Preface

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

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

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

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

In Newcastle we have given practical effect to these links by introducing programmes of study which lead to the award of the B.Math degree together with other first degrees of the University. The other fields with which combined degree programmes have been available since 1975 are Arts, Science, Metallurgy and Commerce. More recently, we have put into effect arrangements for combined degree programmes with Engineering and with Economics. The details of the joint degree courses which are available this year are given in the section of this Handbook which begins at page 19.

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

Not all the areas of mathematical work which are of importance to the Faculty have the word "mathematics" in their titles. Operations research ("the mathematical description of what actually happens, rather than of what ought to happen", according to one of the originators of the subject) is one example. Two others, in
which the Faculty's activity is being expanded substantially at present, are statistics and computer science. For several years the Faculty has offered a postgraduate Diploma in Computer Science, and in 1977 it introduced the undergraduate subject Computer Science II. Our range of undergraduate studies in computer science was completed in 1978 by the presentation of the new subject Computer Science III. A similar extension of our undergraduate offerings in statistics was provided in 1979 with the introduction of Statistics III. Both of these areas, of course, provide points of contact between mathematics and many other subjects. For that reason, mathematicians with special knowledge of computer science or of statistics can expect to be citizens whose special skills will always be in demand.

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

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

R. W. ROBINSON,
Dean, Faculty of Mathematics.
A Guide to Students Enrolling in the Course Leading to the Degree of Bachelor of Mathematics

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

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

<table>
<thead>
<tr>
<th>Part I</th>
<th>Part II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accounting I</td>
<td>Geology I</td>
</tr>
<tr>
<td>Biology I</td>
<td>German IS 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>English 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>
</tbody>
</table>

3. Enrollment 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.

4. Permission will normally be given for the inclusion in a student's course of subjects which are prerequisites or corequisites of subjects appearing in the schedules.
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 Economics II or IIA; Accounting I and Legal Studies I.</td>
</tr>
<tr>
<td>English</td>
<td>A major in English, together with one additional subject chosen from English, Drama or Linguistics.</td>
</tr>
<tr>
<td>Geography</td>
<td>Geography IIA, Geography III, Geography IIC, Geography IIA.</td>
</tr>
<tr>
<td></td>
<td>An Honours Degree in Geography would be of considerable benefit.</td>
</tr>
<tr>
<td>History</td>
<td>At least two, preferably three, courses in History.</td>
</tr>
<tr>
<td>Mathematics</td>
<td>Mathematics IIIA as a minimum.</td>
</tr>
<tr>
<td>Modern Languages</td>
<td>Ideally an Honours Degree in the foreign language proposed, together with a period of residence in the appropriate foreign country.</td>
</tr>
<tr>
<td>Science</td>
<td>A Part III subject in the relevant science, together with some breadth in scientific disciplines.</td>
</tr>
</tbody>
</table>

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

Students in the Faculty of Mathematics who are intending to study for the postgraduate Diploma in Education may be interested in the following prerequisite subjects for that Diploma. It will be noted that any graduate holding the degree of Bachelor of Mathematics possesses the prerequisites required for the Diploma in Education and the prerequisites for at least one curriculum and method subject, namely Mathematics.

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

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>(a) A Part I &amp; Part II subject in English, and</td>
</tr>
<tr>
<td></td>
<td>(i) one additional subject from English, Linguistics or Drama.</td>
</tr>
<tr>
<td>History</td>
<td>(ii) A Part II subject in History.</td>
</tr>
<tr>
<td>Modern Languages</td>
<td>(i) A Part II subject in modern language.</td>
</tr>
<tr>
<td>Classics</td>
<td>(ii) A Part III subject in Greek or Latin.</td>
</tr>
<tr>
<td>Geography</td>
<td>(iii) A Part III subject in Geography.</td>
</tr>
<tr>
<td>Commerce</td>
<td>(iv) B.A. including Economics IIA.</td>
</tr>
<tr>
<td>Economics</td>
<td>or B.Com. including Economics II.</td>
</tr>
<tr>
<td>Social Science</td>
<td>(v) Out of Economics, Geography, History, Psychology, Sociology, Legal Studies, Economic History, one subject at Part II level</td>
</tr>
<tr>
<td>Studies</td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>(vi) At least four subjects in Mathematics for the degree of B.A., B.Math., or B.Sc.</td>
</tr>
<tr>
<td></td>
<td>(vii) A degree in a field of applied science, with experience in the application of mathematics.</td>
</tr>
<tr>
<td>Science</td>
<td>(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.</td>
</tr>
<tr>
<td></td>
<td>(ii) At least one other subject drawn from any of the above or from Mathematics, Geography, or Psychology.</td>
</tr>
<tr>
<td></td>
<td>No specific prerequisites.</td>
</tr>
</tbody>
</table>

Note

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

Mathematics Education Subjects

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

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

Text

Nil

References

Beringhoff
Eves & Newsome
Pólya
Waissmann

What is Mathematics?
Mathematical Discovery
Introduction to Mathematical Thinking

Requirements for the Degree of Bachelor of Mathematics

Section I — General

1. Definitions

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

2. Grading of Degree

The degree of Bachelor of Mathematics may be conferred either as an ordinary degree or as an honours degree.

3. Approval of First Enrolment

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

4. Timetable Requirements

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

5. Annual Examinations

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

6. Special Examinations

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

7. A Subject

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

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

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

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

9. **Prerequisites and Corequisites**

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

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

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) at least one of Mathematics IIIA, Computer Science III, Statistics III or one Part III subject chosen from the Schedules to the Requirements.

13. **Progression**

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

(b) The following restrictions on yearly course loads shall apply. The Dean may, in individual cases, relax restrictions (i), (ii), (iii), but only if he is satisfied that the academic merit of the candidate warrants such relaxation.

(i) No one academic year is to involve more than four subjects.

(ii) If four subjects are taken in any one year, at least three of them must be Part I subjects, and none may be a Part III subject.

(iii) If three subjects are taken in any one year, not more than two of them may be Part III subjects.

14. **Examination Grades**

The results of successful candidates at Annual Examinations and Special Examinations shall be classified:

- High Distinction, Distinction, Credit, Pass.

15. **Time Requirements**

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

16. **Standing**

The Faculty Board may grant standing under the following conditions.

(a) A candidate may be granted standing in recognition of work completed in another tertiary institution or faculty, provided that:

(i) the subjects for which credit is given shall have a reasonable correspondence with those offered in the Faculty;

(ii) an undergraduate of another tertiary institution shall not receive credit for more than four subjects;

(iii) a graduate or 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.

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

(b) six subjects chosen from the other subjects listed in the Schedule of Subjects approved for the degree of Bachelor of Science and

(c) three subjects chosen, with the approval of the Deans of the Faculties of Mathematics and Science, from the subjects approved for any of the degree courses offered by the University provided that:

(i) the number of Part I subjects shall not exceed six;

(ii) the minimum number of Part III subjects shall be three;

(iii) a candidate counting Psychology II C shall not be entitled to count either Psychology II A or Psychology II B;

(iv) a candidate counting Psychology II C shall not be entitled to count either Psychology II A or Psychology II B;

(v) a candidate counting Economics II C shall not be entitled to count either Economics II A or Economics II B;

(vi) a candidate counting Geology II C shall not be entitled to count Geology II A or Geology II B.

26. Mathematics/Metallurgy

After completing a successful first year of study towards either the degree of Bachelor of Mathematics or the degree of Bachelor of Metallurgy, a candidate may enrol in a Mathematics/Metallurgy course. A candidate who has enrolled in such a combined course shall qualify for admission to the ordinary degree of Bachelor of Mathematics and the degree of Bachelor of Metallurgy by passing Mathematics I, Mathematics II A, Mathematics II C, Mathematics II A and one of Mathematics IIIB, Computer Science III, Statistics III or a Part III subject chosen from the Schedules of Subjects approved for the degree of Bachelor of Mathematics and by satisfactorily completing other subjects selected from the Schedule of Subjects approved for the degree of Bachelor of Metallurgy.

27. Commerce/Mathematics

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

28. Engineering/Mathematics

After completing a successful first year of study towards either the degree of Bachelor of Engineering or the degree of Bachelor of Mathematics, a candidate may enrol in an Engineering/Mathematics course. A candidate who has enrolled in such a combined course shall qualify for admission to the degree of Bachelor of Engineering and the ordinary degree of Bachelor of Mathematics, by passing Mathematics I, Mathematics II A, Mathematics II C, Mathematics II A and one of Mathematics IIIB, Computer Science III, Statistics III or a Part III subject chosen from the Schedules of Subjects approved for the degree of Bachelor of Mathematics, and by satisfactorily completing other subjects 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 II A, Mathematics II C, Mathematics II A and one of Mathematics IIIB, Computer Science III, Statistics III or a Part III subject chosen from the Schedules of Subjects approved for the degree of Bachelor of Mathematics and the remainder of which shall by themselves complete the requirements for the degree of Bachelor of Economics.

SCHEDULE A

Mathematics Subjects

<table>
<thead>
<tr>
<th>Subject</th>
<th>Part I</th>
<th>Part II</th>
<th>Part III</th>
<th>Part IV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mathematics I</td>
<td>Mathematics II A</td>
<td>Mathematics II C</td>
<td>Mathematics IV</td>
</tr>
<tr>
<td>Remarks including Prerequisites and Corequisites</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

Pre-requisite Mathematics I

Pre-requisite Mathematics I

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

Pre-requisite Mathematics I

Pre-or Corequisite Mathematics II A

Pre-requisites Mathematics II A & Mathematics II C

Pre-or Corequisite Mathematics II A

Pre-requisites Mathematics III A & one of Mathematics IIIB, Computer Science III or Statistics III
Computer Science Subjects

Subject

Part II
Computer Science II

Part III
Computer Science III

Part III
Statistics III

Statistics Subject

Prerequisites Mathematics IIA & Mathematics IIC

(including Topics CO, H & I)

SCHEDULE B

Subjects With a Substantial Mathematical Content

Part I
Engineering I

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

Prerequisites Engineering I & Mathematics I

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

Prerequisites Mathematics IIA & Mathematics IIC

& either Accounting IIA & Accounting IIB or Accounting IIB

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

Prerequisites Computer Science II, Mathematics IIA & Mathematics IIC

Prerequisites Mathematics IIA & Mathematics IIC

(including Topics CO, D)

Prerequisites Mathematics IIA & Mathematics IIC

(including Topics CO, D)

Prerequisites Economics IIA, Mathematics IIA & Mathematics IIC

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

Prerequisites Mathematics IIA & Mathematics IIC

Prerequisites Mathematics IIA & Mathematics IIC

(including Topics F & H)

Prerequisites Physics II, Mathematics IIA & Mathematics IIC

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

SCHEDULE C

Combined Honours Subjects

Part IV
Mathematics: Physics IV
Prerequisites Mathematics IIIA & Physics IIIA
Mathematics: Psychology IV
Prerequisites Mathematics IIIA & Psychology IIIIC

NOTES ON COMBINED DEGREE COURSES

ARTS/MATHEMATICS

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

The course could be pursued in the following manner:

Year I
Mathematics I and three other Part I subjects.

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

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

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

COMMERCE/MATHEMATICS

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

Year I
Mathematics I

Introductory Quantitative Methods
Economics I
Accounting I

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

Year III
Mathematics IIIA
Three B.Com. subjects

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

Year V
Three B.Com. subjects.
ECONOMICS/MATHEMATICS

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

The course could be pursued in the following manner:

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

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

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

Year IV
Two B.Ec. subjects

Year V
Three B.Ec. subjects

ENGINEERING/MATHEMATICS

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

The course could be pursued in the following manner:

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

Year I
ChE141 Industrial Process Principles
ChE151 Industrial Chemical Processes & Equipment
ME111 Graphics & Engineering Drawing
GE151 Introduction to Materials Science
Chemistry I
Mathematics I
Physics I

Year II
Mathematics IIA
Mathematics IIC
ChE261 Separation Processes I
ChE271 Fuels & Combustion
ChE251 Structures & Pressure Vessel Design
ChE291 Laboratory
ChE272 Fluid Mechanics
ChE241 Process Analysis I
Chemistry IIC

Year III
Mathematics IIIA
ChE371 Kinetics & Thermodynamics
ChE361 Separation Processes II
ChE291 Laboratory
ChE362 Solids Handling & Minerals Processing

ChE354 Electrochemistry & Corrosion
ChE351 Equipment Design
ChE341 Process Analysis II
ChE381 Computations
ChE352 Process Engineering
ChE353 Process Economics

Year IV
ChE462 Environmental Control
ChE471 Industrial Safety
ChE472 Transport Phenomena
ChE482 Process Control
ChE483 Reaction Engineering
One unit from ChE390/400/500
ME121 Workshop Practice

Part III Subject from B.Math. Schedule of Subjects

Year V
ChE490 Design Project
ChE491 Seminar
ChE492 Research Project
Elective I -- 5 units

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

Year I
CE111 Statics
ME111 Graphics & Engineering Drawing
GE112 Introduction to Engineering Design
ME131 Dynamics
GE151 Introduction to Materials Science
ME121 Workshop Practice
Mathematics I
Physics I

Year II
Mathematics IIA
CE212 Mechanics of Solids I
CE213 Mechanics of Solids II
CE221 Properties of Materials
CE222 Materials Technology
CE231 Fluid Mechanics I
CE321 Fluid Mechanics II
CE241 Water Resources Engineering I
CE223J Engineering Geology
ME301 Engineering Computations

Year III
Mathematics IIC
CE314 Structural Analysis I
CE315 Structural Design I
CE324 Soil Mechanics
CE333 Fluid Mechanics III
CE334 Fluid Mechanics IV
CE342 Water Resources Engineering II
GE350 Seminar
EE131 Circuit Fundamentals
EE211 Energy Conversion

Year IV
Mathematics IIIA
CE351 Civil Engineering Systems I
CE372 Transport Engineering
CE425 Reaction Engineering
CE452 Engineering Construction
Structures Elective

Year V
Mathematics IIIIB or a Part III subject from the Schedules of Subjects for B.Math.
CE453 Project
(iii) **B.E./B.Math. in Electrical Engineering**

**Year I**
- Mathematics I
- Physics IA
- Chemistry IS
- CE111 Statics
- EE131 Circuit Fundamentals
- GE112 Introduction to Engineering Design
- ME111 Graphics & Engineering Drawing
- ME131 Dynamics
- ME121 Workshop Practice

**Year II**
- EE211 Energy Conversion
- EE221 Semiconductor Devices
- EE231 Electrical Circuits
- EE262 Systematic Programming
- EE264 Introduction to Logic & Assembly Language
- Ph221 Electromagnetics & Quantum Mechanics
- Mathematics II A
- Mathematics II B

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

**Year IV**
- EE313 Power Systems
- EE314 Electrical Machines
- EE324L Electronics Laboratory
- EE325 Introduction to Digital Technology
- EE333 Advanced Circuit Analysis
- EE341 Automatic Control
- EE344 Communications
- EE362 Switching Theory & Logic Design
- GE350 Seminar
- 4 units of electives outside Faculty of Engineering
- EE421 Electronics Design A
- EE480 Project
- EE481 Project or 2 units from EE300, 400 subjects
- EE491 Seminar
- 8 from EE300, 400 subjects
- 1 unit of elective (Engineering Fac. — non E.F.)

