties of the oceans. Kinematics; conservation laws; rotating frame of reference; coriolis acceleration. Dynamics; Boussinesq approximation; dimensionless parameters; turbulent flow; vorticity. The introductory lectures will be followed by detailed examination of a selection of topics from theories of the ocean circulation, surface wave theory and estuarine oceanography.

Text
Nil

References
Dyer, K. R.
Estuaries: A Physical Introduction (Wiley 1973)
Hill, M. N. (ed.)
The Sea Vol. I (Interscience 1962)
Krauss, E.
Atmosphere-Ocean Interaction (Oxford 1972)
Krauss, W.
Methods and Results of Theoretical Oceanography Vol. I (Gebrüder Borntraeger 1973)
Meyer, R. E. (ed.)
Waves on Beaches (Academic 1972)
Phillips, O. M.
The Dynamics of the Upper Ocean (Cambridge 1966)
Stommel, H.
The Gulf Stream (California 1966)
Sverdrup, H. V. et al.
The Oceans: Their Physics, Chemistry and General Biology (Prentice-Hall 1963)

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.
Text
Street, A. P. & Wallis, W. D. Combinatorial Theory: An Introduction (CBRC 1977)

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
Denes, I. & Keedwell, A. D. Latin Squares and their Applications (English U.P. and Akademiai Kiado 1974)
Hall, M. Jr. Combinatorial Theory (Blaisdell 1967)
Mann, H. B. Addition Theorems. The Addition Theorems of Group Theory and Number Theory (Interscience 1965)
Raghavarao, D. Constructions and Combinatorial Problems in Design of Experiments (Wiley 1971)
Ryser, H. J. Combinatorial Mathematics (Wiley 1963)
Vajda, S. Patterns and Configurations in Finite Spaces (Griffin 1967)
Vajda, S. The Mathematics of Experimental Design. Incomplete Block Designs and Latin Squares (Griffin 1967)

Wallis, W. D. Combinatorial Designs (Univ. of Surrey 1977)

664102 Asymptotic Methods in Analysis — W. P. Wood

Prerequisites
Topics B, C, E and P

Hours
About 27 lecture hours

Examination
One 2-hour paper

Content
This topic will outline methods useful in the solution of a wide class of problems occurring in Applied Mathematics. The topic will include an introduction to asymptotics, asymptotic series, implicit functions, summation formulae, Mellin transforms, the Laplace method for integrals, the saddle point method, the method of steepest descents, indirect asymptotics, iterated functions, differential equations with a large parameter, singularities of differential equations, estimation of the remainder in an asymptotic expansion, numerical quadrature and asymptotic expansions, some examples of asymptotic problems in mathematical physics, e.g., motion in a stratified atmosphere, instability of shear flows, spiral structure of disc galaxies.

Text
Nil

References
Copson, E. T. Asymptotic Expansions (Cambridge U.P. 1965)
Erdelyi, A. Asymptotic Expansions (Dover 1956)
Evgrafov, M. A. Asymptotic Estimates and Entire Functions (Gordon & Breach 1961)
Lauwerier, H. A. Asymptotic Expansions (Amsterdam Mathematisch Centrum 1966)

664121 Random & Restricted Walks — W. P. Wood

Prerequisites
Topics C, E, H and R

Hours
About 27 lecture hours

Examination
One 2-hour paper
Problem of random walk; lattice walks; walks in continuous time; spatial restrictions; correlated walks; self-avoiding walks; diffusion and Brownian motion; applications to polymer physics, astronomy, numerical analysis and solid state physics.

Text
Nil

References
Barber, M. N. & Ninham, B. W. Random and Restricted Walks (Gordon & Breach 1970)
Spitzer, F. Principles of Random Walk (Van Nostrand 1964)
Wax, N. (ed.) Selected Papers on Noise and Stochastic Processes (Dover 1954)

(iii) 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
SI—Introduction to Structuring of Information
SP—Systematic Programming
ML—Introduction to Logic and Assembly Languages
F—Numerical Analysis and Computing

662401 Topic SI — Introduction to Structuring of Information — J. A. Campbell & 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
Elson, M. Data Structures (Science Research Associates 1975)

References
Horowitz, E. & Sahni, S. Fundamentals of Data Structures (Pitman 1976, 1977)
Katzan, H. Jr Introduction to Computer Science (Petrocelli-Charter 1975)
Wirth, N. Algorithms + Data Structures = Programs (Prentice-Hall 1976)

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

Prerequisite Mathematics I

Hours 1 lecture hour and ½ tutorial or practical work hour per week

Examination One 2-hour paper

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 failings 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. L.
Dahl, O. J. et al.
Gutmann, A. J.
International Computers Ltd
International Computers Ltd
Katzan, H. Jr
Kernighan, B. W. & Plauger, P. J.
Kreitzberg, C. B. & Shneiderman, B.
Wirth, N.
Yourdan, E. J.

Concepts of Programming Languages (Science Research Associates 1973)

Programming Language/One 3rd edn (Prentice-Hall 1975)

Structured Programming (Academic 1972)

Programming and Algorithms (Heinemann 1977)

ALGOL Programming Manual

1900 series COBOL Manual

Introduction to Computer Science (Petrocelli-Charter 1975)

Software Tools (Addison-Wesley 1976)

The Elements of FORTRAN Style (Harcourt, Brace, Jovanovich 1972)

Systematic Programming (Prentice-Hall 1973)

Techniques of Program Structure and Design (Prentice-Hall 1975)

662404 Topic ML — Introduction to Logic & Assembly Languages — K. K. Saluja

Prerequisite
Mathematics I

Hours
1 lecture and practical work hours per week

Examination
Progressive assessment and final examination

Content
Number systems: representation and arithmetic. Boolean algebra: combinational logic, Karnaugh maps, flip flops, sequential logic, counters.

Hardware components, processor structure, addressing modes. Assembly language. Instruction sets, pseudo ops, machine language programming, subroutines, co-routines, use of stacks, interrupts, macros, recursion, re-entry, linkers and loaders.

Lectures will be supplemented with practical assignments using PDP-11 computer.

Text

References
Friedman, A. D. Logical Design of Digital Systems (Computer Science)
Stone, H. S. Introduction to Computer Organization and Data Structures (McGraw-Hill 1972)

662202 Topic F — Numerical Analysis and Computing — see page 35

PART III SUBJECT

663400 Computer Science III

Prerequisites
Computer Science II, Mathematics IIA and Mathematics IIC

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)
3. Computer Operating Systems (*EE463)
4. Switching Theory & Logical Design (*EE362)
5. Mathematical Logic (**O)
6. Mathematical Principles of Numerical Analysis (**Z)
7. Programming Languages & Advanced Applications in Computing (*Part IV Mathematics course in 1977)
8. Theory of Computing (**TC)
9. Systems Analysis & Design (*CS — Diploma course; one topic composed of the combination of (i) Systems Analysis and (ii) Systems Design on that course)

Notes
* Not available for selection by students who have previously passed this course, or who are enrolled for it explicitly, extraneous to Computer Science III, in the year in which they are enrolled for Computer Science III.
534137 Compiler Construction — P. J. Moylan

**Prerequisite**
EE361 Introduction to Logic & Assembly Languages

**Hours**
3 hours per week for the 2nd 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 NM 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

**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.

Texts
I.C.L. *1900 Series COBOL Manual*

References
Clifton, H. D. *Systems Analysis for Business Data Processing* (Business Books)
DeRossi, C. J. *Learning COBOL Fast* (Resion)
Feingold, C. *Fundamentals of COBOL Programming* (W. C. Brown)
Kapur, G. K. *Programming in Standard COBOL* (S.R.A.)
Murach, M. *Standard COBOL* (S.R.A.)
Sprowls, R. C. *Computing with COBOL* (Harper & Row)
Watters, J. L. *Cobol Programming* (Heinemann)

