Preface

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

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

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

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

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

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

Not all the areas of mathematical work which are of importance to the Faculty have the word “mathematics” in their titles. Operations research (“the mathematical description of what actually happens, rather than 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. From this year graduates with such special knowledge will, if they so wish, complete the degree of B.Math with Computer Science or Statistics and have their testamur appropriately endorsed.

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. G. KEATS,
Dean, Faculty of Mathematics.
Students should also include the Part
Dean
Professor R. G. Keats, BSc, PhD(Adelaide), DMath(Waterloo), FIMA, FASA
Sub-Dean
Associate Professor W. Brisley, BSc(Sydney), MSc(New South Wales), PhD, DipEd(New England)
Faculty Secretary
Linda S. Harrigan, BA

MATHEMATICS

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

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

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

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

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

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

Computer Programmer
A. Nymeyer, BMath, DipCompSc

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

Administrative Assistant
Rae Pease, BEd(Mitchell CAE)

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 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, Engineering I and Chemistry I.

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

### Part I

<table>
<thead>
<tr>
<th>Faculty</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology I</td>
<td>Geology I</td>
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<tr>
<td>Chemistry I</td>
<td>German IS or 1N</td>
</tr>
<tr>
<td>Classical Civilisation I</td>
<td>Greek I</td>
</tr>
<tr>
<td>Drama I</td>
<td>History I</td>
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<tr>
<td>Economics I</td>
<td>Japanese I</td>
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<tr>
<td>French I</td>
<td>Latin I</td>
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<td>Legal Studies I</td>
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<td>Physics I</td>
<td>Philosophy I</td>
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<tr>
<td>Psychology I</td>
<td>Physics 1A or IB</td>
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<tr>
<td>Sanskrit I</td>
<td>Sociology I</td>
</tr>
</tbody>
</table>

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

*Economics IIA* — Students should also include the Part II Mathematics Topic I, 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 of a student's course of subjects which are prerequisites or corequisites of subjects appearing in the schedules.

Review of Academic Progress in the Faculty of Mathematics

Acting under the Regulations Governing Unsatisfactory Progress, as set out in Volume 1 of the Calendar, the Faculty Board will review:

1. all full-time students who have failed to pass at least four subjects at the end of the second year of attendance;
2. all part-time students who have failed to pass at least four subjects at the end of the fourth year of attendance;

Students are invited to discuss their interests in a particular branch of mathematics with members of the Department who are working in that branch. The appropriate staff members for each branch may be determined by reference to the section entitled “Research in the Department of Mathematics” p. 121.
(3) all students who have failed to pass at least four subjects after one full-time and two part-time years; and
(4) all students, whether part-time or full-time, who in their first year of attendance have a record of complete failure, and may take action under the Regulations.

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

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

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

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

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

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

Prerequisites

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

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

Note

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

Mathematics Education Subjects

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

160406 Mathematics Education II — T. H. MacDonald

Prerequisite

Mathematics I

Pre-or Corequisite

A Part II Mathematics subject

Hours

1 lecture hour per week and two 5-day schoolroom observation periods

Examination

One 2-hour paper

Content

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

Text

Nil

References

Berlinghoff

Mathematics: The Art of Reason

Eves & Newsome

An Introduction to the Foundations and Fundamental Concepts of Mathematics

Pedoe

The Gentle Art of Mathematics

160407 Mathematics Education III — T. H. MacDonald

Prerequisite

Mathematics Education II

Pre- or Corequisite

A Part III Mathematics subject or Statistics III

Hours

1 lecture hour per week and two 5-day schoolroom observation periods

Examination

One 2-hour paper

Content

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

Text

Nil

References

Courant & Robbins

What is Mathematics?

Pólya

Mathematical Discovery

Waissmann

Introduction to Mathematical Thinking

MATHEMATICS WITH ONE OTHER DISCIPLINE

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

B. Math. with Accounting
Year 1 Mathematics I, Accounting I, Legal Studies I and one other subject.
Year 2 Mathematics IIA, Mathematics IIC, Accounting IIC.
Year 3 Mathematics IIA, Accounting IIC (Accounting IIIB and Financial Management option).
The course should also include one additional subject chosen from (i) Taxation, or (ii) Law of Contract and Law of Business Organisations.
Note (i) Taxation may, with the permission of the Dean, be included in the programme for Year 1.
(ii) Law of Contract and Law of Business Organisations count as one subject for the Degree of Bachelor of Mathematics.
(iii) In order to complete the educational requirements for the professional bodies, it is necessary to pass Auditing in addition to the above subjects. The student is advised to continue his studies by completing the Diploma in Business Studies in which case one of (a) Taxation, or (b) Law of Contract and Law of Business Organisations may be included in the Diploma together with Auditing.

B. Math. with a discipline from the Faculty of Science, e.g., Psychology
Year 1 Mathematics I, Psychology I and two other subjects.
Year 2 Mathematics IIA, Mathematics IIC and Psychology IIC.
Year 3 Mathematics IIA, Psychology IIC.

B. Math. with an Engineering discipline, e.g., Civil Engineering
Year 1 Mathematics I, Engineering I and two other subjects (Physics IA is recommended).
Year 2 Mathematics IIA, Mathematics IIC and Civil Engineering IIIM.
Year 3 Mathematics IIA and Civil Engineering IIIM.

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

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

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 (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 enrolled in or is already enrolled in the subjects prescribed as its prerequisites.

(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,
(a) to qualify for the degree of Bachelor of Mathematics, a candidate shall pass nine subjects, including:
   Mathematics I, Mathematics II, Mathematics III, Mathematics II A, and either Mathematics II B or one Part III subject chosen from Schedule B of the Schedule of Subjects;
(b) to qualify for the degree of Bachelor of Mathematics with Computer Science, a candidate shall pass nine subjects, including:
(c) to qualify for the degree of Bachelor of Mathematics with Statistics, a candidate shall pass nine subjects, including:

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

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

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

16. Standing
The Faculty Board may grant standing under the following conditions.
(a) A candidate may be granted standing in recognition of work completed in another tertiary institution or faculty, provided that:
   (i) the subjects for which credit is given shall have a reasonable correspondence with those offered in the Faculty;
   (ii) an undergraduate of another tertiary institution shall not receive credit for more than four subjects;
   (iii) a graduate or diplomate of another tertiary institution or faculty shall not receive credit for more than four subjects and if granted credit may not include as a qualifying subject any subject equivalent to one counted towards his previous qualification.
(b) Notwithstanding the provision of section (a) (i) of this sub-section, a graduate or undergraduate of another tertiary institution may be given credit for subjects not offered for the degree of Bachelor of Mathematics in the University of Newcastle provided that:
   (i) the candidate complies with all other conditions of the Requirements;
   (ii) the candidate has his proposed pattern of course approved at the time at which the concession is granted and does not depart from the proposed pattern without the approval of the Dean.