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

**Year I**
- Mathematics I
- Physics IA
- Chemistry IS
- CE111 Statics
- GE112 Statics
- GE115 Introduction to Materials Science
- GE116 Introduction to Engineering Design
- ME111 Graphics & Engineering Drawing
- ME131 Dynamics
- ME121 Workshop Practice

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

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

**Year I**
- Mathematics I
- Physics IA
- Chemistry IS
- CE111 Statics
- GE112 Statics
- GE115 Introduction to Materials Science
- GE116 Introduction to Engineering Design
- ME111 Graphics & Engineering Drawing
- ME131 Dynamics
- ME121 Workshop Practice

**Year II**
- Mathematics II A
- Mathematics II B
- EE131 Circuit Fundamentals
- ME201 Experimental Methods I
- ME202 Dynamics of Engineering Systems
- ME203 Experimental Methods II
- ME214 Mechanics of Solids I
- ME241 Properties of Materials I
- ME251 Fluid Mechanics I
- ME271 Thermodynamics I
- ME314 Mechanics of Solids II
- ME361 Automatic Control
- ME383 Quality Engineering

**Year III**
- Mathematics III A
- EE211 Energy Conversion
- ME212 Engineering Design I
- ME223 Engineering Technology
- ME232 Dynamics of Machines I
- ME301 Engineering Computations
- ME343 Mechanics of Solids II
- ME361 Automatic Control
- ME383 Quality Engineering

**Year IV**
- Mathematics III B or Part III subject from Schedule of Subjects for B.Math.
- ME312 Engineering Design II
- ME313 Engineering Design III
- ME333 Dynamics of Machines II
- ME383 Methods Engineering
- ME383 Quality Engineering
- ME482 Engineering Economics I
- ME483 Engineering Economics II
- ME487 O.R.— Deterministic Models
- ME488 O.R.— Probabilistic Models
- ME496 Project/Seminar
- Industrial Engineering Elective
- 4 units Departmental Technical Electives
- Mathematics III A
- EE311 Electronics Design A
- EE314 Electrical Machines
- EE324L Electronics Laboratory
- EE325 Introduction to Digital Technology
- EE333 Advanced Circuit Analysis
- EE341 Automatic Control
- EE344 Communications
- EE362 Switching Theory & Logic Design
- GE350 Seminar
- 4 units of electives outside Faculty of Engineering
- EE421 Electronics Design A
- EE480 Project
- EE481 Project or 2 units from EE300, 400 subjects
- EE491 Seminar
- 8 from EE300, 400 subjects
- 1 unit of elective (Engineering Fac. — non E.F.)
(iii) B.E./B.Math. in Electrical Engineering

Year I
- Mathematics I
- Physics IA
- Chemistry IS
- CE111 Statics
- EE131 Circuit Fundamentals
- GE112 Introduction to Engineering Design
- ME111 Graphics & Engineering Drawing
- ME131 Dynamics
- ME121 Workshop Practice

Year II
- EE211 Energy Conversion
- EE221 Semiconductor Devices
- EE232 Electrical Circuits
- EE262 Systematic Programming
- EE264 Introduction to Logic & Assembly Language
- Ph211 Electromagnetics & Quantum Mechanics
- Mathematics IIA
- Mathematics IIC

Year III
- Mathematics IIA
- Mathematics IIB or a Part III subject from the Schedule of Subjects for B. Math.

Year IV
- EE313 Power Systems
- EE314 Electrical Machines
- EE324L Electronics Laboratory
- EE333 Advanced Circuit Analysis
- EE341 Automatic Control
- EE344 Communications
- EE362 Switching Theory & Logic Design
- ME350 Seminar
- 4 units of electives outside Faculty of Engineering
- ME421 Electronics Design A

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

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

Year I
- Mathematics I
- Physics IA
- Chemistry IS
- CE111 Statics
- GE151 Introduction to Materials Science
- GE112 Introduction to Engineering Design
- ME111 Graphics & Engineering Drawing
- ME131 Dynamics
- ME121 Workshop Practice

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

Year III
- Mathematics IIA
- EE211 Energy Conversion
- ME212 Engineering Design I
- ME223 Engineering Technology
- ME232 Dynamics of Machines I
- ME301 Engineering Computations
- ME343 Mechanics of Solids II
- ME361 Automatic Control

Year IV
- Mathematics IIB or Part III subject from Schedule of Subjects for B. Math.
- ME312 Engineering Design II
- ME313 Engineering Design III
- ME333 Dynamics of Machines II
- ME381 Methods Engineering
- ME383 Quality Engineering

Year V
- ME482 Engineering Economics I
- ME484 Engineering Economics II
- ME487 O.R. -- Deterministic Models
- ME488 O.R. -- Probabilistic Models
- ME496 Project/Seminar

Industrial Engineering Elective
- 4 units Departmental Technical Electives

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

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

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

Year III
- Mathematics IIA
- EE211 Energy Conversion
- ME212 Engineering Design I
- ME223 Engineering Technology
- ME232 Dynamics of Machines I
- ME301 Engineering Computations
- ME343 Mechanics of Solids II
- ME361 Automatic Control

Year IV
- Mathematics IIB or Part III subject from Schedule of Subjects for B. Math.
- ME312 Engineering Design II
- ME313 Engineering Design III
- ME333 Dynamics of Machines II
- ME381 Methods Engineering
- ME383 Quality Engineering

Year V
- ME482 Engineering Economics I
- ME484 Engineering Economics II
- ME487 O.R. -- Deterministic Models
- ME488 O.R. -- Probabilistic Models
- ME496 Project/Seminar

Industrial Engineering Elective
- 4 units Departmental Technical Electives
other subjects taken from the Schedule of Subjects approved for the degree of Bachelor of Mathematics and Science III, each combined degree should contain four subjects for which standing may be given, thus the combined degree requires 14 subjects. The Bachelor of Mathematics requires Mathematics I, Mathematics II A, Mathematics II C, Mathematics III A and one of Mathematics III B, Computer Science III, Statistics III or a Part III subject from Schedule B of the Requirements. This leaves nine subjects which must clearly satisfy the Requirements for the Science degree.

The course could be pursued in the following manner:

Year I
Mathematics I and three other Part I subjects.

Year II
three Part II subjects including Mathematics II A and Mathematics II C and another Part I subject.

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

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

MATHEMATICS/METALLURGY
A combined course leading to admission to the degrees of Bachelor of Metallurgy and Bachelor of Mathematics as approved by the Faculty Boards of Mathematics and Engineering shall include Mathematics I, Mathematics II A, Mathematics II C, Mathematics III A and one of Mathematics III B, Computer Science III, Statistics III or a Part III subject chosen from Schedule B of the Schedule of Subjects approved for the degrees of Bachelor of Mathematics and other subjects taken from the Schedule of Subjects approved for the degree of Bachelor of Metallurgy.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Year I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics I</td>
<td></td>
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<tr>
<td>Physics I A</td>
<td></td>
</tr>
<tr>
<td>Chemistry I</td>
<td></td>
</tr>
<tr>
<td>ChE141 Industrial Process Principles</td>
<td></td>
</tr>
<tr>
<td>GE151 Introduction to Materials Science</td>
<td></td>
</tr>
<tr>
<td>ME111 Graphics &amp; Engineering Drawing</td>
<td></td>
</tr>
<tr>
<td>ME121 Workshop Practice</td>
<td></td>
</tr>
<tr>
<td>Mathematics II A</td>
<td></td>
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<tr>
<td>Mathematics II C</td>
<td></td>
</tr>
<tr>
<td>Met214 Theory of Metallurgy Processes I</td>
<td></td>
</tr>
<tr>
<td>Met261 Extraction Metallurgy</td>
<td></td>
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<tr>
<td>Met251 Metallography</td>
<td></td>
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<tr>
<td>Met241 Microplasticity</td>
<td></td>
</tr>
<tr>
<td>Met271 Fabrication Metallurgy</td>
<td></td>
</tr>
<tr>
<td>Met281 Electronic &amp; Atomic Structure of Materials</td>
<td></td>
</tr>
<tr>
<td>Mathematics III A</td>
<td></td>
</tr>
<tr>
<td>Met301 Communication Skills</td>
<td></td>
</tr>
<tr>
<td>ChE353 Process Economics</td>
<td></td>
</tr>
<tr>
<td>Met314 Theory of Metallurgical Processes II</td>
<td></td>
</tr>
<tr>
<td>Met351 Metallography</td>
<td></td>
</tr>
<tr>
<td>Met352 Physical Metallurgy</td>
<td></td>
</tr>
<tr>
<td>Met353 Solidification Processes</td>
<td></td>
</tr>
<tr>
<td>Met371 Materials Selection</td>
<td></td>
</tr>
<tr>
<td>Year IV</td>
<td>Part III Subject from B.Math. Schedule of Subjects</td>
</tr>
<tr>
<td>Met372 Industrial Metallurgy</td>
<td></td>
</tr>
<tr>
<td>Met374 Welding &amp; Non-Destructive Testing</td>
<td></td>
</tr>
<tr>
<td>Met391 Physical Metallurgy Laboratory</td>
<td></td>
</tr>
<tr>
<td>Met392 Chemical Metallurgy Laboratory Electives</td>
<td></td>
</tr>
<tr>
<td>Year V</td>
<td>Directed Reading</td>
</tr>
<tr>
<td>Met401 Directed Reading</td>
<td></td>
</tr>
<tr>
<td>Met402 Seminar</td>
<td></td>
</tr>
<tr>
<td>Met491 Laboratory Project</td>
<td></td>
</tr>
</tbody>
</table>

8 units from Met400 Subjects

REQUIREMENTS FOR THE DIPLOMA IN COMPUTER SCIENCE

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

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

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

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

5. 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.

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

7. (1) In order to qualify for the Diploma, a candidate shall, in not less than two years of part-time or one year of full-time enrolment, complete to the satisfaction of the Board a programme of subjects approved by the Board totalling not less than 11 units.

   (2) The programme referred to in subsection (1) of this section shall consist of:
(a) the core programme set out in the Schedule; and
(b) units chosen from subjects approved by the Board designated either Group A subjects or Group B subjects. A candidate's programme may not include more than two Group B subjects.

(3) The Board may approve a project for inclusion in the candidate's programme. Such a project shall count as a Group B subject with a unit value of not more than 2.

(4) Notwithstanding the provision of subsection (2) of this section a candidate shall not enrol in a subject the content of which, in the opinion of the Board, is substantially equivalent to work already completed towards another degree or Diploma. In such a case the Board shall prescribe an alternative subject to any listed in the Schedule.

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

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

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

(3) The result of a successful candidate in a subject shall be classified: Pass, Credit, Distinction or High Distinction.

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

(2) A candidate who withdraws from any subject after the relevant date shall be deemed to have failed in that subject unless granted permission by the Dean of the Faculty of Mathematics to withdraw without penalty. The relevant date shall be:
   (a) in the case of any subject offered in the first half of the academic year — the eighth Monday in first term;
   (b) in the case of any subject offered in the second half of the academic year — the second Monday in third term;
   (c) in the case of any other subject — the sixth Monday in second term.

11. 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.

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**SCHEDULE OF SUBJECTS**

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

**REQUIREMENTS FOR THE DIPLOMA IN MATHEMATICAL STUDIES**

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

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

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

4. An applicant for registration as a candidate for the Diploma may be granted standing on conditions to be determined by the Faculty Board, provided that standing may not be granted in respect of any studies for

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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.
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.

REGULATIONS GOVERNING MASTERS DEGREES

PART I — GENERAL

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

(2) In these Regulations and the Schedules thereto, unless the context or subject matter otherwise indicates or requires:

1 Subject to confirmation by Council

“Faculty Board” means the Faculty Board of the Faculty responsible for the course in which a person is enrolled or is proposing to enrol;
“programme” means the programme of research and study prescribed in the Schedule;
“Schedule” means the Schedule of these Regulations pertaining to the course in which a person is enrolled or is proposing to enrol; and
“thesis” means any thesis or dissertation submitted by a candidate.

3. (1) To be eligible for admission to candidature an applicant shall:
(a) (i) have satisfied the requirements for admission to a degree of Bachelor in the University of Newcastle as specified in the Schedule; or
(ii) have satisfied the requirements for admission to a degree or equivalent qualification, approved for the purpose by the Faculty Board, in another tertiary institution;
(iii) have such other qualifications and experience as may be approved by the Senate on the recommendation of the Faculty Board or otherwise as may be specified in the Schedule; and
(b) have satisfied such other requirements as may be specified in the Schedule.

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

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

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

5. The programme shall be carried out:
(a) under the guidance of a supervisor or supervisors either appointed by the Faculty Board or as otherwise prescribed in the Schedule; or
(b) as the Faculty Board may otherwise determine.

6. Upon request by a candidate the Faculty Board may grant leave of absence from the course. Such leave shall not be taken into account in calculating the period for the programme prescribed in the Schedule.
7. (1) A candidate may withdraw from a subject or course only by informing the Secretary to the University in writing and such withdrawal shall take effect from the date of receipt of such notification.

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

The relevant date shall be:
(a) in the case of a subject offered in the first half of the academic year — the eighth Monday in first term;
(b) in the case of a subject offered in the second half of the academic year — the second Monday in third term;
(c) in the case of any other subject — the sixth Monday in second term.