534138 Computer Operating Systems — A. Cantoni

**Prerequisite**
EE361 Introduction to Logic & Assembly Languages

**Hours**
Three hours per week for the first half of the year

**Examination**
Progressive assessment and final examination

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

**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)

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**Note:**
- **Prerequisite:** Mathematics I or Commercial E.D.P.
- **Not available for selection by students who have passed Mathematics IIIA including the topic who are enrolled for Mathematics IIIB including the topic concurrently with Computer Science III, or who have passed (as an elective topic) the Part III Mathematics topic whose abbreviation is given following the asterisks.
- **Not available for selection by students who have passed or are concurrently enrolled for a Part III Mathematics subject which includes the topic whose abbreviation is given following the asterisks, or who have passed the topic previously as an elective topic.**
- **Students who are considering eventual careers as Computer Systems Officers in the Commonwealth Public Service are strongly advised to enrol for this topic.**
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

Examination Progressive assessment and final examination

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)

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 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 Crossley, J. et al. What is Mathematical Logic? (Oxford 1972)
Enderton, H. B. A Mathematical Introduction to Logic (Academic 1972)
Hayden, G. E. & Kennison, J. F. Zermelo-Fraenkel Set Theory (Merrill 1968)
Kleene, S. C. Mathematical Logic (Wiley 1967)

663402 Mathematical Principles of Numerical Analysis — W. Summerfield

Prerequisites Topics C & 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

Daniel, J. W. & Moore, R. E. Computation and Theory in Ordinary Differential Equations (Freeman 1970)
Lambert, J. D. Computational Methods in Ordinary Differential Equations (Wiley 1973)
Ortega, J. M. Numerical Analysis—A Second Course (Academic 1972)
663403  Programming Languages & Advanced Applications in Computing — D. W. Blatt

Prerequisite  Topic F

Hours  About 27 lecture hours

Examination  One 2-hour paper

Content
Classification of the principal types of programming languages, with detailed comparisons of the properties of representative languages of each type. Review of the mutual influences between the design of languages and the nature of the applications for which the languages have originally been intended. Presentation of the current state of mathematical and computational work in selected advanced topics, e.g., artificial intelligence, information retrieval and handling of large data bases, computation with symbolic expressions.

Text  Nil

References
Griswold, R. E. et al.  The SNOBOL 4 Programming Language (Prentice-Hall 1968)
Hunt, E. B.  Artificial Intelligence (Academic 1975)
McCarthy, J.  LISP 1.5 Programmers Manual (MIT 1965)
Sammet, J. E.  Programming Languages: History and Fundamentals (Prentice-Hall 1969)
Siklossy, L.  Let’s Talk LISP (Prentice-Hall 1975)
van Rijsbergen, C. J.  Information Retrieval (Methuen 1975)

410104  Systems Analysis & Design — I. R. Beaman

(i) Systems Analysis

Prerequisites  Nil

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
(ii) Systems Design

Prerequisites
CS—Commercial Programming, Systems Analysis & Design A

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

Examination
An examination at end of year

Content
This subject is a development of Systems Analysis, with the inclusion of the following topics: input design, output design, file design, detailed systems design, systems implementation.

An appreciation of the detailed techniques of Systems Design involved in the development of computer-based information systems from a range of applications—i.e. Inventory and Production control; order entry and processing; general ledger accounting systems; sales analysis; payroll.

At least one such system will be observed in depth, as an attempt at detailed systems design.

Text
As for Systems Analysis

References
As for Systems Analysis
Content

Basic concepts required for study of motion: length, time, force and mass; Newton's laws of motion; systems of units; friction. Motion of point masses, rigid bodies and connected bodies in straight or curved paths, or in simple rotation. Relative motion using translating reference frames. General plane motion of rigid bodies. Momentum and impulse, both linear and angular, related to point masses and rigid bodies.

Energy and the conservation principle applied to mechanical work, strain energy, kinetic energy and friction "losses", for particles and rigid bodies.

Text

Menzies, J. L.  
*Dynamics 2nd edn S.I. version* (Wiley 1966)

Reference

Beer, F. P. & Johnston, E. R.  

(iii) 541101 ME111 Graphics

Prerequisites  
Nil

Hours  
42

Examination  
One 2 hour paper  
One 3½ hour paper

Content

Orthographic projection: Fundamentals, auxiliary planes projections of the straight line, of lines inclined to lines, of lines contained by planes, of lines inclined to planes, of planes inclined to planes, section planes, lines of intersection and developments of surfaces.

Text

To be advised

References

Levens, A. S.  
*Graphics* (Wiley)

Luzadder, W. J.  
*Basic Graphics* (Prentice-Hall)

(iv) 541102 ME112 Engineering Drawing & Elementary Design

Prerequisites  
Nil

Hours  
42

Examination  
One 3 hour paper

Content

Orthographic drawings of complete designs. Philosophy and fundamentals of engineering design.
Texts
Wall, T. F.  *An Outline of Industrial Process Principles* (Dept of Chemical Engineering, Univ. of Newcastle)

References
Himmelblau, J.  *Basic Principles and Calculations in Chemical Engineering* (Van Nostrand 1973)

111100 Materials Science I

Prerequisites  One Science 2-unit subject
or Science 2S (advisory)

Corequisites  Mathematics I & Physics IA

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. Heating 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

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

(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 near equilibrium 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
Rhines, F. N.  *Phase Diagrams in Metallurgy* (McGraw-Hill)
Rollason, E. C.  *Metallurgy for Engineers* (Arnold)
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**
- Introductory crystallography; crystal systems, lattices and unit cells. Miller indices and stereographic projection.
- The periodic table and atomic bonding.
- The metallic structures, b.c.c., f.c.c., c.p.h. from stacking equal spheres. Metallic solid solutions, Hume-Rothery rules, short and long range order. Defects.
- Ionic structures, from stacking coordination polyhedra.
- Pauling’s rules.
- Covalent structures.
- Structures with more than one type of bond, silicates and polymers.

**Text**

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

(iv) 111183 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.

**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.)
- Guy, A. G. *Introduction to Materials Science*

or

(iii) 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**

**Text**

**References**
- To be advised

**PART II**

522700 Civil Engineering II

**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*
- (ii) CE231 *Fluid Mechanics* I or ME231 *Fluid Mechanics*
- (iii) CE221 or ME244 *Properties of Materials*
- (iv) CE222 *Materials Technology*
(i) 522107 CE212 Mechanics of Solids

**Prerequisites**  
CE311 & 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)

Popov, E. P.  
*Mechanics of Materials*  
2nd edn (Prentice-Hall 1976)

542105 ME214 Mechanics of Solids I

**Prerequisites**  
Maths I, ME111/112, ME131, CE111

**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.  
*Mechanics of Materials*  
(Wiley)

Shanley, F. R.  
*Introduction to Mechanics of Solids*  
(Prentice-Hall 1968)

(ii) 522202 CE231 Fluid Mechanics I

**Prerequisites**  
Maths I and ME131 Dynamics

**Hours**  
1 lecture hour & ¼ 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, Bernoulli 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**  
Streeter, V. L. & Wylie, E. B.  
*Fluid Mechanics*  
6th edn (McGraw-Hill 1975)

**References**  
Dougherty, R. L. & Franzini, J. B.  
*Fluid Mechanics with Engineering Applications* (McGraw-Hill)

Vennard, J. K. & Street, R. L.  
*Elementary Fluid Mechanics*  
5th edn (Wiley 1975)

or

542202 ME251 Fluid Mechanics

**Prerequisites**  
Maths I, ME131

**Hours**  
42

**Examination**  
Progressive assessment & examination

**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 equation, Euler's equation of motion along a streamline, Bernoulli 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**  
Streeter, V. L. & Wylie, E. B.  
*Fluid Mechanics*  
6th edn I.S. edn (McGraw-Hill)

**References**  
Dougherty, R. L. & Franzini, J. B.  
*Fluid Mechanics with Engineering Applications* (McGraw-Hill)
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**

**Prerequisites** Maths I, ME111, ME112, 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** 1½ lecture hours & 1½ laboratory & tutorial hours per week

**Examination** Two 3-hour papers, the first at mid-year.

**Content**
Metallurgy: basic structure of metals. Brickwork, timber, ceramics, plastics: basic properties and uses. 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)
SAA *Methods for Sampling and Testing Aggregates* AS1141 (Standards Assn of Australia)
SAA *Dense Natural Aggregates for Concrete* AS1465

**References**
Lea, F. M. & Desch, C. H. *Concrete Technology and Practice* (Angus & Robertson)
Taylor, W. H. *Concrete Technology and Practice* (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
To be advised

Psychology IIIC will be a Prerequisite for Psychology IIIC in 1978

PART III

413900 Accounting IIIC

Prerequisites Mathematics IIA & IIC & either Accounting IIA or IIIB

Hours 4 lecture hours & 1 tutorial hour per week

Examination Two 3-hour & two 2-hour papers

Content Either Accounting IIA or Accounting IIIB 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.