Section III — The Honours Degree

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

18. Time Requirements
(a) Except with the special permission of the Faculty Board, a candidate for Honours shall complete the requirements within five years from the commencement of his degree course (not counting years for which leave of absence has been granted) provided that for a part-time student the corresponding period shall be seven years.
A candidate who has been given standing in recognition of work completed elsewhere shall be deemed to have commenced his degree course from a date determined by the Dean.
(b) The Dean may permit a part-time candidate for Honours to complete the Part IV subject or subjects over two successive years.

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

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

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

22. Equivalent Honours
(a) On the recommendation of the Heads of the Departments concerned and with the permission of the Dean, a graduate may enrol in a Part IV subject as a full-time or a part-time student, provided that:
(i) he has not completed a Part IV subject in the disciplines concerned at this or any other tertiary institution approved for this purpose by the Faculty Board;
(ii) he is not otherwise eligible to enrol in that Part IV subject pursuant to these degree Requirements.
(b) Such a graduate who satisfactorily completes the Part IV subject shall be issued with a statement to this effect by the Secretary; the statement shall indicate the Honours level equivalent to the standard achieved by the student in the Part IV subject.

Section IV — Combined Degree Courses

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

24. Arts/Mathematics
(a) A candidate shall comply with all the provisions of the Requirements for the degree of Bachelor of Arts other than Clause 12 and all the Requirements for the degree of Bachelor of Mathematics.
(b) To qualify for admission to the ordinary degrees of Bachelor of Arts and Bachelor of Mathematics, a candidate shall pass fourteen subjects, five of which shall be Mathematics I, Mathematics II A, Mathematics II C, Mathematics III A and one of Mathematics III B, Computer Science III, Statistics III or a Part III subject chosen from the Schedules of Subjects approved for the degree of Bachelor of Mathematics and the remainder of which shall be chosen from the other subjects listed in the Schedule of subjects approved for the degree of Bachelor of Arts, provided that:
(i) not more than three subjects from Group II of the Schedule of subjects approved for the degree of Bachelor of Arts may be counted;
(ii) not more than five Part I subjects out of the total fourteen may be counted;
(iii) at least three subjects shall be Part III subjects;
(iv) a candidate counting Psychology IIC shall not be entitled to count either Psychology IIA or IIB;
(v) a candidate counting Psychology IIC shall not be entitled to count either Psychology IIA or Psychology IIB;
(vi) a candidate counting Economics IIC shall not be entitled to count either Economics IIA or Economics IIB;
(vii) a candidate counting Geology IIC shall not be entitled to count either Geology IIA 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 III A and one of Mathematics III B, Computer Science III, Statistics III or a Part III subject chosen from the Schedules of Subjects approved for the degree of Bachelor of Mathematics and
(b) six subjects chosen from the other subjects listed in the Schedule of Subjects approved for the degree of Bachelor of Science and
(c) three subjects chosen, with the approval of the Deans of the Faculties of Mathematics and Science, from the subjects approved for any of the degree courses offered by the University provided that:
(i) the number of Part I subjects shall not exceed six;
(ii) the minimum number of Part III subjects shall be three;
(iii) a candidate counting Psychology IIC shall not be entitled to count either Psychology IIA or Psychology IIB;
(iv) a candidate counting Psychology IIC shall not be entitled to count either Psychology IIA or Psychology IIB;
(v) a candidate counting Economics IIC shall not be entitled to count either Economics IIA or Economics IIB;
(vi) a candidate counting Geology IIC shall not be entitled to count Geology IIA or Geology IIB.

26. Mathematics/Metallurgy
After completing a successful first year of study towards either the degree of Bachelor of Mathematics or the degree of Bachelor of Metallurgy, a candidate may enrol in a Mathematics/Metallurgy course. A candidate who has enrolled in such a combined course shall qualify for admission to the ordinary degree of Bachelor of Mathematics and the degree of Bachelor of Metallurgy by passing Mathematics I, Mathematics II A, Mathematics II C, Mathematics III A, Mathematics III B, Computer Science III, Statistics III or a Part III subject chosen from the Schedules of Subjects approved for the degree of Bachelor of Mathematics and by satisfactorily completing other subjects to a minimum value of 48 units selected from the programme of subjects approved for the degree of Bachelor of Metallurgy.
27. **Commerce/Mathematics**

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

28. **Engineering/Mathematics**

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

29. **Economics/Mathematics**

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

**SCHEDULE A**

**Mathematics Subjects**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Remarks including Prerequisites and Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part I</td>
<td></td>
</tr>
<tr>
<td>Mathematics I</td>
<td>It is assumed that students have studied Higher School Certificate Mathematics at the two-unit level or higher</td>
</tr>
<tr>
<td>Part II</td>
<td></td>
</tr>
<tr>
<td>Mathematics II A</td>
<td>Prerequisite Mathematics I</td>
</tr>
<tr>
<td>Mathematics II B</td>
<td>Prerequisite Mathematics I</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Mathematics IIC</th>
<th>Prerequisite Mathematics I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics IIA</td>
<td>Pre- or Corequisite Mathematics IIA</td>
</tr>
<tr>
<td>Mathematics IIB</td>
<td>Pre- or Corequisite Mathematics IIB</td>
</tr>
<tr>
<td>Part III</td>
<td>Mathematics IIA &amp; Mathematics IIB</td>
</tr>
<tr>
<td>Part IV</td>
<td>Mathematics IIA &amp; Mathematics IIB</td>
</tr>
</tbody>
</table>