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

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

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

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

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

PART II — EXAMINATION AND RESULTS

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

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

PART III — PROVISIONS RELATING TO THESES

12. (1) The subject of a thesis shall be approved by the Faculty Board on the recommendation of the Head of the Department in which the candidate is carrying out his research.

(2) The thesis shall not contain as its main content any work or material which has previously been submitted by the candidate for a degree in any tertiary institution unless the Faculty Board otherwise permits.

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

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

(2) The Faculty Board shall determine the course of action to be taken should the certificate of the supervisor indicate that in the opinion of the supervisor the thesis is not of sufficient academic merit to warrant examination.

1 At present there is no fee payable.
15. The University shall be entitled to retain the submitted copies of the thesis, accompanying documents and published work. The University shall be free to allow the thesis to be consulted or borrowed and, subject to the provisions of the Copyright Act, 1968 (Com), may issue it in whole or any part in photocopy or microfilm or other copying medium.

16. (1) For each candidate two examiners, at least one of whom shall be an external examiner (being a person who is not a member of the staff of the University) shall be appointed either by the Faculty Board or otherwise as prescribed in the Schedule.

(2) If the examiners’ reports are such that the Faculty Board is unable to make any decision pursuant to Regulation 11 of these Regulations, a third examiner shall be appointed either by the Faculty Board or otherwise as prescribed in the Schedule.

SCHEDULE 3 — MASTER OF MATHEMATICS

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

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

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

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

5. A part-time candidate shall, except with the permission of the Faculty Board, which shall be given only in special circumstances:
   (a) conduct the major proportion of the research or design work in the University; and
   (b) take part in research seminars within the Department in which he is working.

6. Any third examiner shall be an external examiner.

DESCRIPTION OF SUBJECTS

NOTE ON SUBJECT ENTRIES

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

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

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

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

(d) Texts are essential books recommended for purchase.

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

DEGREE OF BACHELOR OF MATHEMATICS

SCHEDULE A

Preliminary Notes

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

(i) **MATHEMATICS SUBJECTS**

### PART I SUBJECT

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Mathematics I</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prerequisites</strong></td>
<td>Nil</td>
</tr>
<tr>
<td><strong>Examination</strong></td>
<td>Two 3-hour papers</td>
</tr>
</tbody>
</table>

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

### PART I TOPICS

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

**Prerequisites**
- Nil

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

**Text**
- *Elementary Linear Algebra* 2nd cdn (Wiley 1977)

**References**
- Briske, W.
- Kolman, B.

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

**Prerequisites**
- Nil

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

**Content**

**Text**
- Nil

**References**
- Apostol, T.
- Spivak, M.

#### Calculus (Topic CA) — W. P. Wood

**Prerequisites**
- Nil

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

**Content**

**Text**
- *Calculus* (Schaum 1974)

**References**
- Apostol, T.
- Hille, E. & Sals, S.
- Kaplan, W. & Lewis, D. J.
- Spivak, M.

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

**Prerequisites**
- Nil

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

**Text**
- *Statistics and Computing* (Wiley 1971)
- *Linear Algebra* (Schaum 1974)
- *Linear Algebra* (Nelson 1973)
Content


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

Text

or

References


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 38 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 76 et seq.

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

List of Topics for Part II Mathematics subjects

<table>
<thead>
<tr>
<th>Topic</th>
<th>Corequisite or Prerequisite Topic</th>
<th>Part III Topic Requiring this Part II Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Mathematical Models</td>
<td>CO</td>
<td>CO</td>
</tr>
<tr>
<td>B Complex Analysis</td>
<td>CO</td>
<td>Q, M, N, P, PD, Q, S, TC, Y, Z</td>
</tr>
<tr>
<td>CO Vector Calculus &amp; Differential Equations</td>
<td></td>
<td>T, X, Z</td>
</tr>
<tr>
<td>D Linear Algebra</td>
<td></td>
<td>PL, YC</td>
</tr>
<tr>
<td>E Numerical Analysis &amp; Computing</td>
<td></td>
<td>R, U, Y</td>
</tr>
<tr>
<td>G Finite Mathematics</td>
<td></td>
<td>H</td>
</tr>
<tr>
<td>H Probability &amp; Statistics</td>
<td></td>
<td></td>
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<tr>
<td>I Applied Statistics</td>
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</tr>
</tbody>
</table>

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. In addition, students taking Mathematics IIA will be required to prepare a report on some aspect of the history of the mathematics studied in this subject.

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 H, K, L and one of the topics A, F, G, I, J. Students who may wish to proceed to Statistics III as a Part III subject should select topic I.
Notes
1. Students whose course includes a Schedule B subject may have their choice of
topics restricted further than is set out in the rules above.
2. Students whose courses include Physics IIIA are advised to include topics CO, Band
either of D, F and H 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 “A” in
1974-1978 corresponds to the topic coded “A” in previous years. Such students
may require special permission for their selection of Part II topics, and should consult
with the Head of the Department.
4. Topics C & E existing before 1978 are no longer offered as separate topics.

PART II TOPICS


Prerequisite or Corequisite
Topic CO

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

Examination
One 2-hour paper

Text
Nil

References
Andrews, J. G. & McClone, R. R.
Kemeny, J. G. & Snell, J. L.
Noble, B.

Rapport, A. & Chammah, A. M.
Smith, J. M.

662109 Topic C0 — Vector Calculus & Differential Equations — W. Brisley

Prerequisites
Nil

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

Examination
One 3-hour paper

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

Taylor's polynomial; Fourier series.

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

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

Text
Either

Kreyszig, E.

or

Greenspan, H. D. & Benney, D. J.

References
Courant, R.

Advanced Engineering Mathematics 4th edn
(Paperback) (Wiley 1979) (4th edn is preferable but 3rd
edn will suffice)

or

Foundations of Applied Mathematics (Prentice-Hall
1978)

References

Differential and Integral Calculus Vol. II (Wiley 1968)
Calculus — an Introduction to Applied Mathematics
(McGraw-Hill 1973)
An extended list of references will be available to students enrolling in the topic.

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

**Prerequisites**
Nil

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

**Examination**
One 2-hour paper

**Content**

**Texts**
Lipschutz, S. *Linear Algebra* (Schaum 1974)
Rorres, C. & Anton, H. *Applications of Linear Algebra* (Wiley 1977 or 2nd edn 1979)

**References**
Anton, H. *Elementary Linear Algebra* 2nd edn (Wiley 1977)
Ayers, F. *Matrices* (Schaum 1962)
Brinsley, 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)

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

**Prerequisites**
Nil

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

**Examination**
One 2-hour paper

**Content**

**Text**

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

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

**Prerequisites**
Nil

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

**Examination**
One 2-hour paper

**Content**
This course will be an introduction to finite mathematics and its application to operations research and behavioural mathematics. The content will include linear programming, game theory, graphetheoretic models, Markov processes, inventory and storage models and queuing theory.

**Text**
Goodman, A. W. & Ratti, J. S. *Finite Mathematics with Applications* 3rd edn (Macmillan 1979)

**References**
Owen, G. *Finite Mathematics* (Saunders 1970)
Saaty, T. L. *Topics in Behavioural Mathematics* (M. A. A. 1973)
Street, A. P. & Wallis, W. D. *Combinatorial Theory: An Introduction* (CBRC 1977)

**662204 Topic H — Probability & Statistics — P. K. Smrz**

**Prerequisite**
Nil

**Hours**
1 lecture hour per week and 1 tutorial hour per fortnight
This topic is an introduction to the theory of probability and statistics. The lectures will include the following topics: Probability space, basic probability theorems, conditional probability, independence of events. Discrete and continuous random variables, probability functions, distribution function. Expectation, mean, variance, moment generating function. Joint distribution, covariance, correlation, independence. Error propagation. Chebyshev inequality and the weak law of large numbers. Binomial and Poisson probability distributions, Normal distribution. Classification of experimental data, histograms. Random samples, sampling distributions for mean and variance. Statistical inference, hypothesis testing types of error, power functions. Point and interval estimation. Application of the $\chi^2$, $T$, $F$ and normal random variables to hypothesis testing.

**Text**

Freund, J. E. or Hoel, P. G.

Mathematical Statistics 2nd edn (Prentice-Hall 1971)

Introduction to Mathematical Statistics 4th edn (Wiley 1971)

Mathematical Statistics with Applications (Duxbury 1973)

**References**

Allenféder, C. B. & Oakley, C. O.

Feller, W.

Gnedenko, B. V.

Hine, J. & Wetherill, G. B.

Kolmogorov, A. N.

Lipschutz, S.

Loève, M.

Moran, P. A. P.

Prerequisites or Corequisites

Topics in Applied Statistics — W. P. Wood

Mathematical Statistics 2nd edn (Prentice-Hall 1971)

Introduction to Mathematical Statistics 4th edn (Wiley 1971)

References

Draper, N. R. & Smith, H.

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

Nolthern, G. E.

Applied Regression Analysis (Wiley 1966)

Finite Markov Chains (Van Nostrand 1967)


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**662302 Topic J — Topic in Applied Mathematics e.g. Mechanics, Potential Theory and Fluid Dynamics — C. A. Croxton**

**Prerequisite or Corequisite**

Topic CO

**Hours**

1 lecture hour per week and 1 tutorial hour per fortnight

**Examination**

One 2-hour paper

**Content**


**Text**

Nil

**References**

Chorlton, F.

Textbook of Dynamics (Van Nostrand 1963)

Goodman, L. E.

Dynamics (Blackie 1963)

Marion, J. B.

Classical Dynamics (Academic 1970)

Meirovitch, L.


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**662303 Topic K — Topic in Pure Mathematics e.g. Group Theory — R. P. Berghout / M. J. Hayes**

**Prerequisites**

Nil

**Hours**

1 lecture hour per week and 1 tutorial hour per fortnight

**Examination**

One 2-hour paper

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42
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 R² or R³.

Text
Nil

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

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

Prerequisites
Nil

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

Examination
One 2-hour paper

Text
Analysis of Metric Spaces (University of Newcastle 1974)

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

PART III SUBJECTS

The Mathematics Department offers two Part III Mathematics subjects, each comprising four topics chosen from the list below. It also offers Part III subjects in Statistics, described on page 46 et seq., and Computer Science, described on page 79 et seq.

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

Plases in both Mathematics IIIA and IIIC are prerequisite for entry to Mathematics IIIIA, and Mathematics IIIA is pre- or corequisite for Mathematics IIIIB. It will be assumed that students taking a third-year subject in 1980 have already studied topics C, D, K and L in 1979 (or C, D, E, K and L if passed prior to 1978) in their Part II subjects.

Students from other faculties who wish to enrol in particular Part III topics, according to the course schedules of those Faculties, should consult the particulars of the list below, and should consult the lecturer concerned. In particular, the prerequisites for subjects may not all apply to isolated topics. Students wishing to enrol in Statistics III should avoid taking topics R, U and Y as Mathematics IIIA topics, and students wishing to enrol in Computer Science III should note that topics O, PL, TC and Z may be chosen as topics in either Mathematics IIIA or Computer Science III, but not both.

Summaries of these topics, together with texts and references, appear on page 47 et seq. 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>K, L</td>
</tr>
<tr>
<td>M</td>
<td>CO</td>
</tr>
<tr>
<td>N</td>
<td>CO</td>
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<td>K, L</td>
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<tr>
<td>P</td>
<td>CO, D, L</td>
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<tr>
<td>PD</td>
<td>CO</td>
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<tr>
<td>PL</td>
<td>F</td>
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<tr>
<td>Q</td>
<td>B, CO</td>
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<tr>
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<td>V</td>
<td>L</td>
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<td>W</td>
<td>L</td>
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<tr>
<td>X</td>
<td>D, K</td>
</tr>
<tr>
<td>Y</td>
<td>CO, H</td>
</tr>
<tr>
<td>Z</td>
<td>CO, D</td>
</tr>
</tbody>
</table>

The selection rules and definitions of the Part III subjects follow. If demand is insufficient, some topics may not be offered in any one year.
663100 Mathematics IIIA

**Prerequisites**
Mathematics IIA & IIC

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

**Examination**
Each topic is examined separately

**Content**
A subject comprising 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 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.

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663300 Statistics III

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

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

**Examination**
Each topic is examined separately

**Content**
A subject comprising four topics: Topics R, U, Y and one other Part III Mathematics topic. (Topic ST is particularly recommended.) Before selecting a particular topic as the optional fourth topic in Statistics III, students should seek advice from a lecturer giving one of the compulsory topics, or from the Head of the Department.

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

**Prerequisites**
Topics K & L

**Hours**
2 hours per week for Terms I and II

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

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

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

**References**
Cohen, I. & Ehrlich, G., *The Structure of the Real Number System* (Van Nostrand 1963)
MacLane, S. & Birkoff, G., *Algebra* 2nd edn (Macmillan 1979)
Wilder, R., *Introduction to the Foundation of Mathematics* (Wiley 1965)

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

**Prerequisite**
Topic CO

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

**Examination**
One 2-hour paper

**Content**
Vectors and tensors in Euclidean and pseudo-Euclidean spaces, linear transformation of coordinates, covariant and contra-variant components. Applications to the classical field theory. General systems of co-ordinates, differential operators in general coordinates. Moving frames, orthogonal coordinates. Surfaces in \( E^3 \) and hyper-surfaces in \( E^5 \).

Text Nil

References
Abram, J. Tensor Calculus through Differential Geometry (Butterworths 1965)
Elsgolc, Mikhlin, S. G. Elements of Tensor Calculus (Methuen 1962)
Arthurs, Hadley, Kemp, Mikhlin, S. G. Variational Methods in Mathematical Physics (Pergamon 1964)
Weinstock, R. Calculus of Variations (McGraw-Hill 1952)

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

Prerequisite Topic CO

Hours 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 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 2nd edn (Van Nostrand 1979, paperback)

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 Topics CO, D & L

Hours One 2-hour paper

Content


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

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

Prerequisite Topic CO

Hours 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.
References

Constant, R. & Hilbert, D.
Epstein, B.
Haack, W. & Wendland, W.
McCarthy, J.
Sneddon, I. N.
Stuart, A. & van Osselt, W.