(0) 413100 Accounting IIIA

Prerequisites Accounting IIA & 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

Accounting Standards The Corporate Report
American Steering Committee
Accounting Assn A Statement of Basic Accounting Theory
Barradell, M. Ethics and the Accountant (Gee 1969)
Baxter, W. T. & Davidson, S. Studies in Accounting Theory (Sweet & Maxwell 1966)
Beck, G. W. Public Accountants in Australia—Their Social Role (Aust. Accounting Research Found.)
Bray, F. S. The Accounting Mission (Melbourne U.P.)
Chambers, R. J. Accounting Evaluation and Economic Behaviour (Prentice-Hall 1966)
Davidson, S. et al. An Income Approach to Accounting Theory (Prentice-Hall 1965)
Goldberg, L. Accounting Concepts of Profit (Ronald)
Hendriksen, E. S. & Hendriksen, E. S. & Budge, B. P. Concepts of Depreciation (Law Book Co. 1960)
Levy, V. M. Government Accounting in Australia (Cheshire 1967)
Littleton, A. C. Law and Practice of Company Accounting in Australia (Butterworths 1973)
Mattessich, R. Public Financial Administration (Law Book Co.)
Moonitz, M. & Littleton, A. C. Structure of Accounting Theory (Amer. Accounting Assn 1953)
Mueller, G. G. Accounting and Analytical Methods (Irwin 1964)
Normanton, E. L. Significant Accounting Essays (Prentice-Hall 1965)
Patton, W. A. & Littleton, A. C. International Accounting (Macmillan 1967)
Paton, W. A. & Littleton, A. C. Advanced Public Accounting Practice (Irwin 1966)
Ross, H. The Accountability and Audit of Government (Manchester U.P. 1966)
Staubus, G. J. An Introduction to Corporate Accounting Standards (Amer. Accounting Assn 1965)
Staubus, G. J. A Theory of Accounting to Investors (California U.P. 1964)
Storey, R. K. The Search for Accounting Principles (A.I.C.P.A. 1964)
Vatter, W. J. \(\text{The Fund Theory of Accounting} \) (Chicago U.P., 1951)

Wixon, R. et al. (eds) \(\text{Accountants' Handbook} \) (Ronald 1970)

\(\text{Inflation Accounting: Report of the Inflation Accounting Committee (IFMSO)}\)


\(\text{(i) 413200 Accounting IIIB} \)

\textbf{Prerequisite} Accounting IIIB

\textbf{Hours} 2 lecture hours per week

\textbf{Examination} One 3-hour paper

\textbf{Content}

Selected contemporary problems in the theory and practice of managerial accounting. Topics studied include the development of management accounting, decision theory and information systems, profit planning, cost-volume profit analysis, incremental analysis, intra company pricing and divisional performance evaluation, product pricing and allocation of costs, cost accounting for income determination, feedback for accounting control, behavioural considerations in management accounting and general concepts of management accounting including decision making for small and medium sized manufacturers, management accounting and statistics; production and operations management.

\textbf{References}

Arney, L. R. & Egginton, D. A.

Anton, H. R. & Firmin, P. A.

Benston, G. J.

Broom, H. N. & Longenecker, J. G.

Broster, E. J.

Chase, R. B. & Aquiland, N. J.

\begin{itemize}
  \item \text{To be advised. Articles are selected from Abacus, The Accounting Review, Journal of Accounting Research, Journal of Business, etc.}
  \item \text{Management Accounting: A Conceptual Approach} (Longman)
  \item \text{Contemporary Problems in Cost Accounting} (Houghton Mifflin 1966)
  \item \text{Contemporary Cost Accounting and Control} (Dickenson 1970)
  \item \text{Small Business Management} 4th edn (South Western)
  \item \text{Management Accounting and Statistics} (Longman)
  \item \text{Production and Operations Management} (Irwin)
\end{itemize}

De Coster, D. T. & Schafer, E. L. \textbf{Management Accounting: A Decision Emphasis} (Wiley/Hamilton)

Greenwood, W. T. \textbf{Decision Theory and Information Systems} (South Western 1969)


Horngren, C. T. \textbf{Accounting for Management Control} (Prentice-Hall 1965)

Li, D. H. \textbf{Accounting Computers, Management Information Systems} (McGraw-Hill)

National Assn of Accountants \textbf{Research Reports and Research Monographs}

Parker, R. H. \textbf{Management Accounting: An Historical Perspective} (Macmillan 1969)


Rosen, L. S. \textbf{Topics in Managerial Accounting} (McGraw-Hill 1970)


Stedry, A. C. \textbf{Budget Control and Cost Behaviour} (Prentice-Hall — Ford Foundation Series 1961)

Thomas, W. E. (ed.) \textbf{Readings in Cost Accounting Budgeting and Control} (South Western 1968)

\begin{itemize}
  \item \text{Mathematics HA & IIC & either Biology IIA or IIB}
  \item \text{4 lecture hours & 8 tutorial & laboratory hours per week & a field excursion}
  \item \text{Two 3-hour papers}
\end{itemize}

\textbf{Content}

\textbf{Fundamentals of Population and Quantitative Genetics}


\textbf{Community Analysis}

Structure and dynamics of biological communities.

\textbf{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.
- Ford, E. B. *Ecological Genetics* (Methuen 1975)
- Pianka, E. R. *Evolutionary Ecology* (Harper & Row)
- Phillipson, J. *Ecological Energetics* (Arnold)
- Poole, R. W. *Introduction to Quantitative Ecology* (McGraw-Hill)

### 513900 Chemical Engineering IIC

#### Prerequisites

Chemical Engineering I, (but see note on page 17), Mathematics IIA & IIC (including topics E & F)

#### Hours

See under individual topics below

#### Examination

To be advised

### Content

Six of the following topics:

(i) **ChE301** Computations — J. Roberts

**Hours** Approx. 21 hours

**Content**

Computations for heat and mass transfer, thermodynamic functions and data processing will be used as an introduction to numerical methods emphasizing iterative techniques. Extensive use of FORTRAN IV and Input/Output operations, sub-routines, subroutines, ICL computer packages and efficient programming in FORTRAN will be made.

**Topic Outlines**

Curved fitting by classical graphical methods. Curve fitting with data transforms by least squares polynomial approximation, mini-max polynomials; coefficient errors.

Iterative solution of algebraic and transcendental single-simultaneous equations by first or second order methods, weighting factors on convergence efficiency.

Matrix methods in solving sets of equations.

Solution of single/simultaneous differential equations of first or higher order.

ICL Analogue Simulation package.

**Text**


**References**


(ii) **ChE312** Reaction Engineering — T. F. Wall

**Hours** 1¼ hours a week for ½ year

**Examination** To be advised

**Content**

Design and operation of chemical reactors for homogeneous and heterogeneous reacting systems. Elementary reaction kinetics leading to interpretation of experimental data needed to design batch and continuous reactors. Effect of heat of reaction and changes of temperature and pressure on design, use of catalysts and residence time estimation. An introduction to design for heterogeneous reacting systems.
(iii) 513105 ChE313 Transport Principles

**Hours** 1\(\frac{1}{2}\) hours per week

**Content**
Heat and mass transfer in unsteady state conditions, transport theory for momentum, heat and mass transfer in laminar and turbulent flow conditions. Boundary layer theory. The course stresses the application of mathematics to the solution of engineering problems. Analogies between heat mass and momentum transfer.