**Computer Science Subjects**

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

**Statistics Subject**

| Prequisites Mathematics IIA & Mathematics IIC (including Topics C0, H & I) |

**SCHEDULE B**

**Subjects With a Substantial Mathematical Content**

<table>
<thead>
<tr>
<th>Part I</th>
<th>Engineering I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part II</td>
<td>Accounting IIC</td>
</tr>
<tr>
<td></td>
<td>Civil Engineering IIM</td>
</tr>
<tr>
<td></td>
<td>Psychology IIC</td>
</tr>
<tr>
<td>Part III</td>
<td>Accounting IIC</td>
</tr>
<tr>
<td>Biology II B</td>
<td>Civil Engineering IIM</td>
</tr>
<tr>
<td>Communications &amp; Automatic Control</td>
<td>Digital Computers &amp; Automatic Control</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Prerequisites Accounting I &amp; Mathematics I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prequisites Engineering I &amp; Mathematics I</td>
</tr>
<tr>
<td>Prequisites Mathematics I, Psychology I, A candidate counting Psychology IIC shall not be entitled to count Psychology IIA or Psychology IIB</td>
</tr>
<tr>
<td>Prequisites Mathematics IIA &amp; Mathematics IIC &amp; either Accounting IIA &amp; Accounting IIB or Accounting IIB</td>
</tr>
<tr>
<td>Prequisites Mathematics IIA &amp; Mathematics IIC &amp; either Biology IIA or Biology IIB</td>
</tr>
<tr>
<td>Prequisites Civil Engineering IIM, Mathematics IIA &amp; Mathematics IIC</td>
</tr>
<tr>
<td>Prequisites Mathematics IIA &amp; Mathematics IIC (including Topics CO, D)</td>
</tr>
<tr>
<td>Prequisites Mathematics IIA &amp; Mathematics IIC (including Topics CO, D)</td>
</tr>
</tbody>
</table>
SCHEDULE C

Combined Honours Subjects

Mathematics, Physics

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 and other Mathematics subjects satisfying the Requirements 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 IIIb, Computer Science III, Statistics III or Part III subject from 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 IIIb, Computer Science III, Statistics III or a Part III subject from Schedule B of the Schedule of Subjects approved for the degree of Bachelor of Mathematics, and all the subjects satisfying the Requirements for the degree of Bachelor of Economics.

The course could be pursued in the following manner:

Year I Mathematics I

Introductory Quantitative Methods

Economics I

One B.Ec. subject

Year II Mathematics IIa

Mathematics IIC

One B.Ec. subject

Year III Mathematics IIIa

Economics II

Two B.Ec. subjects

Year IV Mathematics IIIb, Computer Science III, Statistics III or Part III Schedule B subject from the Requirements for B.Math.

Two B.Ec. subjects

Year V Three B.Ec. subjects.

ENGINEERING/MATHEMATICS

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

The course could be pursued in the following manner:

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

Year I

ChE141 Industrial Process Principles

ChE151 Industrial Chemical Processes & Equipment

ChE152 Industrial Process Design I

GE151 Introduction to Materials Science

Chemistry I

Mathematics I

Physics I

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

Year III
Mathematics III A
ChE371 Kinetics & Thermodynamics
ChE361 Separation Processes II
ChE391 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

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
EE131 Circuit Fundamentals
Mathematics I
Physics I A
CE171 Engineering Surveying I

Year II
Mathematics II A
Chemistry IS
CE212 Mechanics of Solids I
CE213 Mechanics of Solids II
CE221 Properties of Materials
CE222 Materials Technology
CE231 Fluid Mechanics I
CE232 Fluid Mechanics II
CE241 Water Resources Engineering I
CE223J Engineering Geology
ME204 Engineering Computations

Year III
Mathematics II C
CE314 Structural Analysis I
CE315 Structural Design I
CE324 Soil Mechanics

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

Year I
Year I is similar for all combined courses involving the Computer Engineering speciality and consists of the following subjects:
CE111 Statics
EE131 Circuit Fundamentals
CE112 Introduction to Engineering Design
ME111 Graphics and Engineering Drawing
ME131 Dynamics
Mathematics I
Physics I A
Chemistry IS

Year II
EE211 Energy Conversion
EE221 Semiconductor Devices
EE232 Electrical Circuits
EE262 Systematic Programming
EE264 Introduction to Logic & Assembly Language
PH221 Electromagnetics & Quantum Mechanics
Mathematics II A
Mathematics II C

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

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

Year V
EE421 Electronic Design A
EE422 Electronic Design B
EE426 Advanced Digital Systems
EE463 Computer Operating Systems
EE464 Compiler Construction
EE480 Project
EE481 Project OR 2 EE300/400/500 Units
(iv) B.E./B.Math. in Electrical Engineering

**Year I**
- Mathematics I
- Physics IA
- Chemistry 1S
- CE111 Statics
- EE131 Circuit Fundamentals
- GE112 Introduction to Engineering Design
- ME111 Graphics & Engineering Drawing
- ME131 Dynamics

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

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

**Year IV**
- EE313 Power Systems
- EE314 Electrical Machines
- EE323 Linear Electronics
- EE324.1 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

**Year V**
- EE421 Electronics Design A
- EE480 Project
- EE481 Project or 2 units from EE300, 400 subjects
- EE491 Seminar
- 8 units from EE300, 400 subjects
- 1 unit of elective (Engineering Fac. — non E.E.)