Methods of Mathematical Physics Vol. II Partial Differential Equations (Interscience 1966)
Lectures on Partial and Phaffian Differential Equations (Pergamon 1972)
Introduction to the Theory of Partial Differential Equations (Van Nostrand 1967)
Elements of Partial Differential Equations (McGraw-Hill 1957)

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

Prerequisite

Topic F

Hours

1 lecture hour per week and 1 tutorial hour per fortnight

Examination

One 2-hour paper

Content

Survey and detailed comparisons of the properties of representative languages of various types with special consideration of LISP, SNOBOL, and APL. Review of the mutual influences between the design of languages and the nature of the applications for which the languages have originally been intended. Data-base management systems. Other programming systems; e.g. symbolic algebra systems, theorem-proving systems.

Text

Nil

References

Date, C. S.
Gimpel, J. F.
Griswold, R. E.
Jensen, K. & Wirth, N.
McCarthy, J.
Martin, J.
Sammet, J. E.
Siklossy, L.
Tucker, A. B.

An Introduction to Database Systems 2nd edn (Addison-Wesley 1977)
Algorithms in SNOBOL (Wiley 1976)
The SNOBOL Programming Language 2nd edn (Prentice-Hall 1971)
LISP 1.5 Programmer’s Manual (MIT 1965)
Principles of Data-Base Management (Prentice-Hall 1976)
Programming Languages: History and Fundamentals (Prentice-Hall 1969)
Let’s Talk LISP (Prentice-Hall 1975)
Programming Languages (McGraw-Hill 1977)

663106 Topic R — Theory of Statistics — R. G. Keats

Prerequisite

Topic H

Hours

1 lecture hour per week and 1 tutorial hour per fortnight

Examination

One 2-hour paper

Content


Text

Nil

References

Croxton, C. A.
Fong, P.
Huang, K.
Landau, L. D.
Batchelor, G. K.
Milne-Thomson, L. M.

Introductory Eigenphysics (Wiley 1975)
Elementary Quantum Mechanics (Addison-Wesley 1968)
Statistical Mechanics (Wiley 1963)
Statistical Physics (Pergamon 1968)
An Introduction to Fluid Dynamics (Cambridge 1967)
Theoretical Hydrodynamics (Macmillan 1962)


Prerequisites

Topics B, C0

Hours

1 lecture hour per week and 1 tutorial hour per fortnight
References
Cox, D. R. & Hinkley, D. V.
Gibbons, J. D.
Kendall, M. G. & Stuart, A.
Mood, A. M. & Graybill, F. A.
Silvey, S. D.
Zehna, P. W.

663017 Topic S — Geometry — T. K. Sheng
Prerequisite
Topic CO

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

Examination
One 2-hour paper

Content
Euclidean geometry: axiomatic and analytic approach, transformations, isometries, decomposition into plane reflections, inversions, quadratic geometry.
Geometry of incidence: the real projective plane, invariance, projective transformation, conics, finite projective spaces.

Text
Nil

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

663129 Topic ST — Stochastic Processes — R. G. Keats
Prerequisite
Topic H

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

Examination
One 2-hour paper

Content
This subject deals primarily with the theory and application of regenerative events, Markov chains and Markov processes. The lectures will commence with a review and extension of the work in Topic H followed by a discussion of generating functions. The modelling and analysis of queueing systems and other appropriate applications will be studied.

Text
Feller, W.

References
Cox, D. R. & Miller, H. D.
Cox, D. R. & Smith, W. L.

663201 Topic T — Group Theory — W. Brisley
Prerequisites
Topics D & K

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

Examination
One 2-hour paper

Content
Structure of groups: Sylow theorems for finite groups; Series decomposition of groups; soluble groups; nilpotent groups. Finite and infinite abelian groups. Linear groups. Representations.

Text
Group Theory (Schaum 1968)
Introduction to Group Theory (Oliver & Boyd 1973, Longman (paperback) 1976)
The Theory of Groups (Oxford 1968)
A Course on Group Theory (Cambridge 1978)

663209 Topic TC — Theory of Computing — R. W. Robinson
Prerequisites
Topics CO & F

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

Examination
One 3-hour paper and assignments throughout the year.

Content
This course will interest science, mathematics and engineering students who are interested in the theoretical foundations of computer science. Mathematical Models of Computers: Finite Automata are introduced as a first approximation to a model of a computer and some of their properties are studied. Three equivalent models of computation are then introduced and compared. These models are Turing machines, counter machines, and recursive functions. Some of the limits of models of computation (unsolvability) are also discussed.

Algorithmic Aspects of Computation: How "good" an algorithm do we have for performing some computation? Is there any way in which we can say that some algorithm is the "best" for accomplishing some task?
Program Correctness: Methods of program verification are introduced and discussed.

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

Text
Nil

References
Hoel, P. G. & Introduction to Mathematical Statistics 4th edn (Wiley 1971)
Kendall, M. G. & The Advanced Theory of Statistics Vol. 3 (Griffin 1966)
Peng, K. C. & The Design and Analysis of Scientific Experiments (Addison-Wesley 1967)

663204  Topic W — Analysis of Normed Linear Spaces — V. Ficker

Prerequisite
Topic L

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

Examination
One 2-hour paper

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

Text
Giles, J. R. Analysis of Normed Linear Spaces (University of Newcastle 1976)
663206 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. Topics in Algebra (Wiley 1975)
Kaplansky, I. Fields and Rings (Chicago U.P. 1969)
Stewart, I. Galois Theory (Chapman & Hall 1973)

663207 Topic Z — 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 multistep methods of initial value problems involving ordinary differential equations. Investigation of stability of linear marching schemes. Boundary value problems. Finite-difference and finite-element methods of solution of partial differential equations. 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)
PART IV SUBJECT

664100 Mathematics IV

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

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

Students who have passed Computer Science III may, with the permission of the Head of the Department of Mathematics, select not more than half of their topics of study from a supplementary list of courses related to computer science and given in other departments. This list is printed on page 75.

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 1980 follow.

PART IV TOPICS

664137 Introduction to Category Theory — R. F. Berghout

Prerequisites
Topics FM, T or X

Hours
About 27 lecture hours

Examination
One 2-hour paper

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

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

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

664151 Radicals & Annihilators — R. F. Berghout

Prerequisites
Topics FM, T or X

Hours
About 27 lecture hours

Examination
One 2-hour paper

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

Text
Nil

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

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

Prerequisite
Topic TC or Computer Operating Systems

Hours
About 27 lecture hours

Examination
One 2-hour paper

Content
Methods of controlling concurrent activities in a computer. Time dependent errors, functional systems, the deadlock problem. Simple and conditional critical regions, semaphores, message buffers, event queues, Hoare’s monitor path expressions. Modelling with Petri nets. Introduction to scheduling theory.
Structured concurrent programming with practical work in “Concurrent Pascal,” e.g., construction of typical operating systems internals, real-time systems.

Text
Nil

References
Brinch Hansen, P.
The Architecture of Concurrent Programs (Prentice-Hall 1977)
Brinch Hansen, P.
Operating Systems Principles (Prentice-Hall 1973)
Coffman, E. G. & Denning, P. J.
Operating Systems Theory (Prentice-Hall 1973)
Habermann, A. N.
Introduction to Operating Systems Design (SRA 1976)
Shaw, A. C.

664133 Concrete Group Theory — W. Brisley

Prerequisite
Topic K

Hours
About 27 lecture hours

Examination
One 2-hour paper

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

Text
Nil

References
Burrow, M.
Representation Theory of Finite Groups (Academic 1965)
Coxeter, H. S. M. & Moser, W. O. J.
Generators and Relations for Discrete Groups (Springer 1957)
Feit, W. J.
Characters of Finite Groups (Benjamin 1969)
Hall, M. Jr.
The Theory of Groups (Macmillan 1962)
Kurosh, A. G.
The Theory of Groups Vols. I & II (Chelsea 1960)
(tr. & ed. K. A. Hirsch)
Magnus, W. et al.
Combinatorial Group Theory (Interscience 1966)
Scott, W. R.
Group Theory (Prentice-Hall 1964)
and other articles and books mentioned during the course.

664111 Fluid Statistical Mechanics — C. A. Croxton

Prerequisites
Nil

Hours
About 27 lecture hours

Examination
One 2-hour paper

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

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

References
Croxton, C. A.

664120 Quantum Mechanics — C. A. Croxton

Prerequisite
Topic G

Hours
About 27 lecture hours

Examination
One 2-hour paper

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

Texts
Croxton, C. A., Matthews, P. T.
Introduction to Quantum Mechanics (McGraw-Hill 1968)

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 beginning with two dimensional systems, and then dealing with the existence and stability of periodic solutions of more general systems.

Text
Nil
References
Hale, J. K.  Ordinary Differential Equations (Wiley 1969)

664161 Modern Data Analysis — A. J. Dobson

Prerequisite  Topic R or U
Hours  About 27 lecture hours
Examination  One 2-hour paper

Content
Robust statistics. Analysis of residuals. Use of empirical distribution functions and various non-parametric methods. Statistical computing packages such as MINITAB, BMDP, SPSS and GLIM.

Text  Nil

664153 Algebraic Graph Theory — R. B. Eggleton

Prerequisite  Topic D
Hours  About 27 lecture hours
Examination  One 2-hour paper

Content

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

References
Bondy, J. A. & Murty, U. S. R.  Graph Theory with Applications corrected edn (Macmillan 1977)
Harary, F.  Graph Theory (Addison-Wesley 1969)
Lancaster, P.  Theory of Matrices (Academic 1969)
Wilson, R. J.  Introduction to Graph Theory (Longman 1972)

664141 Introduction to Number Theory — R. B. Eggleton

Prerequisite  Topic CO
Hours  About 27 lecture hours
Examination  One 2-hour paper

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

Text  Nil

References
Apostol, T. M.  Introduction to Number Theory (Springer 1976)
Davenport, H.  The Higher Arithmetic 3rd edn (Hilary 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 CO
Hours  About 27 lecture hours
Examination  One 2-hour paper

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

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

Text  Nil

References
Blackett, D. W.  Elementary Topology; Combinatorial and Algebraic Approach (Academic 1967)
Bondy, J. A. & Murty, U. S. R.  Graph Theory with Applications corrected edn (Macmillan 1977)
Harary, F.  Graph Theory (Addison-Wesley 1969)
Ore, O.  The Four Colour Problem (Academic 1967)
Ringel, G.  Map Colour Theorem (Springer 1974)
664143 Families of Sets  —  V. Ficker

Prerequisite
Topic V

Hours
About 27 lecture hours

Examination
One 2-hour paper

Content

Text
Nil

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

664103 Banach Algebra  —  J. R. Giles

Prerequisite or Corequisite
Topic W

Hours
About 27 lecture hours

Examination
One 2-hour paper

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

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

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

Applications of Banach algebra theory.

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

References
Gelfand, I. M., Raikov, D. A. & Shilov, G. E. Commutative Normed Rings (Chelsea 1964)
Gelfand, Naimark, M. A. General Theory of Banach Algebras (Van Nostrand 1960)
Simmons, G. F. Introduction to Topology and Modern Analysis (McGraw-Hill 1963)
Wilansky, A. Functional Analysis (Blaisdell 1964)

664158 Convex Analysis  —  J. R. Giles

Prerequisite or Corequisite
Topic W

Hours
About 27 lecture hours

Examination
One 2-hour paper

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

We begin with a study of convex sets and functions defined on linear spaces: gauges of convex sets, separation properties. We then study topology on linear spaces generated by convex sets: metrisability, normability and finite dimensional cases. We examine continuity and separation for locally convex spaces, continuity for convex functions. We study weak and weak * topologies on normed linear spaces; convexity properties and Banach-Alaoglu Theorem.

We give particular attention to the study of differentation of convex functions. We develop convexity properties and Banach-Alaoglu theorem.

In application we examine fixed point theorems, Brouwer's Schauder's and Tychonoff's theorems.

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

References
Day, M. M. Normed Linear Spaces (Springer 1973)
Diestel, J. Geometry of Banach Spaces—Selected Topics (Springer 1975)
A. J. Guttmann
R. G. Keats
M. J. Hayes

and Planar Classical Heisenberg model.

statistical mechanics. Survey of critical phenomena and analogies. Classical
mechanism of phase transitions, Kac models in one dimension. Heisenberg
biological systems. Renormalization group theory.

series expansions. Anisotropic Heisenberg model and symmetry of ground
state. Critical exponent inequalities and scaling laws. Asymptotic degeneracy as
theories of phase transitions. Exact solution of two dimensional Ising model.

Approximate results in three dimensions. Generation and analysis of exact
series expansions. Anisotropic Heisenberg model and symmetry of ground
state. Critical exponent inequalities and scaling laws. Asymptotic degeneracy as


effect of real critical phenomena on crystals. Theories of phase transitions.

Text

Mathematical Statistical Mechanics (Princeton 1979)

References

Broun, R. H.
Chhetri, M. et al.
Domb, C.
Domb, C. &
Green, M. S. (eds)
Fisher, M. E.
Huang, K.
Stanley, H. E.
Uhlenbeck, G. E. &
Ford, G. W.

664144 High Level Software Development — A. J. Guttmann/ D. W. E. Blatt

Prerequisite Programming experience in a high-level language is assumed

Hours About 27 lecture hours

Examination One 2-hour paper

Content

This course covers the writing of medium to large scale software projects by
developing realistic programs that actually work and solve realistic problems.
Emphasis is placed on top-down design, structured programs, program
portability and other aspects of software engineering. The writing of successful
programs will be an integral part of the course.
The course is run as a seminar series with all participants contributing.

Text

Kernighan, B. W. &
Plauger, P. J.

Software Tools (Addison-Wesley 1976)

Reference

Wasserman, A. I. &
Freeman, P. (eds)

Software Engineering Education, Needs and
Objectives (Springer-Verlag 1976)

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

Prerequisite Topic P

Hours About 27 lecture hours

Examination One 2-hour paper

Content

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

Text
Nil

References
Franks, L. E. Signal Theory (Prentice-Hall 1969)
Hancock, J. C. An Introduction to the Principles of Communication Theory (McGraw-Hill 1961)
Middleton, D. Introduction to Statistical Communication Theory (McGraw-Hill 1960)
Middleton, D. Topics in Communication Theory (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)

664106 Combinatorics — R. W. Robinson

Prerequisite
Topic K

Hours
About 27 lecture hours

Examination
One 2-hour paper

Content
Permutations and combinations, inclusion-exclusion and generating functions. Pólya’s theorem and its application to counting various kinds of structures and graphs will be discussed. Also asymptotic analysis of many of the exact results.