Text
Levenspiel, O. *Chemical Reaction Engineering* 2nd edn (Wiley 1972)

(iv) 513222 ChE314 Process Control --- W. G. Kirchner

**Hours** 1\(\frac{1}{2}\) hours a week

**Examination** To be advised

**Content**
Introduction to process dynamics, the well-stirred vessel, treatment of experimental data, Laplace Transform Applications. Block diagram rotation, open loop and closed loop systems, the transfer function application and limitations. Control modes. Stability of closed loop system, elementary rlocus., Bode diagram, Feed forward, Control, cascade control with applications to control of temperature, flow pressure and composition.

Text

(v) 513107 ChE322 Particulate Systems --- J. Roberts/I. McC. Stewart

**Hours** 1\(\frac{1}{2}\) hours per week

**Examination** To be advised

**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—Retention—Retention—Retention-analysis—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

**Hours** 1\(\frac{1}{2}\) hours a week for 1 year

**Examination** To be advised

**Content**
1. **Process Plant Costs** --- fixed, variable, direct, indirect --- review of cost accounting procedures applied to above. Balance sheet and income statements. 2. **Cost estimation procedures** --- cost indices --- six ninths 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—CeE412 Radiant Heat Transfer — T. Wall

Hours
1½ hours a week for ½ year

Examination
To be advised

Content

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

523700 Civil Engineering III

Prerequisite
Civil Engineering II, Mathematics II A & II C

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

Examination
Four 3-hour papers

Content
(i) CE324 Soil Mechanics
(ii) CE313A Structural Analysis I
(iii) CE332 Fluid Mechanics II
(iv) CE351 Civil Engineering Systems I

(i) 523102 CE324 Soil Mechanics — J. B. Berrill
Corequisite
CE332 Fluid Mechanics II

Hours
2 lecture hours & 1 laboratory hour per week

Examination
One 3-hour paper

Content
Index properties, classification of soils; permeability, capillarity, seepage and flow nets; stresses in soils; settlement and consolidation; compaction, shear strength and failure criteria; stability of retaining walls.
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 modelling, computer simulation, various mathematical programming techniques, heuristics. Choice of techniques, problem formulation. Example applications of the systems approach to civil engineering problems.

**Text**
de Neufville, R. & Stafford, J. H. *Systems Analysis for Engineers and Managers* (McGraw-Hill)

**References**
Baumol, W. J. *Economic Theory and Operations Analysis* (Prentice-Hall)
Wagner, H. M. *Principles of Operations Research* (Prentice-Hall)

533900 Communications and Automatic Control

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

**Hours**
6 lecture, tutorial & laboratory hours per week

**Examination**
Progressive assessment & final examination

**Content**
(i) 533213 EE341 Automatic Control — G. C. Goodwin
Prerequisites Part II Mathematics Topics C, D, E, H
Hours 3 lecture, tutorial & laboratory hours per week for 1st ½ year
Examination Progressive assessment & final examination

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

References
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
Prerequisite EE341
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** — B. D. O. Anderson

**Prerequisites**
Part II Mathematics Topics C, D, E

**Hours**
3 hours per week for 2nd 1/2 year

**Content**
Mathematical background to optimization. Comparison of optimization methods; engineering applications—such as to problems of identification, control, pattern recognition and resource allocation.

**Texts**
Aoki, M. *Introduction to Optimization Techniques* (Macmillan 1971)

Luenberger, D. G. *Introduction to Linear and Non-linear Programming* (Addison-Wesley 1973)

**Reference**
Luenberger, D. G. *Optimisation via Vector Space Methods* (Wiley 1969)

(iv) 534136 EE444 **Communications** — G. C. Goodwin

**Prerequisites**
EE331 Circuits & Part II Mathematics Topic H

**Hours**
3 hours per week for 2nd 1/2 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**

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533901 **Digital Computers and Automatic Control**

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

**Hours**
6 lecture, tutorial & practical hours per week

**Examination**
Progressive assessment & final examination

**Content**
(i) 533213 EE341 *Automatic Control — see page 101*
(ii) 533110 EE342 *Linear System Theory — see page 101*
(iii) 533219 EE361 *Introduction to Logic & Assembly Languages — see page 123*
(iv) 533220 EE362 *Switching Theory & Logical Design — see page 124.*

423800 **Economics IIC**

**Prerequisites**
Mathematics IIA & IIC & 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) 423102 *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

**Content**
A knowledge of matrix algebra and of the mathematical statistics dealt with in Statistical Analysis is recommended. The course examines the usefulness of single equation regression analysis in applied economic research and also provides an introduction to simultaneous estimation procedures.

**Text**
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)
Koutsotianis, A.  Theory of Econometrics (Macmillan)
Wonnacott, R. J. & T. H. Wonnacott, R. J. & T. H.  Econometrics (Wiley)

(ii) 423204 Mathematical Economics — C. J. Aislagic/K. A. Lamb

Hours  3 lecture hours per week
Examination  One 3-hour paper

Content
(i) The mathematical reformulation and interpretation of traditional micro- and macroeconomic theory.
(ii) Modern capital and growth theory and mathematical programming.

Texts
Dernburg, T. F.  Macroeconomic Analysis: An Introduction to Comparative Statics and Dynamics (Addison-Wesley 1969)
References
Benavie, A.  Mathematical Techniques for Economic Analysis (Prentice-Hall 1972)
Chiang, A. C.  Fundamental Methods of Mathematical Economics 2nd edn (McGraw-Hill)
Gandolfo, G.  Mathematical Methods and Models in Economic Dynamics (North-Holland 1971)
Hadley, G. & Kemp, M. C.  Finite Mathematics in Business and Economics (North-Holland 1972)
Intriligator, M. D.  Mathematical Optimization and Economic Theory (Prentice-Hall 1971)
Read, R. C.  A Mathematical Background for Economists and Social Scientists (Prentice-Hall 1972)
Vandermeulen, D. C.  Linear Economic Theory (Prentice-Hall 1971)

(iii) 423104 Growth and Development — N. J. Dickinson/C. W. Stahl

Hours  3 lecture hours per week
Examination  Two 3-hour papers (i) end of 1st ½ of year (ii) end of year

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 1967)
Text
Hamberg, D.  Models of Economic Growth (Harper & Row 1973)

References
Bauer, P. T.  Dissent on Development (Weidenfeld & Nicolson 1971)
Enke, S.  Economics for Development (Dobson 1963)
myrdal, g.  
myint, h.  
szentes, t.  

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

examination one 3-hour paper

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.


texts

ellsworth, p. t. & leith, j. c.  

or

scammell, w. m.  
snap, r. h.  
wells, s. j.  

references

bhagwati, j. (ed.)  
caves, r. e. & johnson, h. g. (eds)  
clement, m. d. et al.  
coop, r. r. (ed.)  

eller, h. r.  
eller, h. r.  
kindleberger, c. p.  
mccoll, g. d. (ed.)  