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

**Year I**
- Mathematics I
- Physics IA
- Chemistry 1S
- CE111 Statics
- GE151 Introduction to Materials Science
- GE112 Introduction to Engineering Design
- ME111 Graphics & Engineering Drawing
- ME131 Dynamics
- ME223 Engineering Technology

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

**Year III**
- Mathematics IIIA
- EE211 Energy Conversion
- ME121 Workshop Practice
- ME212 Engineering Design I
- ME232 Dynamics of Machines I
- ME204 Engineering Computations
- ME243 Mechanics of Solids II
- ME361 Automatic Control

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

**Year I**
- Mathematics I
- Physics IA
- Chemistry 1S
- CE111 Statics
- GE151 Introduction to Materials Science
- GE112 Introduction to Engineering Design
- ME223 Engineering Technology
- ME131 Dynamics

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

**Year III**
- Mathematics IIIA
- EE211 Energy Conversion
- ME121 Workshop Practice
ME342 Properties of Materials II
ME343 Mechanics of Solids II
ME361 Automatic Control

Year IV
Mathematics III B or Part III subject from Schedule of Subjects for B. Math.
ME302 Experimental Methods III
ME312 Engineering Design II
ME313 Engineering Design III
ME352 Fluid Mechanics II
ME372 Heat Transfer
ME373 Thermodynamics II
GE350 Seminar

MATHEMATICS/SCIENCE
The details for the combined course follow simply from the Requirements for each degree. Each degree requires nine subjects so the combined degree requires 18 subjects less four subjects for which standing may be given, thus the combined degree should contain 14 subjects. The Bachelor of Mathematics requires Mathematics I, Mathematics II A, Mathematics II B, 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 III 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 III 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 degree of Bachelor of Mathematics and other subjects taken from the Schedule of Subjects approved for the degree of Bachelor of Metallurgy.

Subject
Mathematics I
Physics I A
Chemistry
ChE141 Industrial Process Principles
GE151 Introduction to Materials Science
ChE151 Industrial Chemical Process & Equipment
ChE152 Industrial Process Design I

Year II
Mathematics II A
Mathematics II C

Met214 Theory of Metallurgy Processes I
Met261 Extraction Metallurgy
Met251 Metallography
Met241 Microplasticity
Met271 Fabrication Metallurgy
Met281 Electronic & Atomic Structure of Materials

Year III
Mathematics III A
ChE353 Process Economics
Met314 Theory of Metallurgical Processes II
Met351 Metallography
Met355 Physical Metallurgy
Met375 Industrial Metallurgy

Year IV
Part III Subject from B. Math. Schedule of Subjects

Year V
2. Directed Reading
Year VI
Met402 Seminar
Met401 Directed Reading
Met491 Laboratory Project

8 units from Met400 Subjects

REQUIREMENTS FOR THE DIPLOMA IN COMPUTER SCIENCE

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

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

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

4. An applicant for admission to candidature for the Diploma shall:
   - 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
   - have other qualifications approved for this purpose by the Senate on the recommendations of the Board and the Faculty Board.

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

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

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

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

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

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

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

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

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

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

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

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

(2) A candidate who withdraws from any subject after the relevant date shall be deemed to have failed in that subject unless granted permission by the Dean of the Faculty of Mathematics to withdraw without penalty. The relevant date shall be:
(a) in the case of any subject offered in the first half of the academic year — the 8th Monday in first term;
(b) in the case of any subject offered in the second half of the academic year — the 2nd Monday in third term;
(c) in the case of any other subject — the 6th Monday in second term.

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

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### SCHEDULE OF 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>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; Alg.</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>Systems Analysis</td>
<td>Commerce</td>
<td>—</td>
<td>1</td>
</tr>
</tbody>
</table>

1. The lecturer in the subject will assume that all students have a good understanding of the content of items in this column.
2. Subjects with a prefix CS are subjects offered in the Faculty of Mathematics specifically for the Diploma in Computer Science.

### REQUIREMENTS FOR THE DIPLOMA IN MATHEMATICAL STUDIES

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

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

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

4. An applicant for registration as a candidate for the Diploma may be granted standing on conditions to be determined by the Faculty Board, provided that standing may not be granted in respect of any studies for which credit has been given for admission to a degree or for the award of another diploma.
5. In order to qualify for the Diploma, a candidate shall, in not less than three terms in the case of a full-time student or not less than six terms in the case of a part-time student, complete a course of studies comprising 12 units of advanced work offered by the Department of Mathematics or another department offering courses with considerable mathematical content. Two units of this advanced work may be a project approved by the Faculty Board. Each unit will require attendance at lectures, seminars and tutorials, reading exercises, laboratory work and examinations as may be prescribed by the Faculty Board.

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

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

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

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

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

REGULATIONS GOVERNING MASTERS DEGREES

PART 1 — GENERAL

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

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

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

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

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

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

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

(3) An applicant shall not be admitted to candidacy 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 THERSES

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

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

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

1 At present there is no fee payable.

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

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

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

SCHEDULE 8 — MASTER OF MATHEMATICS

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

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 IIIA, II B, IIC and Statistics III there is some choice available to students; for Mathematics IIIA and IIIB there is a wider choice. No topic may be counted twice in making up distinct subjects. (Students who passed some mathematics subjects before this arrangement of subjects was introduced should consult the "transition arrangements" set out on p. 155 of the 1970 Faculty of Arts handbook, and p. 76 of the 1973 Faculty of Mathematics handbook. Note that the "code letters" for the topics may vary slightly from year to year.)

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

Progressive Assessment

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

(i) MATHEMATICS SUBJECTS

PART I SUBJECT

661100 Mathematics I

Prerequisites Nil

Hours 4 lecture hours and 2 tutorial hours per week

Examination Two 3-hour papers

Content

Topics

AI — 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

Content


Text

Anton, H. Elementary Linear Algebra 2nd edn (Wiley 1977)

References

Brusley, W. A Basis for Linear Algebra (Wiley 1973)
Kolman, B. Elementary Linear Algebra (Macmillan 1977)
Liebeck, H. Algebra for Scientists and Engineers (Wiley 1971)
Lipschutz, S. Linear Algebra (Schaum 1974)

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

Prerequisites Nil

Hours 1 lecture hour and ½ tutorial hour per week

Content

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

Text

Nil
Statistics

statistical and numerical analysis.

Simple three-dimensional geometry

tangency.

Introduction to computers.

Prerequisites

Nil

Text

Ayres, F. Calculus (Schaum 1974)

References

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

Spivak, M. Calculus (Benjamin 1967)

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

Prerequisites

Nil

Text

University of Newcastle Computing Centre DEAMON Handbook

University of Newcastle Statistical Tables

References

Conte, S. D. & de Boor, C. Elementary Numerical Analysis (McGraw-Hill 1972)

Grogono, P. Programming in PASCAL 2nd edn (Addison-Wesley 1980)

Hine, J. & Wetherill, G. B.