Text
Nil

References
Beckenback, E. F. Applied Combinatorial Mathematics (Wiley 1964)
Hall, M. Combinatorial Theory (Blaisdell 1967)
664134 Recursion Theory — R. W. Robinson

Prerequisite
Topic TC

Hours
About 27 lecture hours

Examination
One 2-hour paper

Content
Recursive functions and Turing reducibility are discussed, along with various more special reducibilities. The structure of the degrees of unsolvability is investigated using priority method constructions.

Text
Nil

References
Kleene, S. C. Introduction to Metamathematics (Van Nostrand 1952)
Rogers, H. Theory of Recursive Functions and Effective Computability (McGraw-Hill 1967)
Sacks, G. E. Degrees of Unsolvability (Princeton 1963)
Shoenfield J. R. Degrees of Unsolvability (North-Holland 1971)

664164 Number Theory — T. K. Sheng

Prerequisites
Nil

Hours
About 27 lecture hours

Examination
One 2-hour paper

Content

Text
Nil

References
Andrews, G. E. Number Theory (Saunders 1971)
Hardy, G. & Wright, E. M. Introduction to Number Theory (Oxford 1960)
Niven, I. & Auckerman, H. S. An Introduction to the Theory of Numbers (Wiley 1968)

664159 Foundations of Modern Differential Geometry — P. K. Smrz

Prerequisite
Topic C or CO

Hours
About 27 lecture hours

Examination
One 2-hour paper

Content
This topic will introduce basic concepts of the local theory of differentiable manifolds.

Text
Nil

References
Auslander, L. Differential Geometry (Harper & Row 1967)

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.

Text
Nil

References
Liu, C. L. Introduction to Combinatorial Mathematics (McGraw-Hill 1968)
Riordan, J. Combinatorial Analysis (Wiley 1958)

664146 Rational Number Theory — T. K. Sheng

Prerequisite
Topic CO

Hours
About 27 lecture hours
664155 Advanced Numerical Analysis — W. Summerfield

Prerequisite
Either Topic F or Topic Z

Hours
About 27 lecture hours

Examination
One 2-hour paper

Content
Often, one has to resort to an numerical method to "solve" a mathematical problem; before the resultant numbers can be interpreted in terms of the latter conditioning, one must analyse how their generation has been biased by the numerical method. The three major problem areas of numerical analysis involve rounding error, discretisation error and convergence (in iterative methods). The effect of each of these types of error is often masked by "ill-conditioning" either in the numerical method or in the mathematical problem itself. This course concentrates on the basic theoretical results pertaining to these areas, especially as they apply to linear systems of equations, eigenvalue problems and to differential equations.

Text
Nil

References

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
Sloane, N. J. A. A Short Course on Error Correcting Codes (Springer 1975)

664148 Urban Spatial Traffic Patterns — R. J. Vaughan*

Prerequisites
Topics CO and H

Hours
About 27 lecture hours

* Available for the Diploma in Environmental Studies (if offered) in 1980.
664102 Asymptotic Methods in Analysis — W. P. Wood

**Prerequisites**
Topics B, CO 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)

De Bruijn, N. G.

Erdelyi, A.
*Asymptotic Expansions* (Dover 1956)

Evgrafov, M. A.
*Asymptotic Estimates and Entire Functions* (Gordon & Breach 1961)

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**Notes**
- Courses available for choice as Part IV topics by students who have passed Mathematics IIA, Computer Science III or Statistics III. Not all of these courses are necessarily offered in any one year.
- Additionally, students permitted to select courses from this list should also select any of the following topics which they have not studied in Computer Science III:
  - Compiler Construction
  - Computer Operating Systems
  - Programming Languages and Systems
Students who pass Computer Science subjects are entitled to membership of the Australian Computer Society.

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

PART II TOPICS

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

Prerequisite Mathematics I

Corequisite Topic SP

Hours 1 lecture hour per week and 1/2 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

PART III TOPICS

534137 Compiler Construction — R. J. Evans

Prerequisite
EE264 Introduction to Logic & Assembly Languages or Topic ML

Hours
3 hours per week for the 1st half year

Examination
Progressive assessment and final examination

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

The course consists mainly of lectures and assignments on computers.

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

References
Aho, A. V. & Ullman, J. D. The Theory of Parsing, Translation and Compiling
2nd Vol. (Prentice-Hall)
Donovan, J. J. Systems Programming (McGraw-Hill)
534138  Computer Operating Systems — A. Cantoni

**Prerequisite**
EE264 Introduction to Logic & Assembly Languages or Topic ML

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

**Examination**
Progressive assessment and final examination

**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.

410143  Commercial Programming

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

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

**Examination**
One 3-hour paper

**Content**
Basic concepts of file handling and file maintenance, including file creation and processing.
Flow charting; file merging and updating of transactions; tape blocking and buffering.
General run types including editing, searching and sorting. Direct access versus serial; random or sequential organisation; re-run techniques; verifying programme accuracy; table lookup; programme documentation and use of test data.
DIBOL, as a business data processing and file organisation language. Extensive practical work in DIBOL, including case studies.

**Texts**
- D.F.C. Feingold, C.
- **DIBOL-11 Language Reference Manual**
- Fundamentals of COBOL Programming (W. C. Brown)

**References**
- Chai, W. A. & H. W. Clifton, H. D.
- Davis, G. B. & Litecky, C. R.
- De Rossi, C. J.
- Kapur, K. G.
- Laden, H. N. & Gildersleeve, T. R.
- McCracken, D. D. et al.
- Mirarch, M.
- Sanders, D. H.
- Sprowls, R. C.
- Stern, N. B. & R. A.
- Watters, J. L.
- Coffman, E. G. & Denning, P. J.
- Hansen, P. B.
- Madnick, S. E. & Donovan, J. J.
- Coffman, E. G. & Denning, P. J.
- Hansen, P. B.
- Madnick, S. E. & Donovan, J. J.
- Boyett, J. L.
- Feingold, C.
- **Programming Standard COBOL** (Academic)
- Systems Analysis for Business Data Processing (Business Books)
- **Elementary Cobol Programming** (McGraw-Hill)
- Learning COBOL Fast (Reston)
- Programming in Standard COBOL (S.R.A.)
- Systems Design for Computer Applications (Wiley)
- Programming Business Computers (Wiley)
- Standard COBOL (S.R.A.)
- Computers in Business (McGraw-Hill)
- Computing with COBOL (Harper & Row)
- Cobol Programming (Wiley)
- Cobol Programming (Heinemann)

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

**Prerequisite**
Mathematics I and Topic ML

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

**Examination**
Progressive assessment and final examination

**Content**
Boolean algebra, combinational logic, logical circuits, minimization techniques, threshold logic. Data representation, binary arithmetic, codes, error checking and correcting. Sequential logic, flip-flops, state diagrams, state reduction, races and hazards. Logic subsystems: registers, adders, counters, converters, coders, etc. Basic architecture of digital computers. Lectures will be supplemented by practical assignments on logic trainers and some tutorial sessions.

**Text**
- Nagle, Carroll & Irwin
- *An Introduction to Computer Logic* (Prentice-Hall)

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**
Views of an operating system. Multiprogramming, interacting concurrent processes, process control primitives. Processor management, memory management, name management. Protection.
The course consists mainly of lectures supplemented by tutorial sessions.
Mathematical Principles of Numerical Analysis — W. Summerfield

Prerequisites
Topics CO & 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.

Programming Languages & Systems — W. D. Wallis

Prerequisite
Topic F

Hours
About 27 lecture hours

Examination
One 2-hour paper

Content
Survey and detailed comparisons of the properties of representative languages of various types with special consideration of LISP, SNOBOL, and APL. Review of the mutual influences between the design of languages and the nature of the applications for which the languages have originally been intended. Data-base management systems. Other programming systems; e.g. symbolic algebra systems, theorem-proving systems.

Theory of Computing — R. W. Robinson

Prerequisites
Topics CO & F

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

Examination
One 3-hour paper and assignments throughout the year

Content
This course will interest science, mathematics and engineering students who are interested in the theoretical foundations of computer science. Mathematical Models of Computers: Finite Automata are introduced as a first approximation to a model of a computer and some of their properties are studied. Three equivalent models of computation are then introduced and compared. These models are Turing machines, counter machines, and recursive functions. Some of the limits of models of computation (unsolvability) are also discussed.

Algorithmic Aspects of Computation: How "good" an algorithm do we have for performing some computation? Is there any way in which we can say that some algorithm is the "best" for accomplishing some task?
Program Correctness: Methods of program verification are introduced and discussed.

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

Text Nil

References

410104 Systems Analysis & Design

(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 is concerned with the early activities carried out in the development of computer-based information systems. Topics covered include, the role of systems in modern business; the profession of systems analysis and design; management of the life cycle of a business information system; the tools of the systems analyst; the study phase, its associated documentation and its relationship to design, development and implementation. Students are also introduced to the concepts of structured analysis.

Texts

References

(ii) Systems Design

Prerequisites CS — Commercial Programming, Systems Analysis

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

Examination An examination at end of year

Content
This subject is a development of Systems Analysis and includes: data transmission; real time systems; information retrieval; file processing form design; management and the computer; file design; systems design and determination; operating systems; multi-programming.

Text Nil

References As for Systems Analysis

SCHEDULE B

PART I

541100 Engineering I

Prerequisites 3-unit Mathematics & multistrand Science at the 4-unit level (advisory)

Corequisite Mathematics I

Hours To be advised

Examination

Content
Four of the following units to be chosen.

(i) CE111 Statics
(ii) ME131 Dynamics
(iii) ME111 Graphics and Engineering Drawing
(iv) GE112 Introduction to Engineering Design
(v) EE131 Circuit Fundamentals
(vi) ChE141 Industrial Process Principles
(vii) GE151 Introduction to Materials Science

(i) 521101 CE111 Statics

Hours To be advised

Examination

Content
Two-dimensional force systems; equilibrium, funicular polygon, rigid bars, shear force, axial force, bending moment; pin-jointed frames,
analytical and graphical treatment: equilibrium of three-dimensional force systems, cables.

Text
Hall, A. S. & Archer, F. *Principles of Statics* (Uni. of N.S.W. Students Union 1966)

(ii) 541103 ME131 Dynamics

Hours 1½ hours per week

Examination Progressive assessment & examination

Content
Basic concepts for the study of motion: length, time, force and mass; Newton’s laws of motion; law of friction; systems of units. Motion of point masses, rigid bodies and connected bodies in straight or curved paths and in simple rotation. Relative motion using translating reference frames. General plane motion of rigid bodies. Momentum and impulse, both linear and angular, related to point masses and rigid bodies. Energy and the conservation principle applied to mechanical work, strain energy, kinetic energy, friction losses, for particles and rigid bodies. In addition to lectures, the course includes weekly tutorials devoted to the solution of problems in Dynamics.

Text

(iii) 541104 ME111 Graphics and Engineering Drawing

Prerequisites Nil

Hours 42

Examination Progressive Assessment

Content
A study in communication and analysis by pictorial means. Methods of projection covering orthogonal projection of points, lines, planes and solids; lengths of lines, angles and intersection between lines, planes and contoured surfaces; orthographic projection, dimensioning and sectioning; isometric projection; prospective projection.

Texts
Beakley, G. C. & Chilton, E. G. *Introduction to Engineering Design and Graphics* (Macmillan)

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

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

(iv) 501101 GE112 Introduction to Engineering Design

Prerequisites Nil

Hours 42

Examination Progressive Assessment

Content
Philosophy and fundamentals of engineering design.

Texts
*Australian Standard Engineering Drawing Practice* CZ1 1976 (Inst. of Engineers, Australia)

Beakley, G. C. & Chilton, E. G. *Introduction to Engineering Design and Graphics* (Macmillan)

(v) 531203 EE131 Circuit Fundamentals

Prerequisites Nil

Hours To be advised

Examination To be advised

Content
Part 1 (Introduction)
Introduction to Electrical Engineering, Model Theory, Units.

Part 2 (Resistive Circuits)
Ohms Law, Kirchhoff’s Law, Parallel and Series resistive circuits. Nodal and Mesh Analysis, Thevenins and Norton’s Theorems.

Part 3 (Transient Circuits)

Part 4 (Sinusoidal Analysis)
The Phasor Concept, Complex Impedance and Admittance, Phasor diagrams.

Part 5 (Power in AC Circuits)
Power, Volt-Amps, Reactive Power, Power Factor.

The course will be evenly divided between lectures and laboratory work and will also be supplemented by tutorial sessions.

(vi) 511108 ChE141 Industrial Process Principles

Hours To be advised

Examination To be advised

Content
(vii) 501012 GE151 Introduction to Materials Science

Prerequisites
Nil

Hours
42 hours of lectures, plant visits and demonstrations (students are not required to perform laboratory work)

Examination
To be advised

Content
The course provides a general introduction to materials of engineering significance and to the relationships which exist between structures, properties and applications. The detailed treatment of various aspects is left to the later stages of the degree programme.

The following sections are given approximately equal amounts of time and emphasis:

- Atomic bonding; atomic arrangements in metals, glasses and polymers; the effects of stress and temperature on simple metals; the control of metallic structures by composition and thermal treatments; common metals of engineering importance; the structure and properties of ceramics and cement products.
- Polymers, rubbers and woods; engineering applications for polymers; the mechanical testing of materials; composite material; the fundamentals of corrosion and practical considerations; the electrical, magnetic, optical and thermal properties of solid materials.

Text
Finn, R. A. & Trojan, P. K. Engineering Materials and their Applications (Houghton Mifflin 1975)

PART II

522700 Civil Engineering II M

Prerequisites
Mathematics I, CE111, ME131, GE112 and ME111

Hours
5 lecture hours & 2½ tutorial hours per week

Examination
Five 3-hour papers

Content
(i) CE212 Mechanics of Solids I
Prerequisites
CE111 & Maths I
Hours
2 lecture hours & 1 tutorial hour per week for first half year
Examination
One 3-hour paper

(ii) CE213 Mechanics of Solids II
Prerequisite
CE212
Hours
2 lecture hours & 1 tutorial hour per week for second half year
Examination
One 3-hour paper

(iii) CE231 Fluid Mechanics I
Prerequisites
Maths I, ME131 Dynamics
Hours
2 lecture hours & 1 tutorial/laboratory hour per week for first half of year
Examination
One 3-hour paper

Content
Fundamentals, fluid statics, kinematics of fluid motion, flow of an incompressible ideal fluid.