(iv) 423102 international economics — p. w. sherwood

examination one 3-hour paper

content

The effects of government intervention in the economy through the budget and through the operation of publicly-owned business undertakings. Inter-governmental fiscal relationships are examined. At the microeconomic level, an analysis of the effects of tax and expenditure policies, in particular, community welfare and incentives. At the macroeconomic level, aggregative models are used to analyse the relation of fiscal policy to other economic policies for stability and growth.

preliminary reading

eckstein, o.  

texts

references

buchanan, j. m. & flowers, m. r.  
culbertson, j. m.  
fromm, g. & taubman, p.  
houghton, r. w. (ed.)  
johnsen, l.  
keiser, n. f.  
mathews, r. l. & jay, w. r. c.  
musgrave, r. a. & p. b.  
peacock, a. & shaw, g. k.  
shoup, c. s.  

the international economy 5th edn (macmillan 1975)

international trade and payments (macmillan 1974)

international trade and the australian economy 2nd edn (longman 1973)

international economics rev. edn (allen & unwin 1973)

public finance 3rd edn (prentice-hall 1973)

the public finances (irwin)

macroeconomic theory and stabilisation policy (mcgraw-hill)

public economic theory and policy (collins-macmillan)

public finance (penguin)

reading in macroeconomics (prentice-hall)

federal finance (nelson)

public finance in theory and practice (mcgraw-hill)

the economic theory of fiscal policy (allen & unwin)

public finance (weidenfeld & nicholson)
**73300 Geology IIIC**

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

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

**Examination**
Two 3-hour papers plus assessment

**Content**
Sedimentology — the petrogenesis of sedimentary rocks. Economic geology — principles of formation of economic mineral deposits; major Australian ore deposits; ore mineralogy. Structural geology — structural aspects of geosynclinal concept; orogenies; continental drift; global tectonics. Photogrammetry and Photogeology — basic principles of interpretation; aerial photographs and their use in stratigraphic and structural studies. Exploration Geophysics; geophysical techniques — their interpretation and application in petroleum and mining exploration, and hydrogeological and engineering investigations. Appropriate Computer Science subject or Mathematics topic not previously taken in the course (to be decided in consultation with the Head of Department).

**Texts**
Consult lecturers concerned

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**543500 Industrial Engineering II**

**Prerequisites**
Mathematics IIA & IIC

**Hours**
6 lecture hours per week

**Examination**
Progressive assessment

**Content**
(i) 543501 ME381 Methods Engineering
(ii) 543502 ME383 Quality Engineering
(iii) 543503 ME384 Design for Production
(iv) one of the following

- 544409 ME419 Design of Conveyors & Materials Handling Equipment
- 544418 ME449 Reliability Analysis for Mechanical Systems (not offered in 1978)
- 544102 ME482 Engineering Economics
- 544104 ME483 Production Engineering (not offered in 1978)

(i) 543501 ME381 Methods Engineering

**Hours**
1½ hours per week

**Examination**
Progressive assessment

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**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) 543502 ME383 Quality Engineering

**Hours**
1½ hours per week

**Examination**
Progressive assessment & examination

**Content**

**Text**
Nil

**References**
Amer. Soc. of Tool & Mfg Engrs *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, mechanical engineering and production design and development 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.)
McCormick, E. J. Human Factors Engineering (McGraw-Hill 1964)

(iv) 544409 ME419 Design of Conveyors & Materials Handling Equipment — A. W. Roberts
Prerequisites ME313, ME232
Hours 42
Examination Progressive assessment
Content

Texts
Nil

References
Brook, N. Mechanics of Bulk Materials Handling (Butterworths 1971)
Hawk, M. C. Bulk Materials Handling (Univ. of Pittsburgh, School of Engineering Vol. I (3) 1971 & Vol. II (8) 1973)
Hudson, E. G. Storage and Flow of Solids (Bull. 123. Utah Engineering Experiment Station 1964)
Jenike, A. W. Conveyors (John Wiley—Chapman & Hall)
Rudenko, N. Materials Handling Equipment (Peace Publishers, Moscow)
Spivakovsky & Dyaeckkov Conveyors and Related Equipment (Peace Publishers, Moscow)
Stocker, H. E. Materials Handling (Prentice-Hall)
or
544102 ME482 Engineering Economics — J. W. Hayes
Prerequisite Maths I
Hours 42
Examination To be advised
Content
The time value of money, economic criteria for decision making, purchase and replacement economics, cost benefit analysis, evaluation of accounting data for decision making. Introduction to demand, supply, price and the policy of the firm in various operating environments. Decision making under risk and uncertainty.

Texts
Fabrycky, W. J. & Thuesen, G. J. Economic Decision Analysis (Prentice-Hall 1974)
or

References
De Garmo, E. P. & Canada, J. R. Engineering Economy 5th edn (McMillan 1973)

553900 Mechanical Engineering III C
Prerequisites Mathematics IIA & IIC (including Topics E, 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) ME402 Systems Planning, Organisation & Control
(viii) ME487 Operations Research—Deterministic Models
(b) (iii) ME402 Systems Planning, Organisation & Control
(viii) ME487 Operations Research—Deterministic Models
(ix) ME488 Introduction to
(c) (ii) ME402 Systems Planning, Organisation & Control
(iv) ME404 Mathematical Programming—not offered in 1978
(vii) ME499 Reliability Analysis for Mechanical Systems—not offered in 1978
(d) (i) ME361 Automatic Control
(v) ME434 Advanced Kinematics & Dynamics of Machines—not offered in 1978
(vi) ME448 Introduction to
(e) (iii) ME402 Systems Planning, Organisation & Control
(iv) ME404 Mathematical Programming—not offered in 1978
(i) ME361 Automatic Control — G. C. Goodwin

Hours
1½ hours per week

Examination
Progressive assessment & examination

Content

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) 543204 ME361 Automatic Control

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)
De Russo, P. M. et al.  State Variables for Engineers (Wiley 1965)

(iii) 544452 ME402 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)


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**(vii) 544841 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**


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

**References**

McMillan, C. *Mathematical Programming* (Wiley)


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**(ix) 544842 ME488 Operations Research — Probabilistic Models**

— G. D. Butler

**Hours** 1½ hours per week

**Examination** Progressive assessment

**Content**

Statistical decision theory; forecasting, methods moving average, exponentially smoothed average. Inventory control theory. Fixed order quantity; fixed order cycle systems; production — inventory systems. Queueing theory; simple queue, multi-server queues. Queues in series. Transients in queues; simulation of systems. Applications.

**Text**

Saaty, T. L. *Elements of Queueing Theory* (Prentice-Hall)

**References**


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


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**(x) 544843 ME489 Operations Research — Applications in Industry**

— G. D. Butler

**Hours** 1½ hours per week

**Examination** To be advised

**Content**

The case study approach to industrial cases. The application of operations research to industrial problems.

**Text**

Nil

**References**


Duckworth, E. *A Guide to Operational Research* (Methuen 1965)


McKenny, J. L. & Rosenbloom, R. S. *Cases in Operations Management* (Wiley 1969)


743100 Physics IIIA

Prerequisites Physics II, a Mathematics II subject with Topics C, E, G and H or B or D recommended.

Hours 4 lecture hours & 8 laboratory hours per week

Examination Assessment to the equivalent of three 3-hour papers

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 IIC

Prerequisites Mathematics II A, 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 IIB. Students will also be required to complete an independent investigation in mathematical psychology under supervision.

Text Kerlinger, F. N. & Pedhazur, E. J. Multiple Regression in Behavioral Research (Holt, Rinehart & Winston 1973)

References
Flavell, J. H. The Developmental Psychology of Jean Piaget (Van Nostrand 1963)
Jackson, D. N. & Messick, S. Problems in Human Assessment (McGraw-Hill 1967)
Laming, D. Mathematical Psychology (Academic 1973)
Mandler, J. M. & Mandler, G. Thinking: From Association to Gestalt (Wiley 1964)

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.

664200 Mathematics/Psychology IV

Prerequisites Mathematics IIIA, Psychology IIC. A student desiring admission to this subject must apply in writing to the Dean of the Faculty of Mathematics before 7th December of the preceding year.

Hours To be advised

Examination


**Psychological Measurement --- I. A. Keats**

**Prerequisites**
Nil

**Hours**
1 ½ hours per week

**Examination**
To be advised

**Content**
The logic of measurement and its application to psychological phenomena and at least one paper on one of the more recently developed psychological scaling methods.

**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* (Aarhus Stiftsbogtrykkerie A-S 1964)

Torgerson, W. S. *Theory and Methods of Scaling* (Wiley 1958)

**Mathematical Models in Perception & Learning --- R. A. Heath**

**Prerequisites**
Part II Mathematics Topic II recommended

**Hours**
1 ½ 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)


**DIPLOMA IN COMPUTER SCIENCE**

**SCHEDULE OF SUBJECTS**

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

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

Topics C and E existing before 1978 are no longer offered as separate topics, and have been replaced by the Topic CO, whose present content is a good guide to the assumed standard of attainment indicated below.