Wetherill, G. B.

A Programmed Text in Statistics Vols 1, 2, 3

Introduction to Mathematical Statistics (Wiley 1971)

PART II SUBJECTS

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

Summaries and booklists for these topics are given on page 36 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 70 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</td>
<td>Mathematical Models</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Complex Analysis</td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>Vector Calculus &amp; Differential Equations</td>
<td>M, N, P, PD, Q, TC, Y, Z</td>
</tr>
<tr>
<td>D</td>
<td>Linear Algebra</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Topic in Applied Mathematics e.g. Mechanics, Potential Theory and Fluid Dynamics</td>
<td>CO</td>
</tr>
<tr>
<td>H</td>
<td>Probability &amp; Statistics</td>
<td>R, ST, U, Y</td>
</tr>
<tr>
<td>I</td>
<td>Applied Probability and Statistics</td>
<td>H</td>
</tr>
<tr>
<td>K</td>
<td>Topic in Pure Mathematics e.g. Group Theory</td>
<td>FM, O, T, X</td>
</tr>
<tr>
<td>L</td>
<td>Analysis of Metric Spaces</td>
<td>FM, O, P, V, W</td>
</tr>
</tbody>
</table>

* It is strongly suggested that those students wishing to take Topic Z in 1982, should take Topic F in 1981.

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

662100 Mathematics IIA

Prerequisite

Mathematics I

Hours

4 lecture hours and 2 tutorial hours per week

Examination

Each topic is examined separately
Topics B, CO and D. In exceptional circumstances and with the consent of the Head of the Department, one other topic may be substituted for B. Additional substitutions may be allowed in the case of candidates who have passed the subject Mathematics II B. In addition, students taking Mathematics II A will be required to prepare a report on some aspect of the history of the mathematics studied in this subject.

662200 Mathematics II B

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

662300 Mathematics II C

Prerequisite
Mathematics I

Pre- or Corequisite
Mathematics II A

Hours
4 lecture hours and 2 tutorial hours per week

Examination
Each topic is examined separately

Content
Topics K, L and two of the topics A, E, F, H, I. 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 specified further than is set out in the rules above.
2. Students whose courses include Physics III A are advised to include topics CO, Band one 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 "L" in 1974-1980 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. Students taking Mathematics II A, II B, II C, should consult the Head of Department.

PART II TOPICS

662101 Topic B — Complex Analysis — M. J. Hayes

Prerequisite or Corequisite
Topic CO

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

Examination
One 2-hour paper

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

Text
Nil

References
Andrews, J. G. & McClone, R. R.
Kemeny, J. G. & Snell, J. L.
Rapoport, A. & Channmah, A. M.
Smith, J. M.

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

Prerequisite or Corequisite
Topic CO

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

Examination
One 2-hour paper

Content

Text
Spiegel, M. R.

References
Churchill, R. V.
Greenberg, M. D.
Kreyszig, E.
Pólya, G. & Latta, G. E.

Theory and Problems of Complex Variables
(McGraw-Hill 1964)

Complex Variables and Applications
(McGraw-Hill 1970)

Foundations of Applied Mathematics
(Prentice-Hall 1978)

Advanced Engineering Mathematics
(4th edn, Wiley 1979)

Complex Variables
(Wiley 1974)
662109 Topic CO — 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. Advanced Engineering Mathematics 4th edn (Paperback) (Wiley 1979) (4th edn is preferable but 3rd edn will suffice)

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

References

Courant, R. Differential and Integral Calculus Vol. II (Wiley 1968)


Sneddon, I. N. Fourier Series (Routledge 1961)


An extended list of references will be available to students enrolling in the topic.

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

Prerequisites Nil

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

Examination One 2-hour paper

Content

Text
Lipschutz, S. Linear Algebra (Schaum 1974)

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

662201 Topic E — Topic in Applied Mathematics e.g. Mechanics, Potential Theory and Fluid Dynamics — C. A. Croxton

Prerequisite or Corequisite Nil

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

Examination One 2-hour paper

Content

Text
Nil

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


Prerequisites Nil

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

Examination One 2-hour paper

Content
662204  Topic I — Probability & Statistics — R. G. Keats

**Prerequisites**  Nil

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

**Examination**  One 2-hour paper

**Content**  

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

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

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

Gnedenko, B. V.  
*The Theory of Probability* Chapters I & II (Chelsea 1962)

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

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

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

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

Mendenhall, W. & Scheaffer, R. L.  
*An Introduction to Probability Theory* (Duxbury 1973)

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


**Prerequisite or Corequisite**  Topic H

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

**Examination**  One 2-hour paper

**Content**  

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

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

**References**  

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

**Prerequisites**  Nil

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

**Examination**  One 2-hour paper

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

**Text**  Nil
References
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)

663204 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
Giles, J. R. *Analysis of Metric Spaces* (University of Newcastle 1974)

References
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 44 et seq., and Computer Science, described on page 73 et seq.

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

Passes in both Mathematics IIA and IIC are prerequisite for entry to Mathematics IIIA, and Mathematics IIIA is pre- or corequisite for Mathematics IIIIB. It will be assumed that students taking a third-year subject in 1981 have already studied topics CO, D, K and L in 1980 (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 44 et seq. of this handbook.

List of Topics for Part III Mathematics

<table>
<thead>
<tr>
<th>Topic</th>
<th>Prerequisite</th>
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<tbody>
<tr>
<td>FM</td>
<td>K, L</td>
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<tr>
<td>M</td>
<td>CO</td>
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<tr>
<td>N</td>
<td>CO</td>
</tr>
<tr>
<td>O</td>
<td>K, L</td>
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<tr>
<td>P</td>
<td>CO, D, L</td>
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<tr>
<td>PD</td>
<td>CO</td>
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<tr>
<td>PL</td>
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<td>Q</td>
<td>CO</td>
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<td>QRS</td>
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<td>R</td>
<td>H</td>
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<td>S</td>
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<td>ST</td>
<td>H</td>
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<tr>
<td>T</td>
<td>D, K</td>
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<tr>
<td>TC</td>
<td>CO, F</td>
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<td>U</td>
<td>H</td>
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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>
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<tr>
<td>Y</td>
<td>CO, H</td>
</tr>
<tr>
<td>Z</td>
<td>CO, D, *</td>
</tr>
</tbody>
</table>

* In 1982 Topic F will probably be an additional prerequisite.