Text
(iv) 522204 CE232 Fluid Mechanics II

**Prerequisites**
CE231

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

**Examination**
One 3-hour paper

**Content**
Flow of a compressible ideal fluid, impulse-momentum principle, flow of a real fluid, similarity and dimensional analysis.

**Text**
As for CE231

(v) 522105 CE222 Materials Technology

**Content**
Concrete technology: component materials; properties of plastic and hardened concrete; concrete mix design; manufacturing and field control.

**Texts**
- Jackson, N.
- Nagarajan, N. & Antill, J. M.

752300 Psychology IIC

**Prerequisites**
Psychology I & Mathematics I

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

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

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

**Texts**
To be advised

**References**
To be advised

PART III

413900 Accounting IIC

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

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

**Examination**
Two 3-hour & two 2-hour papers

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

(i) 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.

**Preliminary Reading**
- Henderson, S. & Peirson, G.
  *An Introduction to Financial Accounting Theory* (Longman Cheshire)
- Anthony, N. V. et al. (eds) *Readings in Advanced Accounting Theory* (Butterworths)

**References**
Journal articles and extracts from relevant accounting monographs including the following:
- American Institute of Certified Public Accounts
- Backer, M. (ed.)
- Baxter, W. T. & Davidson, S.
- Beck, G. W.
- Chambers, R. J.
- Dean, G. W. & Wells, M. C. (eds)

- *Objectives of Financial Statements*
- *Studies in Accounting* (I.C.A.E.W.)
- *Public Accountants in Australia — Their Social Role* (Accounting Research Foundation)
- *Current Cost Accounting: Identifying the Issues*
Goldberg, I.

Hendriksen, E. S.

Jay, W. R. C. & Mathews, R. I.

Jager, M. O. et al.

Moonitz, M.

Parker, R. H. & Harcourt, G. C.

Sprouse, T. R. & Moonitz, M.

or

(ii) 713200 Accounting IIIB

Prerequisite

Accounting IIIB

Hours

2 lecture hours per week

Examination

One 3-hour paper

Content

Selected contemporary problems in the theory and practice of managerial accounting. Topics studied include classical optimization, cost volume profit analysis and capital budgeting (under conditions of uncertainty), the application of Bayesian and nonparametric statistical methods to quality control, the use of simple linear statistical models in cost estimation and behavioural perspectives on managerial accounting.

References

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

Benston, G. J.

Caplan, E. H. & Landekich, S.

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

Gordon, L. A. et al.

Hofstede, G. H.

Mintzberg, H.

Rush, H. M.

An Inquiry into the Nature of Accounting (American Accounting Assn 1965)

Accounting Theory (Irwin 1970)

Government Accounting in Australia (Cheshire 1967)

Company Financial Statements: Form and Content (Butterworths)

The Basic Postulates of Accounting (A.I.C.P.A.)

Readings in the Concept of Measurement of Income (Cambridge U.P.)

A Tentative Set of Broad Accounting Principles for Business Enterprises (A.I.C.P.A.)

713200 Biology IIIB

Prerequisites

Mathematics IIA & IIC & either Biology IIA or IIB

Hours

4 lecture hours & 8 tutorial & laboratory hours per week

Examination

Two 3-hour papers

Content

Biology IIIB consists of two units, Environmental Physiology, and Community Analysis and Quantitative Genetics.

(i) 713201 Environmental Physiology

Hours

4 lecture hours & 8 hours tutorial & laboratory classes per week for 14 weeks

Content

Plants

Interrelationships between the environment and the operation of key physiological processes including photosynthesis, mineral ion acquisition and assimilate transfer.

Animals

Biology of reproduction in vertebrates with particular emphasis on adaptations to the environment.

References

Baker, D. A.

Mithorpe, F. L. & Moorby, J.

Nalbandov, A. V.

Transport Phenomena in Plants (Chapman & Hall 1978)


Reproductive Physiology 3rd edn (Freeman 1976)

References

Austin, C. R. & Short, R. V.

Bloom, W. & Fawcett Evans, L. T.

Leopold, A. C. & Kriedemann, P. E.

Torrey, T. W. & Feduccia, A.

Reproduction in Mammals Vols 1–6 (Cambridge 1972)

A Textbook of Histology 10th edn (Saunders 1975)

Crop Physiology (Paperback ed. Cambridge University Press)

Plant Growth and Development (McGraw-Hill 1975)

Morphogenesis of the Vertebrates 4th edn (John Wiley 1979)

(ii) 713202 Community Analysis and Quantitative Genetics

Hours

4 lecture hours & 8 hours tutorial & laboratory classes per week for 14 weeks

Content

Community Analysis

Structure and dynamics of biological communities.
Quantitative Genetics

Texts
Krebs, C. J. Stewart, J. (ed.) S290 Genetics, Units 11, 12, 13 (Open University Press 1976)
Zar, J. H. Biostatistical Analysis (Prentice-Hall)

References
Connell, P. W. C.S.I.R.O.
Daubenhonire, R. F. Falconer, D. S.
Ford, E. B. Kershaw, K. A.

523700 Civil Engineering IIM

Prerequisite
Civil Engineering IIM, Mathematics IIA & IIC

Hours
6 lecture hours & 4½ tutorial; laboratory hours per week

Examination
Four 3-hour papers, one 2-hour paper & two 1½-hour term papers

Content
(i) CE324 Soil Mechanics
(ii) CE314 Structural Analysis I
(iii) CE333 Fluid Mechanics III
(iv) CE334 Fluid Mechanics IV
(v) CE351 Civil Engineering Systems I

(i) 523102 CE324 Soil Mechanics

Prerequisite
CE212

Pre- or Corequisites
CE333 & CE334

Hours
1 lecture hour & 2 tutorial & laboratory hours per week

Examination
One 2-hour paper

Content
Index properties, classification of soils; permeability, capillarity, seepage and flow nets; stresses in soils; settlement and consolidation; compaction, shear strength and failure criteria; stability of retaining walls.

Text

References
Capper, P. L. & Cassie, W. F. Lambe, T. W.
SAA AS1289

(ii) 523109 CE314 Structural Analysis I

Prerequisites
CE212, CE213 & Maths I

Hours
2 lecture hours & 1 tutorial hour per week

Examination
One 3-hour paper

Content

Texts
Nil

References
Norris, C. H., Wilbur, J. B. & Utka, S.
Hall, A. & Kabaila, A. P.
Raz, S. A.
Horne, M. R.
Neal, B. G.

(iii) 523306 CE333 Fluid Mechanics III

Prerequisite
CE232

Hours
2 lecture hours & 1 tutorial & laboratory hour per week for the first half year

Examination
One 3-hour paper

Content
Fluid flow in pipes, fluid measurements, elementary hydrodynamics, fluid flow about immersed objects.

Text
As for CE231
(iii) 534132 EE443 Optimization Techniques - Not offered in 1980

**Hours**
3 hours per week for first half year

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

**Texts**
Aoki, M. *Introduction to Optimization Techniques* (Macmillan 1971)
Luenberger, D. G. *Introduction to Linear and Non-Linear Programming* (Addison-Wesley 1973)

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

(iv) 534136 EE344 Communications — G. C. Goodwin

**Hours**
3 hours per week for second half year

**Examination**
Progressive assessment & final examination

**Content**
Introduction to the common forms of analog modulation, as well as pulse modulation systems including pulse code modulation. Performance in the presence of noise is considered.

The course consists mainly of lectures which will be supplemented by some tutorial sessions.

**Text**
Gregg, W. D. *Analog and Digital Communications: Concepts, Systems, Applications and Services* (Wiley)

(v) 534134 EE447 Digital Communications

**Prerequisite**
EE344 Communications

**Content**
Pulse modulation schemes, including pulse code modulation, multi-plexing, matched filters.

The course consists mainly of lectures supplemented by tutorial sessions.

**Text**
As for EE344 Communications

533901 Digital Computers and Automatic Control

**Prerequisites**
Mathematics II A & II C (including Topics CO, D)

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

Examination
Progressive assessment & final examination

Content
(i) 533213 EE341 Automatic Control — see page 97
(ii) 533110 EE342 Linear System Theory — see page 97
(iii) 532111 EE264 Introduction to Logic & Assembly Languages — see CS topic, page 116
(iv) 533220 EE362 Switching Theory & Logical Design — see CS topic, page 117

423800 Economics IIC

**Prerequisite**
Mathematics II A & II C & Economics II A

**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 — R. W. McShane
(ii) 423204 Mathematical Economics
(iii) 423104 Growth and Development
(iv) 423102 International Economics
(v) 423103 Public Economics

**Prerequisite**
Economic Statistics II or Statistical Analysis

**Hours**
2 lecture hours per week

**Examination**
One 3-hour paper

**Content**
A knowledge of matrix algebra and of the mathematical statistics dealt with in Statistical Analysis is recommended for students attempting this course.

The course is concerned with examining the usefulness of single equation regression analysis in applied economic research and also with providing an introduction to simultaneous estimation procedures.

**Text**

**References**
Goldberger, A. *Econometrics* (John Wiley & Sons 1964)
Hadley, G. *Linear Algebra* (Addison-Wesley 1961)
Huang, D. S. *Regression and Econometric Methods* (John Wiley & Sons 1970)
Kmenta, J. *Elements of Econometrics* (Macmillan)
(ii) 423204 Mathematical Economics

Prerequisites
Economics II or IIA

Hours 3 lecture hours per week

Examination One 3-hour paper

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

Text

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

(iii) 423104 Growth and Development

Prerequisite
Economics II

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

Examination Two 3-hour papers, (i) at the end of the first half of the academic year and (ii) in the end of the academic year examination period

Content
The 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 underdeveloped countries with specific focus upon their dualistic nature. The structure of the rural and urban economics 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 throughout this half of the course.

(i) Growth:

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

Preliminary Reading
Bober, S. The Economics of Cycle and Growth (Wiley 1968)
Dernburg, T. F. A Contribution to the Theory of the Trade Cycle (Clarendon 1967)
Meade, J. E. Economic Growth and Development — A Mathematical Introduction (Wiley 1971)

(ii) Development:

Text
No specific text is required. Students will be required to read articles and chapters from books relevant to the various sections of this half of the course. Below is a list of some of the main books which will be referred to. The student is encouraged to read extensively and these references should be considered as valuable sources.

References
Bauer, P. T. Dissent on Development (Weidenfeld & Nicholson 1971)
Enke, S. Economics for Development (Dobson 1963)
Henderson, J. & Quandt, R. Asian Drama (Twentieth Century Fund 1968)
Kraay, E. M. & Myint, H. The Economics of Developing Countries 4th edn (Hutchinson 1973)
Maddison, A. The Political Economy of Underdevelopment (Budapest: Akademiai Kiado 1973)

(iv) 423102 International Economics

Hours 2 lecture hours per week & 1 seminar hour per fortnight
Examination
One 3-hour paper

Content

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

Texts
Grubel, H. C. International Economics (Irwin 1977)
Snapc, R. H. International Trade and the Australian Economy 2nd edn (Longman 1973)

References
Clement, M. D. et al. Theoretical Issues in International Economics (Constable 1967)
Heller, H. R. International Monetary Economics (Prentice-Hall 1974)
McCull, G. D. (ed.) Overseas Trade and Investment (Pelican 1972)

(v) 423103 Public Economics

Hours
2 lecture hours plus seminars

Examination
One 3-hour paper

Content
The effects of government intervention in the economy through the budget and through the operation of publicly-owned business undertakings and inter-governmental fiscal relationships are examined. At the macroeconomic level, there is an analysis of the effects of tax and expenditure policies on, in particular, community welfare and incentives.

At the macroeconomic level, aggregative models are used to analyse the relation of fiscal policy to other economic policies for stability and growth.

Preliminary Reading
Eckstein, O. Public Finance 3rd edn (Prentice-Hall 1973)

Texts
Nil

References

Public Finance Theory and Policy (Collins-Macmillan)
Fromm, G. & Taubman, P. Public Finance Theory and Policy (Collins-Macmillan)
Public Finance (Penguin)
Public Economics (North-Holland 1971)
Reading in Macroeconomics (Prentice-Hall)
Federal Finance (Nelson)

Cost-Benefit Analysis 2nd edn (Allen & Unwin)
Public Finance in Theory and Practice (McGraw-Hill)

The Public Finances (Irwin)
The Economic Theory of Fiscal Policy (Allen & Unwin)

Public Finance (Wardenfield & Nicholson)

733300 Geology IIC

Prerequisites
Physics IA, Mathematics IIA, IIC & Geology IIA

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

Examination
Two 3-hour papers plus assessment

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

Texts
Consult lecturers concerned

543500 Industrial Engineering I

Prerequisites
Mathematics IIA & IIC
Content

Four of the following:

(i) 543501 ME381 Methods Engineering
(ii) 543502 ME383 Quality Engineering
(iii) 543503 ME384 Design for Production
(iv) 544425 ME419 Bulk Materials Handling Systems Analysis and Design
(v) 544418 ME449 Reliability Analysis for Mechanical Systems
(vi) 544410 ME482 Engineering Economics I
(vii) 544404 ME483 Production Engineering
(viii) 544406 ME484 Engineering Economics II

(i) 543501 ME381 Methods Engineering

Hours

1½ hours per week

Examination

Progressive assessment

Content


Text

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

Stevenson, M. G. Methods Engineering (N.S.W. Univ. Press)

(ii) 543502 ME383 Quality Engineering

Hours

1½ hours per week

Examination

Progressive assessment & examination

Content


Text

Nil

(iii) 543503 ME384 Design for Production

Hours

1½ hours per week

Examination

Progressive assessment & examination

Content

The application of economics, methods engineering, ergonomics and mechanical engineering to the development and design of a product.
### Course Details

#### Text


#### (viii) 544104 ME483 Production Engineering

<table>
<thead>
<tr>
<th>Hours</th>
<th>42</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Examination</strong></td>
<td>Progressive assessment &amp; examination</td>
</tr>
</tbody>
</table>

#### Content

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

#### (viii) 544464 ME484 Engineering Economics II

<table>
<thead>
<tr>
<th>Hours</th>
<th>1½ hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Examination</strong></td>
<td>Progressive assessment</td>
</tr>
</tbody>
</table>

#### Content


**Text**


#### 553900 Mechanical Engineering IIC

**Prerequisites**

Mathematics IIA & IIC (including Topics F & H)

<table>
<thead>
<tr>
<th>Hours</th>
<th>6 hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Examination</strong></td>
<td>Progressive assessment</td>
</tr>
</tbody>
</table>

#### Content

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

#### (a) (i) ME361 Automatic Control

(ii) ME401 Systems Analysis

(iii) ME505 Systems Analysis, Organisation & Control

(iv) ME487 Operations Research - Deterministic Models

#### (b) (i) ME361 Automatic Control

(ii) ME401 Systems Analysis

(iii) ME505 Systems Analysis, Organisation & Control

(iv) ME487 Operations Research - Deterministic Models

(v) ME486 Operations Research - Probabilistic Models

#### (c) (iii) ME505 Systems Analysis, Organisation & Control

(i) ME404 Mathematical Programming I

(ii) ME488 Operations Research - Probabilistic Models

#### (d) (i) ME361 Automatic Control

(vii) ME434 Advanced Kinematics & Dynamics of Machines

(viii) ME448 Introduction to Photomechanics

(ix) ME449 Reliability Analysis for Mechanical Systems

#### (i) 543204 ME361 Automatic Control - G. C. Goodwin

<table>
<thead>
<tr>
<th>Hours</th>
<th>1½ hours per week</th>
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</thead>
<tbody>
<tr>
<td><strong>Examination</strong></td>
<td>Progressive assessment &amp; examination</td>
</tr>
</tbody>
</table>

#### Content


**Text**

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

#### (ii) 544451 ME401 Systems Analysis

<table>
<thead>
<tr>
<th>Hours</th>
<th>1½ hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Examination</strong></td>
<td>Progressive assessment &amp; examination</td>
</tr>
</tbody>
</table>

#### Content

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

**Texts**


Schwarzenbach, J. & Gill, K. F. *Systems Modelling and Control*
### Systems Analysis, Organization & Control

**Hours**
1 1/2 hours per week

**Examination**
Progressive assessment & examination

**Content**

**Text**
Nil

### Operations Research -- Deterministic Models

**Hours**
1 1/2 hours per week

**Examination**
Progressive assessment

**Content**
Concept of optimization; optimization approaches; formulation of models; linear programming; allocation and assignment; simplex method; parametric programming; integer programming; network theory; dynamic programming. Applications.