**Group I**

**Core Subjects**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Department Offering</th>
<th>Assumed Standard of Attainment</th>
<th>No. of Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS—Commercial Programming</td>
<td>Commerce</td>
<td>Mathematics I, Topic 104, or Commercial Electronic Data Processing</td>
<td>1</td>
</tr>
<tr>
<td>EE361—Introduction to Logic &amp; Assembly Languages</td>
<td>Electrical Engineering</td>
<td>Mathematics I</td>
<td>1</td>
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<tr>
<td>EE362—Switching Theory &amp; Logical Design</td>
<td>Electrical Engineering</td>
<td>Mathematics I</td>
<td>1</td>
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<tr>
<td>CS—Programming &amp; Algorithms</td>
<td>Mathematics</td>
<td>Mathematics I</td>
<td>1</td>
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<tr>
<td>CS—Data Structures &amp; Programming</td>
<td>Mathematics</td>
<td>CS—Programming &amp; Algorithms</td>
<td>1</td>
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<tr>
<td>CS—Numerical Analysis</td>
<td>Mathematics</td>
<td>Part II Mathematics, Topics C, D, F</td>
<td>1</td>
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</tbody>
</table>

**Group II**

**Subjects in the main-stream of computer science**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Department Offering</th>
<th>Assumed Standard of Attainment</th>
<th>No. of Units</th>
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</thead>
<tbody>
<tr>
<td>Information Systems</td>
<td>Commerce</td>
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<td>1</td>
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<tr>
<td>Quantitative Business Analysis II</td>
<td>Commerce</td>
<td>Mathematics I or Commercial EDP</td>
<td>1</td>
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<tr>
<td>Social Implications of Computers Systems Analysis</td>
<td>Commerce</td>
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<td>1</td>
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<tr>
<td>Systems Design</td>
<td>Commerce</td>
<td>CS—Commercial Programming Systems Analysis</td>
<td>1</td>
</tr>
<tr>
<td>EE341—Automatic Control</td>
<td>Electrical Engineering</td>
<td>Part II Mathematics, Topics C, D, E, F</td>
<td>1</td>
</tr>
<tr>
<td>EE345—Sample Data &amp; Digital Control</td>
<td>Electrical Engineering</td>
<td>EE341 or EE361—Automatic Control</td>
<td>1</td>
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<tr>
<td>EE322—Introduction to Digital Technology</td>
<td>Electrical Engineering</td>
<td>EE221—Semiconductor Devices</td>
<td>1</td>
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<tr>
<td>Subject</td>
<td>Department Offering Subject</td>
<td>Assumed Standard of Attainment</td>
<td>No. of Units</td>
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<tr>
<td>EE457</td>
<td>Digital Communications</td>
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<tr>
<td>EE456</td>
<td>Computer Operating Systems</td>
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<td>EE454</td>
<td>Compiler Construction</td>
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<tr>
<td>EE461</td>
<td>Topics in Switching Theory</td>
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<td>EE456</td>
<td>Pattern Recognition</td>
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<tr>
<td>EE466</td>
<td>Automata &amp; Computing Machines</td>
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<td>EE456</td>
<td>Advanced Computer Architecture</td>
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<tr>
<td>EE456</td>
<td>Formal Languages &amp; Automata</td>
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<tr>
<td>CS</td>
<td>Topic in Applied Probability</td>
<td>e.g., Information Theory</td>
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<td>CS</td>
<td>Theory of Computing</td>
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<tr>
<td>CS</td>
<td>Mathematical Principles of Numerical Analysis</td>
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<tr>
<td>CS</td>
<td>Programming Languages &amp; Advanced Applications in Computing</td>
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<tr>
<td>ME402</td>
<td>Systems Planning, Organization &amp; Control</td>
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<tr>
<td>ME404</td>
<td>Mathematical Programming</td>
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<tr>
<td>ME581G</td>
<td>Mathematical Programming</td>
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</table>

**Group III**

Subjects which have some application to computer science

<table>
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<tr>
<th>Subject</th>
<th>Department Offering Subject</th>
<th>Assumed Standard of Attainment</th>
<th>No. of Units</th>
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</thead>
<tbody>
<tr>
<td>CFS15</td>
<td>Elastic Continua</td>
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<tr>
<td>Theories of Organisation</td>
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<tr>
<td>EE323</td>
<td>Linear Electronics</td>
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<td>EE324L</td>
<td>Electronics Laboratory</td>
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<tr>
<td>EE342</td>
<td>Linear System Theory</td>
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<tr>
<td>EE344</td>
<td>Communications</td>
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<tr>
<td>EE421</td>
<td>Electronic Design A</td>
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<td>EE422</td>
<td>Electronic Design B</td>
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<tr>
<td>EE442</td>
<td>Nonlinear optimal control</td>
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<tr>
<td>EE443</td>
<td>Optimization Techniques</td>
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<tr>
<td>EE456</td>
<td>Computer Aided Analysis of Power-Systems</td>
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<tr>
<td>CS</td>
<td>Mathematical Logic</td>
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<tr>
<th>Subject</th>
<th>Department Offering Subject</th>
<th>Assumed Standard of Attainment</th>
<th>No. of Units</th>
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<tbody>
<tr>
<td>CS</td>
<td>Operations Research</td>
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<tr>
<td>CS</td>
<td>Theory of Statistics</td>
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<tr>
<td>CS</td>
<td>Asymptotic Methods in Analysis</td>
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<tr>
<td>CS</td>
<td>Random &amp; Restricted Walks</td>
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<td>CS</td>
<td>Signal Detection</td>
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<td>CS</td>
<td>Stochastic Processes</td>
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<td>CS</td>
<td>Combinatorial Designs</td>
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<tr>
<td>CS</td>
<td>Quantitative Aspects of Social Phenomena</td>
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<td>CS</td>
<td>Graph Theory</td>
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<tr>
<td>ME449</td>
<td>Reliability Analysis for Mechanical Systems</td>
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<tr>
<td>ME487</td>
<td>Operations Research for Probabilistic Models</td>
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<tr>
<td>ME488</td>
<td>Operations Research for Probabilistic Models</td>
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<tr>
<td>ME506G</td>
<td>Design of Experiments for Engineering Research</td>
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<td>Met 312</td>
<td>Optimization &amp; Control</td>
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<tr>
<td>CS</td>
<td>Instrumentation Techniques</td>
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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 per project.

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.

**Subjects Overlapping in Content**

The Board of Studies in Computer Science has decided that pursuant to Section 8 of the Requirements for the Diploma in Computer Science a student is not permitted to include in his programme any of the mutually exclusive subjects listed in the Table below, nor may he include a subject if he has previously included the content of that subject in his work for a degree or diploma which has already been conferred or awarded or approved for conferment or award.

The Board of Studies in Computer Science has decided that pursuant to Section 8 of the Requirements for the Diploma in Computer Science a student is not permitted to include in his programme any of the mutually exclusive subjects listed in the Table below, nor may he include a subject if he has previously included the content of that subject in his work for a degree or diploma which has already been conferred or awarded or approved for conferment or award.
Description of Subjects

Group I — Core Subjects

410136 CS—Commercial Programming — I. R. Beaman

Assumed Standard of Attainment

Mathematics I Topic NM or Commercial E.D.P.

Hours

2 lecture hours per week for 1st 1/2 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.

Texts

I.C.L. 1900 Series COBOL Manual
Chai, W. A. & H. W. Programming Standard COBOL (Academic)

References

Clifton, H. D. Systems Analysis for Business Data Processing (Business Books)
DeRossi, C. J. Learning COBOL Fast (Reston)

533219 EE361 Introduction to Logic & Assembly Languages — K. K. Saluja

Assumed Standard of Attainment

Mathematics I

Hours

3 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.