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 at least one of P, PD, QRS, R, ST, 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. Students should consult members of academic staff regarding their choice of topics.

663200 Mathematics IIIIB

Prerequisite or Corequisite Mathematics IIIA

Hours 4 lecture hours and 2 tutorial hours per week
Examination
Each topic is examined separately

Content
A subject comprising four topics chosen from the topics listed above. Students should consult members of academic staff regarding their choice of topics.

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

STATISTICS SUBJECT

663300 Statistics III

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

Hours
4 lecture hours and 2 tutorial hours per week

Examination
Each topic is examined separately

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

Prerequisites
Topics K & L

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

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

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

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

References
Abram, J. Tensor Calculus through Differential Geometry (Butterworths 1965)
Lichnerowicz, A. Elements of Tensor Calculus (Methuen 1962)
Tyllesley, J. R. An Introduction to Tensor Analysis (Longman 1975)
Willmore, T. J. An Introduction to Differential Geometry (Oxford 1972)

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

Text
Nil

References
Abram, J. Tensor Calculus through Differential Geometry (Butterworths 1965)
Lichnerowicz, A. Elements of Tensor Calculus (Methuen 1962)
Tyllesley, J. R. An Introduction to Tensor Analysis (Longman 1975)
Willmore, T. J. An Introduction to Differential Geometry (Oxford 1972)

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

Prerequisite
Topic CO

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

Examination
One 2-hour paper

Content

References
A Survey of Modern Algebra 3rd edn (Macmillan 1965)
Foundations of Real Numbers (McGraw-Hill 1967)
The Structure of the Real Number System (Van Nostrand 1963)
What is Mathematics? (Oxford 1961)
Naive Set Theory (Van Nostrand 1960)
Foundations of Analysis (Chelsea 1951)
Algebra 2nd edn (Macmillan 1979)
Introduction to the Foundation of Mathematics (Wiley 1965)

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

663103 Topic O — Mathematical Logic — W. Brisley
Prerequisites
Topics K & L

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

Examination
One 2-hour paper

Content
Introduction: inference rules as a formalisation of deductive processes; sets; axiomatic theories; predicates. The sentential calculus, predicate calculus and predicate calculus with equality. First order theories; consistency, independence and completeness. Examples will be taken from the usual axiomatically defined Mathematical systems, and Gödel's undecidability theorem will be discussed.

Text
Mendelson, E. Introduction to Mathematical Logic 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)
Hedden, G. E. & Kennison, J. F. Zermelo-Fraenkel Set Theory (Merrill 1968)
Hofstadter, D. R. Gödel, Escher, Bach: an Eternal Golden Braid (Harvester Press 1979)
Kleene, C. Mathematical Logic (Wiley 1967)

663104 Topic P — Ordinary Differential Equations — J. G. Couper
Prerequisites
Topics CO, D & L

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

Examination
One 2-hour paper

Content

Text
Nil

References
Couper, 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
1 lecture hour per week and 1 tutorial hour per fortnight

Examination
One 2-hour paper

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

Text
Nil

References
Smith, M. G. Introduction to the Theory of Partial Differential Equations (Van Nostrand 1967)

663211 Topic PL — Programming Languages & Systems — W. D. Wallis
Prerequisite
Knowledge of FORTRAN and PASCAL

Hours
2 lecture hours per week and 1 tutorial hour per week in the latter part of the year

Examination
One 2-hour paper

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

Text
Pratt, T. W. Programming Languages: Design and Implementation (Prentice-Hall 1975)
References
Elson, M. Concepts of Programming Languages (Science Research Associates 1973)
Griswold, R. E. et al. The SNOBOL Programming Language 2nd edn (Prentice-Hall 1971)
Elson, S. Programming Languages: History and Fundamentals (Prentice-Hall 1969)
Siklossy, L. Let’s Talk LISP (Prentice-Hall 1975)
Tucker, A. B. Programming Languages (McGraw-Hill 1977)

663105 Topic Q — Fluid Mechanics — W. Summerfield

Prerequisites
Topic CO

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

Examination
One 2-hour paper

Content
Basic concepts: continuum, pressure, viscosity. Derivation of the equations of motion for a real incompressible fluid; Poiseville and Stokes’ boundary layer flow. Dynamical similarity and the Reynolds number. Flow at high Reynolds number; ideal (non-viscous) fluid; simplification of the equations of motion: the case of irrotational flow; Kelvin’s circulation theorem; Bernoulli equations. Investigation of simple irrotational inviscid flows; two-dimensional flows; circulation; axisymmetric flow around sphere; virtual mass. Generation of vorticity at solid boundaries; boundary layers and their growth in flows which are initially irrotational.

Text
Nil

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

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

Prerequisite
Topic H

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

Examination
One 2-hour paper

Content

Text
Nil

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

663107 Topic S — Geometry — T. K. Sheng

Prerequisites
Nil

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

Examination
One 2-hour paper
Content
Euclidean geometry: axiomatic and analytic approach, transformations, isometries, decomposition into plane reflections, inversions, quadratic geometry.
Geometry of incidence: the real projective plane, invariance, projective transformation, conics, finite projective spaces.

Text
Nil

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

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 queuing systems and other appropriate applications will be studied.

Text
Feller, W. An Introduction to Probability Theory and its Applications (Wiley 1968)

References
Cox, D. R. & Smith, W. L. Queues (Chapman & Hall 1979)

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

Prerequisite
Topic H

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

Examination
One 2-hour paper

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

Text
Nil

References
Cochran, W. G. & Cox, G. M. Experimental Designs (Wiley 1964)
Fisher, R. A. The Design of Experiments Any edn (Oliver & Boyd)
Kendall, M. G. & Stuart, A. The Advanced Theory of Statistics (Griffin 1966)
Peng, K. C. The Design and Analysis of Scientific Experiments (Addison-Wesley 1967)
663203  Topic V — Measure Theory & Integration — V. Ficker

Prerequisite  Topic I.