**Texts**
- *Operations Research* (Macmillan)
- *Principles of Operations Research* (Prentice-Hall)

### Operations Research -- Probabilistic Models

**Hours**
1 1/2 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**
As for ME487
Reliability Analysis for Mechanical Systems
A. J. Chambers, A. W. Roberts

Hours
1½ hours per week

Examination
To be advised

Content
Some important probability concepts. Fundamental concepts of the
theory of reliability. Some quantitative aspects of reliability. Component
failure, Matrix formulation of problems. Spectral method for calculation
of reliability.
Basic concepts of systems. Reliability analysis of systems. Methods for
improving the reliability of systems. Cost-Benefit analysis. Reliability
Case Studies. Automobile suspension ignition system. Measuring system.

Text
Shooman, M. I. Probabilistic Reliability. An Engineering Approach
(McGraw-Hill 1968)

743100 Physics HIA

Prerequisites
Physics II, at least one Mathematics II subject which should include, in addition to topic CO
(which counts as two topics), topic B and one of the topics D, F and H

Hours
Approximately 4 lecture hours & 8 laboratory
hours per week

Examination
Assessment to the equivalent of 10 hours 25
minutes of examination time

Content
The areas of classical and quantum physics essential to the understanding
of both advanced pure physics and also the many applications of physics.
Some electronics is also included.
A. Classical Physics
Mathematical methods, advanced mechanics, special theory of relativity,
electromagnetics including waveguide and antenna theory.
B. Modern Physics
Quantum mechanics, atomic and molecular physics, statistical physics,
solid state physics, nuclear physics, electronics.
C. Laboratory
Parallels the lecture course in overall content with at least one experiment
available in each topic, although students are not expected to carry out
all the experiments available.

Texts
Refer to the Physics Department notice board.
Students should retain their Physics II texts.
Head of Department of Physics. Project work will normally begin in the first week of February.

664200 Mathematics/Psychology IV

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

**Hours**
To be advised

**Examination**
To be advised

**Content**
4 Mathematics topics chosen from the Part IV Mathematics topics (see page 58 et seq.).
Psychological Measurement (see below).
Mathematical Models in Perception and Learning (see below).

(i) Psychological Measurement — J. A. Keats

**Prerequisites**
Nil

**Hours**
1½ hours per week

**Examination**
To be advised

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

**Text**
Nil

**References**
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 Stiftsbogtrykkeri A-S 1964)
Torgerson, W. S. *Theory and Methods of Scaling* (Wiley 1958)

(ii) Mathematical Models in Perception & Learning — R. A. Heath

**Prerequisites**
Part II Mathematics Topic H recommended

**Hours**
1½ hours per week

**Examination**
To be advised

**Content**
An introduction to the application of stochastic process models to the analysis of psychological processes involved in perception and learning. Use of a real-time computer.

**Text**
Nil

**References**

**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.

**Core Subjects**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Department Offering Subject</th>
<th>Assumed Standard of Attainment</th>
<th>No. of Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS- Commercial Programming</td>
<td>Commerce</td>
<td>Mathematics I, Topic SC, or Commercial Electronic Data Processing</td>
<td>1</td>
</tr>
<tr>
<td>CS- Introduction to Logic &amp; Assembly Languages</td>
<td>Electrical Engineering</td>
<td>Mathematics I or suitable alternative preparation</td>
<td>1</td>
</tr>
<tr>
<td>CS- Switching Theory &amp; Logical Design</td>
<td>Electrical Engineering</td>
<td>Mathematics I or suitable alternative preparation</td>
<td>1</td>
</tr>
<tr>
<td>CS- Programming &amp; Algorithms</td>
<td>CS Programming &amp; Algorithms</td>
<td>Mathematics I or suitable alternative preparation</td>
<td>1</td>
</tr>
<tr>
<td>CS- Data Structures &amp; Programming</td>
<td>Mathematics</td>
<td>Mathematics I or suitable alternative preparation</td>
<td>1</td>
</tr>
<tr>
<td>CS- Numerical Analysis Systems Analysis</td>
<td>Commerce</td>
<td>Mathematics I or suitable alternative preparation</td>
<td>1</td>
</tr>
</tbody>
</table>

**General Notes**
The subjects listed below are approved pursuant to Section 7 of the Requirements for the Diploma in Computer Science. The Board may approve from time to time additions to the list of subjects shown below. A candidate may count not more than two Group B subjects towards the Diploma.
The Board may approve the inclusion in a student's programme of a project. This project would be in lieu of Group B subjects and may not count more than two units.
A student may suggest to the Dean for consideration by the Board the inclusion in his programme of a subject not listed below. Students interested in positions as Computer Systems Officers in the Australian Public Service are strongly advised to include the subject Systems Design in their course.

### Subjects Overlapping in Content

The Board of Studies in Computer Science has decided that a candidate is not permitted to include in his programme more than one of each pair of the mutually exclusive subjects listed in the Table below, nor may he include a subject if he has previously included the content of that subject in his work for a degree or Diploma which has already been conferred or awarded or approved for conferment or award.

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**Quantitative Business Analysis II**  
ME487 - Operations Research-Deterministic Models

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**Subjects Approved for the Diploma**

### Group A

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

<table>
<thead>
<tr>
<th>Subject</th>
<th>Department Offering Subject</th>
<th>Assumed Standard of Attainment</th>
<th>No. of Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Systems</td>
<td>Commerce</td>
<td>Commercial EDP</td>
<td>1</td>
</tr>
<tr>
<td>Quantitative Business Analysis II</td>
<td>Commerce</td>
<td>Introductory Quantitative Methods</td>
<td>1</td>
</tr>
<tr>
<td>Systems Design</td>
<td>Commerce</td>
<td>CS - Commercial Programming</td>
<td>1</td>
</tr>
<tr>
<td>EE341 - Automatic Control</td>
<td>Electrical Engineering</td>
<td>Part II Mathematics, Topics CO, D, H</td>
<td>1</td>
</tr>
<tr>
<td>EE345 - Digital Signal Processing</td>
<td>Electrical Engineering</td>
<td>EE341 or EE345 - Automatic Control</td>
<td>1</td>
</tr>
<tr>
<td>EE347 - Digital Communications</td>
<td>Electrical Engineering</td>
<td>EE264 or CS - Introduction to Logic &amp; Assembly Languages</td>
<td>1</td>
</tr>
<tr>
<td>EE463 - Computer Operating Systems</td>
<td>Electrical Engineering</td>
<td>EE264 or CS - Introduction to Logic &amp; Assembly Languages</td>
<td>1</td>
</tr>
<tr>
<td>EE464 - Compiler Construction</td>
<td>Electrical Engineering</td>
<td>EE264 or CS - Introduction to Logic &amp; Assembly Languages</td>
<td>1</td>
</tr>
<tr>
<td>EE462 - Topics in Switching Theory</td>
<td>Electrical Engineering</td>
<td>EE342 - Switching Theory &amp; Logical Design</td>
<td>1</td>
</tr>
<tr>
<td>CS - Theory of Computing</td>
<td>Mathematics</td>
<td>Part II Mathematics, Topics CO, D or equivalent</td>
<td>1</td>
</tr>
<tr>
<td>CS - Mathematical Principles of Numerical Analysis</td>
<td>Mathematics</td>
<td>Part II Mathematics, Topics CO, D</td>
<td>1</td>
</tr>
<tr>
<td>CS - Programming Languages &amp; Systems</td>
<td>Mathematics</td>
<td>Part II Mathematics, Topic F</td>
<td>1</td>
</tr>
<tr>
<td>CS - Concurrent Programming Techniques</td>
<td>Mathematics</td>
<td>CS - Theory of Computing OR EE463 - Computer Operating Systems Programming experience in a high-level language</td>
<td>1</td>
</tr>
<tr>
<td>CS - High Level Software Development</td>
<td>Mathematics</td>
<td>EE463 - Computer Operating Systems Programming experience in a high-level language</td>
<td>1</td>
</tr>
<tr>
<td>ME305 - Systems Analysis, Organization &amp; Control</td>
<td>Mechanical Engineering</td>
<td>Part II Mathematics, Topics CO, D, H</td>
<td>1</td>
</tr>
<tr>
<td>ME404 - Mathematical Programming</td>
<td>Mechanical Engineering</td>
<td>Part II Mathematics, Topics CO, D</td>
<td>1</td>
</tr>
<tr>
<td>ME511 - Mathematical Programming II</td>
<td>Mechanical Engineering</td>
<td>ME404 - Mathematical Programming I</td>
<td>1</td>
</tr>
</tbody>
</table>

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### Group B

**Subjects which have some application to computer science**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Department Offering Subject</th>
<th>Assumed Standard of Attainment</th>
<th>No. of Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE201</td>
<td>Electrical Engineering</td>
<td>Part II Mathematics, Topic D</td>
<td>1</td>
</tr>
<tr>
<td>EE315</td>
<td>Electrical Engineering</td>
<td>Part II Mathematics, Topic D</td>
<td>1</td>
</tr>
<tr>
<td>EE325</td>
<td>Electrical Engineering</td>
<td>Part II Mathematics, Topic D</td>
<td>1</td>
</tr>
<tr>
<td>EE462</td>
<td>Electrical Engineering</td>
<td>Part II Mathematics, Topic D</td>
<td>1</td>
</tr>
<tr>
<td>EE464</td>
<td>Electrical Engineering</td>
<td>Part II Mathematics, Topic D</td>
<td>1</td>
</tr>
<tr>
<td>EE466</td>
<td>Electrical Engineering</td>
<td>Part II Mathematics, Topic D</td>
<td>1</td>
</tr>
<tr>
<td>EE467</td>
<td>Electrical Engineering</td>
<td>Part II Mathematics, Topic D</td>
<td>1</td>
</tr>
<tr>
<td>EE503</td>
<td>Electrical Engineering</td>
<td>Part II Mathematics, Topic D</td>
<td>1</td>
</tr>
<tr>
<td>EE504</td>
<td>Electrical Engineering</td>
<td>Part II Mathematics, Topic D</td>
<td>1</td>
</tr>
</tbody>
</table>

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### Description of Subjects

**Core Subjects**

#### 410136 CS - Commercial Programming

**Assumed Standard of Attainment**  
Mathematics I Topic SC or Commercial E.D.P.

**Hours**  
2 lecture hours per week for first half year

**Examination**  
One 3-hour paper at mid year

**Content**  
Basic concepts of file handling and file maintenance, including file creation and processing.
Flow charts, file merging and updating of transactions; tape blocking and buffering.

General run types including editing, searching and sorting. Direct access versus serial; random or sequential organisation; re-run techniques; verifying programme accuracy; table lookup; programme documentation and use of test data.

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

Texts
Feingold, C. Fundamentals of COBOL Programming (W. C. Brown)

References
Chai, W. A. & H. W. Programming Standard COBOL (Academic)
Clifton, H. D. Systems Analysis for Business Data Processing (Business Books)
DeRossi, C. J. Learning COBOL Fast (Reston)
Kapur, G. K. Programming in Standard COBOL (S.R.A.)
McCracken, D. D. Programming Business Computers (Wiley)
et al.
Murach, M. Standard COBOL (S.R.A.)
Sprowls, R. C. Computing with COBOL (Harper & Row)
Stern, N. B. & R. A. Cobol Programming (Wiley)
Watters, J. L. Cobol Programming (Heinemann)

533211 CS — Introduction to Logic & Assembly Languages — K. K. Saluja

Assumed Standard of Attainment Mathematics I

Hours 2 hours of lectures & practical work per week for first two terms

Examination Progressive assessment & final examination

Content
Boolean Algebra: Representation and Arithmetic

Structured Programming, program design. Flow charts, Decision Tables, Natural Language formulations of algorithms, Introduction to FORTRAN, PASCAL and the conversational language BASIC. Use of higher level languages to solve problems of a non-numerical nature. Programming

Text
Guttmann, A. J.

References
Day, A. C.

Grogono, P.
Jensen, K. & Wirth, N.
Kernighan, B. W. & Plauger, P. J.
Kernighan, B. W. & Plauger, P. J.
Knuth, D.