Texts

— Processor Handbook PDP-11/20 (DEC)

References

Chu, Y. Computer Organization and Micro Programming (McGraw-Hill)
Donovan, J. J. Systems Programming (McGraw-Hill)
Friedman, A. D. Logical Design of Digital Systems (Computer Science)
Stone, H. S. Introduction to Computer Organization and Data Structures (McGraw-Hill)
553220 EE362 Switching Theory & Logical Design — K. K. Saluja

**Assumed Standard of Attainment**

Mathematics I

**Hours**

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

**Examination**

Progressive assessment and final examination

**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. u-Programming (minimization and coding techniques).

Lectures 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)

660112 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 2-hour paper

**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 ½ 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**

GROUP II

Subjects in the mainstream 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

Content
The application of the theory of information systems to the analysis and design of computer systems. Topics include, the study and analysis of existing manual and computer systems; the design of batch sequential and direct access processing systems; an introduction to the COBOL programming language; a detailed treatment of computer security management; considerations when implementing a computer system.

Texts
Llewellyn, R. W. Information Systems (Prentice-Hall)
Semprevivo, P. C. Systems Analysis: definition, process, and design (Science Research Associates)
Van Tassel, D. Computer Security Management (Prentice-Hall)

References
Adams, E. B. Management of Information Technology --- Case Studies (Petrocelli/Charter)
Brightman, R. W. Information Systems for Modern Management (Macmillan)
Eliason, A. L. & Kitts, K. D. Business Computer Systems and Applications (Science Research Associates)
Jancura, E. G. Audit and Control of Computer Systems (Petrocelli/Charter)

Lyon, J. K. *An Introduction to Data Base Design* (Wiley)

Martin, J. *Design of Real-Time Computer Systems* (Prentice-Hall)

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

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


Watters, J. L. *COBOL Programming* (Heinemann)

Yourdon, E. *Design of On-Line Computer Systems* (Prentice-Hall)

### 412601 Quantitative Business Analysis II

**Assumed Standard of Attainment**

Nil

**Hours**

2 lecture hours per week

**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; queuing theory; dynamic programming; business forecasting; elements of simulation; management of quantitative analysis projects in real life.

**Texts**


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

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


**References**

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


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

### 410135 Social Implications of Computers --- (may not be offered in 1978)

**Assumed Standard of Attainment**

Mathematics I or Commercial E.D.P.

**Hours**

2 hours per week for 2nd ½ 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**


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

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

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

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

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

Ofilia, L. et al. *Semprevivo* (P.C.)

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

410128 Systems Design — I. R. Henman

**Assumed Standard of Attainment**

CS — Commercial Programming, Systems Analysis

**Hours**

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

**Examination**

An examination at end of year

**Content**

This subject is a development of Systems Analysis, with the inclusion of the following topics: input design, output design, file design, detailed systems design, systems implementation.

An appreciation of the detailed techniques of Systems Design involved in the development of computer-based information systems from a range of applications — i.e. Inventory and Production control; order entry and processing; general ledger accounting systems; sales analysis; payroll.

At least one such system will be observed in depth, as an attempt at detailed systems design.

**Texts**

As for Systems Analysis

**References**

Offered by Department of Electrical Engineering

533115 EE325 Introduction to Digital Technology — K. K. Saluja

**Assumed Standard of Attainment**

EE361 Introduction to Logic & Assembly Languages and EE221 Semiconductor Devices

**Hours**

3 hours per week

**Examination**

Progressive assessment & final examination

**Content**

Logic families; characteristic, functions and interfacing. Digital measurements; A/D, D/A conversion, rotational and translational encoders, time and frequency measurements. Digital system interconnection; bus systems, interfacing, single and differential transmission.

Memory technology; solid state, core memory, RAM, ROM, magnetic surface memory systems.

Random logic and programmed logic systems; IC, MSI, LSI, micro-programmed systems, microprocessor systems.

Lectures will be supplemented by practical assignments on a microprocessor system.

**Text**

Nil

**References**

Kohonen, T. McGlynn, D. R.

Digital Circuits and Devices (Prentice-Hall)
Microprocessors Technology, Architecture and Applications (John Wiley)

334134 EE441 Digital Communications — J. B. Moore

Prerequisite Nil

Hours 3 hours of lectures & tutorials per week for 2nd ½ year

Examination Progressive assessment & final examination

Content
1. Noisy Memoryless M-ary channels
   Orthogonal signalling on noisy memoryless channels. Optimum receivers, the matched filters, the correlation receiver. Shannons channel capacity theorem. Introduction to coding techniques; block, algebraic and convolution codes.

2. Noisy channels with memory

Text To be advised

References
Wozencraft, J. M. The Principles of Communication Engineering (Wiley)

534124 EE463 Computer Operating Systems — A. Cantoni

Assumed Standard of Attainment EE361 Introduction to Logic & Assembly Languages

Hours 3 hours per week for the 1st ½ year

Examination Progressive assessment & final examination

Content
Views of an operating system. Multiprogramming, interacting concurrent processes, process control primitives, Processor management, memory management, name management. Protection.

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)

Madnick, S. E. & Donovan, J. J.
Operating Systems (McGraw-Hill)

534143 EE464 Compiler Construction — P. J. Moylan

Assumed Standard of Attainment EE361 Introduction to Logic & Assembly Languages

Hours 3 hours per week for the 2nd ½ year

Examination Progressive assessment & final examination

Content
The design of assemblers. Introduction to the theory of grammars, parsing techniques, construction of compilers, object code generation. Construction of interpreters.

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

References
Aho, A. V. & Ullman, J. D. The Theory of Parsing, Translation and Compiling Vol. 2 (Prentice-Hall)
Donovan, J. J. Systems Programming (McGraw-Hill)

Further references will be given in class.

534145 EE462 Topics in Switching Theory
530108 EE565 Pattern Recognition
530119 EE566 Automata & Computing Machines
530125 EE567 Computer Process Control
530121 EE568 Advanced Computer Architecture
530122 EE569 Formal Languages & Automata

Offered by Department of Mathematics

660116 CS—Topic in Applied Probability e.g. Information Theory — Mathematics III Topic Y, see page 51
660127 CS—Theory of Computing — Mathematics III Topic TC, see page 48
660123 CS—Mathematical Principles of Numerical Analysis — Mathematics III Topic Z, see page 52
660132 CS—Programming Languages & Advanced Applications in Computing — Mathematics III Topic PL, see page 45
GROUP III — SUBJECTS

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 CE515 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 organisations and the rationalisation of work; organisational structures; bureaucracies as working communities; the scientific management movement; Mayo and the Hawthorne experiments; Kurt Lewin and field theory; group membership and intergroup conflict; search for principles of management; worker participation models; organisational development; and propositions of organisational behaviour.

Texts

Lupton, T. Management and the Social Sciences (Penguin)

Poole, M. Worker Participation in Industry (Routledge Kegan & Paul)

Sofer, C. Organisations in Theory and Practice (Heinemann)

Mouzelis, N. P. Organisation and Bureaucracy—An Analysis of Modern Theories (Routledge Kegan & Paul)

Offered by Department of Mechanical Engineering

544452 ME402 Systems Planning, Organization & Control — see page 113
544417 ME404 Mathematical Programming
540119 ME581G Mathematical Programming — not offered in 1978

Offered by Department of Electrical Engineering

533107 EE323 Linear Electronics
533108 EE324L Electronics Laboratory
533110 EE342 Linear System Theory
533113 EE344 Communications
534109 EE421 Electronic Design A
534110 EE422 Electronic Design B
534140 EE442 Non-linear optimal control—not offered in 1978
534132 EE443 Optimization Techniques
530100 EE416 Computer-aided Analysis of Power Systems—not offered in 1978

MATHEMATICS

660114 CS—Mathematical Logic—See Mathematics III, Topic O page 43
660115 CS—Operations Research—See Mathematics III, Topic U page 48
660129 CS—Theory of Statistics—See Mathematics III, Topic R page 47
660118 CS—Asymptotic Methods in Analysis—See Mathematics I V page 67
660119 CS—Random and Restricted Walks—See Mathematics IV page 67
660120 CS—Signal Detection—See Mathematics IV page 60
660121 CS—Stochastic Processes—See Mathematics IV page 61
660122 CS—Combinatorial Designs—See Mathematics IV page 66
660123 CS—Combinatorics—See Mathematics IV page 62
660125 CS—Graph Theory—May not be offered in 1978
660131 CS—Quantitative Aspects of Social Phenomena—See Mathematics IV page 58

Offered by Department of Mechanical Engineering

544416 ME449 Reliability Analysis for Mechanical Systems—not offered in 1978
544811 ME487 Operations Research — Deterministic Models
544812 ME488 Operations Research — Probabilistic Models
544843 ME489 Operations Research — Applications in Industry
540101 ME580G 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.