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

Examination  One 2-hour paper

Content

Text
de Barra, G.  Introduction to Measure: Theory (Van Nostrand 1974)

References
Bartle, R. G.  The Elements of Integration (Wiley 1966)
Halmos, P. R.  Measure Theory (Van Nostrand 1950)
Munroe, M. E.  Introduction to Measure and Integration (Addison Wesley 1953)

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

Prerequisite  Topic L.

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

Examination  One 2-hour paper mid-year

Content
Hilbert space, the geometry of the space and the representation of continuous linear functionals. Operators on Hilbert space, adjoint, self-adjoint and projection operators. Complete orthonormal sets and Fourier analysis on Hilbert space. Banach spaces, topological and isometric isomorphisms, finite dimensional spaces and their properties. Dual spaces, the Hahn-Banach Theorem and reflexivity. Spaces of operators, conjugate operators.

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

References
Banach, S.  Théories des Opérations Linéaires 2nd edn (Chelsea)
Giles, J. R. & Fomin, S. V.  Analysis of Metric Spaces (University of Newcastle 1975)
Kreysig, E.  Introductory Functional Analysis with Applications (Wiley 1978)
Simmons, G. F.  Introduction to Topology and Modern Analysis (McGraw-Hill 1963)

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

Prerequisites
Topics D & K.

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

Examination  One 2-hour paper

Content

Text
Nil

References
Birkhoff, G. D. & MacLane, S.  A Survey of Modern Algebra (Macmillan 1953)
Herstein, I. N.  Topics in Algebra (Wiley 1975)
Kaplansky, I.  Fields and Rings (Chicago U.P. 1969)
Stewart, I.  Galois Theory (Chapman & Hall 1973)

663206  Topic Y — Theory of Probability — V. Ficker

Prerequisites
Topics CO & H.

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

Examination  One 2-hour paper

Content
Probability spaces, random variables, integration of random variables, various types of convergence of random variables, conditional expectations, independence of random variables and products of probability spaces.

Text
Nil

References
Burrill, C. W.  Measure, Integration and Probability (McGraw-Hill 1972)
Loève, M. Probability Theory (Van Nostrand 1960)

664100 Mathematics IV

Prerequisites
Mathematics IIIA and at least one of Mathematics IIIB, Computer Science III or Statistics III and additional work as prescribed by the Head of the Department of Mathematics.
A student desiring admission to this subject 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 70.

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)
Dvinsky, N. Rings and Radicals (Allen-Unwin 1964)
Herstein, I. N. Noncommutative Rings (Wiley 1968)
Kaplansky, I. Fields and Rings (Chicago 1969)
McCoy, N. The Theory of Rings (McMillan 1965)
Wagner, R. The Ring of the Nibelungen (Philips 1973)

664157 Concurrent Programming Techniques – Not offered in 1981

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

664166 Symmetry – W. Brisley

Prerequisites
Topics D and K

Hours
About 27 lecture hours

Examination
One 2-hour paper

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

Text
Nil

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

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

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

Reference

664120 Quantum Mechanics – C. A. Croxton

Prerequisites
Nil

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.
### 664140 Dynamical Systems — J. G. Couper

**Prerequisites**
Topics I. and P

**Hours**
About 27 lecture hours

**Examination**
One 2-hour paper

**Content**
This course will be concerned with the orbit structure of differential equations beginning with two dimensional systems, and then dealing with the existence and stability of periodic solutions of more general systems.

**Text**
Nil

**References**

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

**Prerequisite**
Topic D

**Hours**
About 27 lecture hours

**Examination**
One 2-hour paper

**Content**

**Text**
*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)
- Ore, O. *The Four Colour Problem* (Academic 1967)
- White, A. T. *Graphs, Groups and Surfaces* (North Holland American Elsevier 1973)
- Wilson, R. J. *Introduction to Graph Theory* (Oliver & Boyd 1972)

### 664167 Measure Theory — V. Ficker

**Prerequisite**
Topic V

**Hours**
About 27 lecture hours

**Examination**
One 2-hour paper

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

**Text**
Nil

**References**
- Berberian, S. K. *Measure and Integration* (Macmillan 1965)
- Halmos, P. R. *Measure Theory* (Van Nostrand 1950)
- Rogers, C. A. *Hausdorff Measures* (Cambridge 1970)
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, normality and finite dimensional cases. We examine continuity and separation for locally convex spaces, continuity for convex functions. We study weak and weak * topologies on normed linear spaces: convexity properties and Banach-Alaoglu theorem. We study extreme points of convex sets, the Krein-Milman theorem. We give particular attention to the study of differentiation of convex functions on normed linear spaces: Gateaux and Frechet derivative, Mazur's and Asplund's theorems.

Text
Giles, J. R. (1980) An Introduction to Convex Analysis with Applications in the Differentiation of Convex Functions (University of Newcastle)

References
Diestel, J. (Springer 1975) Geometry of Banach Spaces—Selected Topics
Giles, J. R. (University of Newcastle 1978) Analysis of Normed Linear Spaces
Holmes, R. B. (Springer 1975) Geometric Functional Analysis and its Applications
Simmons, G. F. (McGraw-Hill 1963) Introduction to Topology and Modern Analysis
Wilansky, A. (Blaisdell 1964) Functional Analysis

664148 High Level Software Development — A. J. Guttman

Prerequisite
Programming experience in a high-level language is assumed

Hours
About 27 lecture hours concentrated into the first two terms

Examination
One 2-hour paper and assignments throughout the course

Content
This course covers the writing of medium to large scale software projects. The course covers: software tools and packages, data base management systems and involves a series of review seminars on current software engineering literature. Parts of the course are run as a seminar series with all participants contributing. The writing of successful programs is integral to the course, and in the data base section a small online multiuser data base is developed as a class project.
664116 Mathematical Models of Phase Transitions — A. J. Guttmann, J. S. Reeve