Yourdon, E.

agascar Algorithms (Heinemann 1977)

Fortran Techniques with Special Reference to Non-numerical Applications (Cambridge U.P. 1972)

Programming in PASCAL (Addison-Wesley 1979)
The Elements of Programming Style (McGraw-Hill 1974)
Software Tools (Addison-Wesley 1976)

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 second half 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. PASCAL 60, ALGOL 68, COBOL, FORTRAN, LISP, etc.

Text
Nil

References
Berziss, A. T.

Day, A. C.

Data Structures: Theory and Practice 2nd edn (Academic 1975)

Fortran Techniques: with Special Reference to Non-numerical Applications (Cambridge U.P. 1972)

Galler, B. A. & Perlis, A. J.

Gear, W.

Knuth, D. E.

McCameron, F. A.

Page, E. S. & Wilson, L. B.

Sammet, J. E.

A View of Programming Languages (Addison-Wesley 1970)


COBOL, Logic and Programming (Irwin-Dorsey 1974)

Information Representation and Manipulation in a Computer 2nd edn (Cambridge U.P. 1978)

Programming Languages: History and Fundamentals (Prentice-Hall 1969)

660113 CS -- Numerical Analysis -- D. I. S. McElwain

Assumed Standard of Attainment
Mathematics I

Hours
1 lecture hour & 1 tutorial hour per week

Examination
One 2-hour paper

Content
Solution of simultaneous linear equations by direct and iterative methods, and a selection from the following topics: Non-linear equations, Approximation -- functions, experimental data, integrals, Random number generation, Overdetermined systems; linear programming, Optimisation. Ordinary differential equations -- initial and boundary value problems. Eigenvalues and eigenvectors of matrices.

Text
Nil

References

Forster, G. & Moler, C. B.

Ralston, A.

Steinberg, D. I.

Additional references to be advised.

410127 Systems Analysis

Assumed Standard of Attainment
Nil

Hours
2 lecture hours per week for the first half year & associated practical work

Examination
An examination at mid-year

Content
This course is concerned with the early activities carried out in the development of computer-based information systems.

119
Topics covered include, the role of systems in modern business: the profession of systems analysis and design; management of the life cycle of a business information system; the tools of the systems analyst; the study phase, its associated documentation and its relationship to design, development and implementation. Students are also introduced to the concepts of structured analysis.

**Texts**

Gore, M. & Stubbe, J.  
Gore, M. & Stubbe, J.  
Gave, C. & Sarson, T.  

*Elements of Systems Analysis* (W. C. Brown)  
*Elements of Systems Analysis Workbook* (William C. Brown)  
*Structural Systems Analysis: Tools and Techniques* (Prentice-Hall)  

**References**

Davis, W.  
Davis, W.  
Gildersleeve, T.  
Semprevivo, P. C.  

*Information Processing Systems* (Addison-Wesley)  
*Information Processing Systems — Student Workbook* (Addison-Wesley)  
*Successful Data Processing Systems Analysis* (Prentice-Hall)  
*Systems Analysis: Definition, Process and Design* (S.R.A.)

**GROUP A**

Subjects in the main-stream of Computer Science

**Offered by the Department of Commerce**

**413611 Information Systems**

**Assumed Standard of Attainment**

Commercial Electronic Data Processing  
(or Management Studies if passed in 1974)

**Hours**

2 lecture hours per week, I tutorial/group meeting hour per week

**Examination**

Progressive assessment/group assignments  
One 2-hour paper

**Content**

COBOL programming; a general consideration of information systems; a particular consideration of computer associated business systems. Subject matter is aimed towards students who will be undertaking business careers. Topics include: data v. information; people and systems; the industrial or computer revolution; data base concepts; problem solving. Students will correct, debug, rewrite and write several programs using COBOL.

**Texts**

*International Computers Ltd.*  
The University of Newcastle Burch, J. G. J., Strater, F. R. Jr & Grudmatski, G.  

*Introduction to COBOL.* ICI Student Edition  
(1nternational Computers Ltd.)  
*Computing Centre Handbook*  
*Information Systems: Theory and Practice* 2nd edn  
(Wiley)

**References**

Doke, V. T. & Essick, E.  
Murach, M.  
Hartman, W., Matthes, H. & Procme, A.  
Johnson, R. A. et al.  
Murdoch, R. G. & Ross, J. E.  
Schoderbeck, P. P.  
Stern, Nancy  
Jeffery, D., Ross & Dale, B.

*Principles of Business Data Processing* (Science Research Associates)  
*Information Systems Handbook* (ARDI)  
*The Theory and Management of Systems* (McGraw-Hill)  
*Information Systems for Modern Management* (Prentice-Hall)  
*Management Systems* (Wiley)  
*Flowcharting: A tool for understanding computer logic* (Wiley)  
*Computer Based Business Systems: Text and Cases* (Prentice-Hall)

**412601 Quantitative Business Analysis II**

**Assumed Standard of Attainment**

Introductory Quantitative Methods

**Hours**

2 lecture hours per week

**Examination**

One 2-hour paper; progressive assessment & project

**Content**

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

**Texts**

Anderson, J. et al.  
Levin, R. I. & Kirkpatrick, C. A.  
Pollard, A. H. et al.  
Starr, M. K. & Stein, I.  

*Thesis and Assignment Writing* (Wiley)  
*Quantitative Approaches to Management* 3rd edn  
(McGraw-Hill)  
*Demographic Techniques* (Pergamon)  
*The Practice of Management Science* (Prentice-Hall)

**410128 Systems Design**

**Assumed Standard of Attainment**

CS — Commercial Programming, Systems Analysis

**Hours**

2 lecture hours per week for the second half year & associated practical work

**Examination**

An examination at end of year

**Content**

This subject is a development of Systems Analysis and includes: data transmission; real time systems; information retrieval; file processing
form design; management and the computer; file design; systems design and determination; operating systems; multi-programming.

Texts

References

As for Systems Analysis

Offered by Department of Electrical Engineering

533213 EE341 Automatic Control — see page 97.

533116 EE345 Digital Signal Processing

Assumed Standard of Attainment

Hours

3 hours of lectures & tutorials per week for second half year

Examination

Progressive assessment & final examination

Content


The course consists mainly of lectures which will be supplemented by tutorial sessions.

Text

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

References

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

533115 EE325 Introduction to Digital Technology — A. Cantoni

Assumed Standard of Attainment

Hours

3 hours per week for first two terms only

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, microprogrammed systems, microprocessor systems.

Lectures will be supplemented by practical assignments on a microprocessor system and some tutorial sessions.

Text

Peatman, J. B. Microcomputer Based Design (McGraw-Hill)

References

Barna, A. & Porat, D. I. Introduction to Microcomputers and Microprocessors (John Wiley)
Kohonen, T. Digital Circuits and Devices (Prentice-Hall)
McGlynn, D. R. Microprocessors Technology, Architecture and Applications (John Wiley)

534134 EE447 Digital Communications — J. B. Moore

Assumed Standard of Attainment

Hours

3 hours of lectures & tutorials per week for first half year

Examination

Progressive assessment & final examination

Content

Pulse modulation schemes, including pulse code modulation, multiplexing, matched filters.

The course consists mainly of lectures supplemented by tutorial sessions.

Text

Gregg, W. D. Analog and Digital Communications: Concepts, Systems, Applications and Services (Wiley)

References

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

534124 EE463 Computer Operating Systems — A. Cantoni

Assumed Standard of Attainment

Hours

3 hours per week for the second half year
Progressive assessment & final examination

**Content**
Views of an operating system. Multiprogramming, interacting concurrent processes, process control primitives. Processor management, memory management, name management, Protection.
The course consists mainly of lectures supplemented by tutorial sessions.

**Text**
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)

**Assumed Standard of Attainment**
EE264 Introduction to Logic & Assembly Languages

**Hours**
3 hours per week for the first half year

**Examination**
Progressive assessment & final examination

**Content**
The design of assemblers. Introduction to the theory of grammars, parsing techniques, construction of compilers, object code generation. Construction of interpreters.
The course consists mainly of lectures and assignments on computer.

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

**References**
Donovan, J. J. *Systems Programming* (McGraw-Hill)
Further references will be given in class.

**Assumed Standard of Attainment**
EE362 Switching Theory & Logical Design

**Hours**
3 hours per week for the first half year

**Content**

**Offered by Department of Mathematics**

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<th>Course Title</th>
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<td>660128</td>
<td>CS—Mathematics Principles of Numerical Analysis</td>
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<td>CS—Programming Languages &amp; Systems</td>
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<td>CS—Concurrent Programming Techniques</td>
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<td>CS—High Level Software Development</td>
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**Offered by Department of Mechanical Engineering**

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<td>544427</td>
<td>ME404 Mathematical Programming I</td>
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<td>540132</td>
<td>ME581 Mathematical Programming II</td>
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**Assumed Standard of Attainment**

**Content**
An introduction to non-linear optimization problems. Dynamic programming and its application to a range of resource allocation, production planning and inventory control problems. Linear programming problems in integers; introduction to branch-and-bound methods and implicit enumeration algorithms for problems in binary variables.

**Texts**

**GROUP B**

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

**Offered by Department of Civil Engineering**

<table>
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</table>

For details consult the Engineering Faculty Handbook
Offered by Department of Commerce

413612 Theories of Organisation

Assumed Standard of Attainment
Organisational Behaviour

Hours
2 lecture hours per week

Examination
Two 3-hour papers

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

Texts
Lapman, T. Management and the Social Sciences (Penguin)
Posle, M. Worker Participation in Industry (Routledge, Kegan & Paul)
Sofer, C. Organisations in Theory and Practice (Heinemann)
or Mouzelis, N. P. Organisation and Bureaucracy — An Analysis of Modern Theories (Routledge, Kegan & Paul)

References
Argyle, M. The Psychology of Interpersonal Behaviour (Penguin)
Brown, W. Organisations (Heinemann)
Katz, D. & Kahn, R. L. The Social Psychology of Organisations (Wiley)
Kerr, C. D. et al. Industrialism and Industrial Man (Penguin)
Klein, L. New Forms of Work Organisations (Tavistock)
Murch, J. G. & Simon, H. A. Organisations (Wiley)
Silverman, D. The Theory of Organisations (Heinemann)

Offered by Department of Electrical Engineering

533107 EE323 Linear Electronics
533108 EE324I Electronics Laboratory
533110 EE342 Linear System Theory — see page 97
533113 EE344 Communications — see page 98
534109 EE421 Electronic Design A
534110 EE422 Electronic Design B
534400 EE442 Non-Linear Optimal Control — not offered in 1980
534412 EE443 Optimization Techniques — not offered in 1980

533107 EE323 Linear Electronics 1
533110 EE342 Linear System Theory — see page 97
533113 EE344 Communications — see page 98
534109 EE421 Electronic Design A 1
534110 EE422 Electronic Design B 1
534400 EE442 Non-Linear Optimal Control — not offered in 1980
534412 EE443 Optimization Techniques — not offered in 1980

For details consult the Engineering Faculty Handbook.

Offered by Department of Mathematics

660118 CS—Mathematical Logic
660129 CS—Theory of Statistics
660138 CS—Asymptotic Methods
660199 CS—Random and Restricted Walks
660120 CS—Signal Detection
660122 CS—Combinatorial Designs
660123 CS—Combinatorics
660125 CS—Graph Theory

Offered by Department of Mechanical Engineering

544418 ME449 Reliability Analysis for Mechanical Systems — see page 105
544644 ME467 Operations Research — Deterministic Models — see page 108
544642 ME469 Operations Research — Probabilistic Models — see page 108
560153 ME593 Design of Experiments for Engineering Research

Offered by Department of Metallurgy

113393 Met312 Modelling and Control of Metallurgical Processes

Offered by Department of Physics

742201 CS—Instrumentation Techniques

Assumed Standard of Attainment
Physics IA or IB

Hours
1 hour per week & a 12-hour project

Examination
Project assessment & one 2-hour paper

Content
From the subject Electronics and Instrumentation 1:
Specialist Instrumentation — 8 lectures
Instrumentation Systems — 8 lectures
Measurement Devices — 14 lectures

Text
Malmstadt, H. V. et al. Instrumentation for Scientists Series (Vols 1-4)

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

Algebra
Associate Professor W. Brisley is working on some problems in group theory which arise from graph theory, and also on some applications of algebra to data-processing problems.

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

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

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

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

Fluid Mechanics
Associate Professor A. J. Guttmann is studying the problem of extrapolating regular perturbation series in fluid mechanics.
Dr W. T. F. Lau is concerned with viscous flow problems. Meniscus profiles are also of current interest.
Dr W. Summerfield is interested in all phenomena in which fluid dynamics plays a significant role; for example, ocean waves, turbulence, estuarian-dynamics, weather prediction, sailing vessels, surfing, animal propulsion.

Functional Analysis
Associate Professor J. R. Giles is carrying out research in the particular area of the geometry of Banach spaces, and interest there is focused on various smoothness and rotundity properties of the norm and their implications for the space. This work is being generalised to a study of differentiation of convex functions on Banach spaces. Particular attention is being given to characterising Banach spaces where the continuous convex functions have various differentiability properties.
Dr V. Ficker and Mr C. J. Ashman are working in measure theory, particularly in some problems of families of sets.
Mr. R. F. Berghout is pursuing research into the development of algebra, notably modern algebra, as well as the relations between this and classical occidental and oriental algebra. Mr. Berghout is working on Greek algebra.

Information Theory
Professor R. G. Keats and Dr. A. J. Dobson are continuing to work in co-operation with research scientists at the Defence Research Centre at Salisbury, S.A. Current work is concerned with processing clipped data from a number of receivers arrayed in various geometric patterns.

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.

Medical Statistics and Epidemiology
Dr. A. J. Dobson and Dr. R. W. Gibberd collaborate with the Faculty of Medicine to investigate various problems in epidemiology and biostatistics. Current research includes: regional variations in mortality; age and sex-specific death rates from ischaemic heart disease in Australia; collection and analysis of data from the Hunter Valley Heart Attack Study; design and analysis for a survey of smoking habits of schoolchildren and the evaluation of an intervention programme; development and validation of an index of quality of life in patients with chronic diseases.

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

Dr. T. K. Sheng studies the structure of humanly manageable numbers, application of dispersive and explosive linear operators, distribution of algebraic numbers in the complex plane, and functions defined on rational numbers. Lines determined by lattice points and application of the results obtained to statistical mechanics are studied. Convexity indices and their applications to transport networks, etc.

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

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

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

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

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1 Not offered in 1980.
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1 Not offered in 1980.