Offered by Department of Physics

660126 CS—Instrumentation Techniques

Assumed Standard of Attainment

<table>
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<th>Hours</th>
<th>One hour per week &amp; a 12-hour project</th>
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<tr>
<td>Content</td>
<td>Project assessment &amp; one 2-hour paper</td>
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<td>Examinations</td>
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<td>Texts</td>
<td>From the subject Electronics and Instrumentation II:</td>
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<td>Specialist Instrumentation — 8 lectures</td>
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<td>Instrumentation Systems — 8 lectures</td>
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<td>Measurement Devices — 14 lectures</td>
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<td>Malmstadt, H.V. et al. Instrumentation for Scientists Series (Vols 1-4)</td>
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<td>Text with Experiments or Text only or combined volume (Benjamin 1973)</td>
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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.

Astrophysics and High-Energy Particle Physics
Professor J. A. Campbell is investigating astrophysical problems in which the use of techniques and results from particle physics is essential. Examples of such problems are: determination of equations of state for material at densities higher than nuclear density, pion condensation, superfluidity in neutron stars, and the release and transport of energy in astrophysical material by neutrino reactions.

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

Combinatorial Theory and Operations Research
Dr R. B. Eggleton is interested in all aspects of combinatorial mathematics, particularly graph theory.
Professor R. W. Robinson is applying combinatorics to the counting of various structures, such as graphs and search trees.

Dr R. J. Vaughan is interested in the application of optimisation methods to industrial production problems.
Associate Professor W. D. Wallis is carrying out research on block designs and graph theory.

Computing and Numerical Analysis
Professor J. A. Campbell is concerned with all aspects of computer science that include the use of models of dynamic occupancy of computer storage by programmes and data, analysis of algorithms and computational complexity, methods for automatic programming, debugging and formation of plans or hypotheses, and computations with symbolic expressions.
Associate Professor A. J. Guttman is interested in methods of function approximation, particularly from the viewpoint of using a differential equation representation. He is also interested in the analysis of theoretical and experimental data.
Dr W. Summerfield is working on ways of determining the “condition” of linear systems of equations. Further, he is interested in the solution by linear marching schema of ordinary differential equations, in particular “stiff” systems. He is also investigating the finite element method of solution for partial differential equations.

Differential Geometry and Relativity
Dr P. Smrz is working on generalizations of Einstein’s theory of relativity using modern differential geometry—in particular, the theory of Lie groups and fibre bundles.

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

Environmental and Urban Studies
Dr R. W. Gibberd is studying the art of population projections and various models of urban structure and urban development. He is also interested in urban sociology, voting patterns and urban demographic models.
Dr R. J. Vaughan is investigating mathematical models in urban geography.
Associate Professor W. D. Wallis is working on mathematical models in urban geography and urban sociology.

Epidemic Theory
Professor J. A. Campbell is applying mathematical methods and results developed to describe the spread of infectious diseases to other processes, which have some basic properties in common with epidemics, e.g., growth of data structures during computations, and tourism.
Fluid Mechanics

Associate Professor A. J. Guttmann is studying the problem of extrapolating regular perturbation series in fluid mechanics. Dr W. T. F. Lau is concerned with potential flow and viscous flow problems.

Functional Analysis

Associate Professor J. R. Giles is involved in determining properties of Banach spaces which can be derived from relations between the points of the space and their support functionals. In particular, he is examining differentiability properties of the norm. He is also working on the development of the theory of the numerical range of operators on locally convex spaces, and of elements of locally m-convex algebras.

Dr V. Ficker and Mr C. J. Ashman are working in measure theory, particularly in some problems of families of sets.

Geophysical Fluid Dynamics

Dr W. Summerfield is currently studying the dynamics of estuarine systems. He is also interested in all ocean wave (and turbulence) phenomena.

History of Mathematics

Mr R. F. Berghout is pursuing research into the development of algebra, notably modern algebra, as well as the relations between this and classical occidental and oriental algebra.

Mr Berghout, together with Mrs Frost, is working on Greek algebra. Mrs Frost is currently translating into English some of Euclid's as yet untranslated works.

Information Theory

Professor R. G. Keats is continuing to work in co-operation with research scientists at the Weapons Research Establishment who are active in the study of signal processing. This work involves the study of non-linear systems with stochastic inputs.

Lexicostatistics

Dr A. J. Dobson studies the historical and geographical relationships between languages by statistical analysis of their vocabularies. Stochastic models of language evolution are developed.

Mathematical Models of Tumour Growth

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

Models of Learning

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

Molecular Biology

Professor J. A. Campbell is concerned with the algebraic modelling of the process of folding which converts proteins from the strings or chains in which they are first formed to their final complex three-dimensional molecular structure.

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.

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 studying stochastic models of events which occur periodically subject to random variation; in particular, tropical cyclones and circadian rhythms.

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 in the application of mathematics to traffic engineering, traffic accidents and transportation planning.
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>
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<th>Computer Number</th>
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<th>NAMES OF COMPONENTS</th>
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1 Not offered in 1978
2 May not be offered in 1978
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1 Not offered in 1978
FACULTY OF MATHEMATICS HANDBOOK 1978

ADDENDA AND ERRATA
ADDENDA AND ERRATA

The two items following should be inserted following page 21.

MATHEMATICS/SCIENCE

The details for the combined course follow simply from the Requirements for each degree. Each degree requires nine subjects so the combined degree requires 18 subjects less four subjects for which standing may be given, thus the combined degree should contain 14 subjects. The Bachelor of Mathematics requires Mathematics I, Mathematics IIIA, Mathematics IIC, Mathematics IIIIB and either Mathematics IIIIC or Computer Science 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:

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<th>Year</th>
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<td>Year II</td>
<td>three Part II subjects including Mathematics IIA and Mathematics IIC and another Part I subject.</td>
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<tr>
<td>Year III</td>
<td>Mathematics IIIA plus two other subjects which must include at least one Part III subject.</td>
</tr>
<tr>
<td>Year IV</td>
<td>either Mathematics IIIIB, Computer Science 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.</td>
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</table>

MATHEMATICS/METALLURGY

A combined course leading to admission to the degrees of Bachelor of Metallurgy and Bachelor of Mathematics as approved by the Faculty Boards of Mathematics and Engineering shall include Mathematics I, Mathematics II, Mathematics IIIA, Mathematics IIIIB and either Mathematics IIIIC 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.

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 (EN226) should be included as an elective.

The elective list covering subjects which may be taken in lieu of Mathematics IIIIB is given in Schedule B of the degree of Bachelor of Mathematics.
In the List of Topics for Part II Mathematics subjects, Topic G should have no Corequisite or Prerequisite Topic.

Note 4. The date should be 1978, not 1977.

Topic G. The lecturer will be P.K. Smrz, not R.W. Gibberd as listed.

Topic K. The lecturer will be J.R. Giles, not R.F. Berghout as listed.

Topic PL. The lecturer will be D.W. Blatt, not J.A. Campbell as listed.

Topic U. The Hours section should read: 2 lecture hours per week and 1 tutorial hour per week for the second half year.

Topic W. The Text for this topic will be:

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

Topic Y. The Hours section should read: 2 lecture hours per week and 1 tutorial hour per week for the first half year.