**Prerequisites**
Nil

**Examination**
About 27 lecture hours

**Content**

**Text**

664124 Signal Detection — R. G. Keats

**Prerequisite**
Topic H

**Examination**
One 2-hour paper

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

**Text**
Nil

664150 General & Algebraic Topology — M. J. Hayes

**Prerequisite**
Topic L

**Hours**
About 27 lecture hours

**Examination**
One 2-hour paper
664145  Viscous Flow Theory  W. I. F. Lau

Prerequisite  Topic Q

Hours  About 27 lecture hours

Examination  One 2-hour paper

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

Text  Nil

References
Batchelor, G. K.  *An Introduction to Fluid Dynamics* (Cambridge 1967)
Langlois, W. E.  *Slow Viscous Flow* (Macmillan 1964)
Schlichting, H.  *Laminar Boundary Layers* (Oxford 1963)

664118  Perturbation Theory  D. L. S. McElwain

Prerequisites  Topic CO

Hours  About 27 lecture hours

Examination  One 2-hour paper

Content

Text  Nil

References
Cole, J. D.  *Perturbation Methods in Applied Mathematics* (Blaisdell 1968)
Nayfeh, A. H.  *Perturbation Methods* (Wiley 1973)
The University of Newcastle Calendar consists of the following volumes:

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

Volume 2 - University Bodies and Staff
   Part 1 Principal Officers, Council, Senate, Boards and Committees,
   Part 2 The Professors and Staff

Volume 3 - Handbook, Faculty of Architecture
Volume 4 - Handbook, Faculty of Arts
Volume 5 - Handbook, Faculty of Economics and Commerce
Volume 6 - Handbook, Faculty of Education
Volume 7 - Handbook, Faculty of Engineering
Volume 8 - Handbook, Faculty of Mathematics
Volume 9 - Handbook, Faculty of Medicine
Volume 10 - Handbook, Faculty of Science
Volume 11 - Annual Report

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

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

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

Other Publications
Undergraduate Prospectus
Postgraduate Prospectus
Information for Students
University News
Gazette

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1 PRINCIPAL DATES 1981

January
1 Thursday  Public Holiday — New Year’s Day
9 Friday  Last day for return of Re-Enrolment Forms
Continuing Students
12 Monday  Deferred Examinations begin
23 Friday  Deferred Examinations end
26 Monday  Public Holiday — Australia Day
31 Saturday  Closing date for applications for residence in
Edwards Hall

February
11 Wednesday  New students attend in person to enrol and pay
charges
12 Thursday  Late enrolment session for new students

March
2 Monday  First Term begins

April
17 Friday  Good Friday — Easter Recess commences
22 Wednesday  Lectures resume
22 Wednesday  Last day for withdrawal without academic penalty
from first half year subjects
25 Saturday  Public Holiday — Anzac Day

May
9 Saturday  First Term ends
25 Monday  Examinations begin
29 Friday  Examinations end

June
1 Monday  Second Term begins
8 Monday  Public Holiday — Queen’s Birthday
12 Friday  Last day for return of Confirmation of Enrolment
forms
30 Tuesday  Closing date for Applications for Admission to the
Bachelor of Medicine course in 1982

July
6 Monday  Last day for withdrawal without academic penalty
from full year subjects
6 Monday  Examinations begin
10 Friday  Examinations end

August
8 Saturday  Second Term ends
10 Monday  Examinations begin
14 Friday  Examinations end
31 Monday  Third Term begins

September
7 Monday  Last day for withdrawal without academic penalty
from second half year subjects

October
1 Thursday  Closing date for Applications for Admission 1982
(Undergraduate courses other than Medicine)
5 Monday  Public Holiday — Eight Hour Day

November
2 Monday  Annual Examinations begin
20 Friday  Annual Examinations end

Note: Term dates for students in the Bachelor of Medicine course are

1982

January
18 Monday  Deferred Examinations begin
29 Friday  Deferred Examinations end

March
1 Monday  First Term begins
II GENERAL INFORMATION

Enrolment of New Students

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

Enrolment of Continuing Students

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

1. Lodging Enrolment Forms
   Re-enrolment materials will be mailed to all undergraduate students in mid-December. Those who wish to enrol in 1981 and who are eligible to do so (see Regulations Governing Unsatisfactory Progress) should complete the enrolment form as soon as possible after the release of the 1980 annual examination results, and forward it to the Secretary, University of Newcastle, N.S.W., 2308.

2. Completing Enrolment
   When the proposed programme has been approved, an Authority to Complete Enrolment form will be mailed to the student showing charges payable. Students are required to complete enrolment by lodging the form with the Cashier with charges payable. This can be done by mail or in person. The Cashier's office is open 10 am to 12 noon and 2 pm to 4 pm Monday to Friday. At least 21 days notice is allowed from the date of posting to the date by which charges must be paid if a late charge is to be avoided.

Student Cards

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

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

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

Library Cards

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

Re-admission after Absence

A person who has been enrolled previously at the University of Newcastle, but not enrolled in 1980, is required to lodge an Application for Admission if further undergraduate enrolment is desired. Applications are available from the Student Administration Office and should preferably be lodged by 1 October 1980.

Attendance Status

Students enrol as full-time or part-time students as may be determined by the Dean of the Faculty.

Change of Address

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

Change of Name

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

Change of Programme

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

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

Withdrawal without Academic Penalty

A student is regarded as having failed in a subject if he enrols in it and does not pass the examination (not sitting for the examinations is regarded as not passing the examinations) unless withdrawal without penalty has been approved.

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

Withdrawal will normally be approved without penalty if the application to withdraw is received by the Secretary before the date shown below.

<table>
<thead>
<tr>
<th>Subject</th>
<th>First Half-year Subjects</th>
<th>Second Half-year Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sixth Monday in First Term (9 July 1981)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eighth Monday in Second Term (22 April 1981)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Unless the Dean of the Faculty grants permission for withdrawal without penalty a student who withdraws after the date shown above will be deemed to have failed in the subject or subjects.

(vi)
Confirmation of Enrolment

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

Indebtedness

The Council of the University has directed that students who are indebted to the University because of unpaid charges, library fines or parking fines may not complete enrolment in a following year;

- receive a transcript of academic record; or
- graduate or be awarded a Diploma.

Students are requested to pay any debts incurred without delay.

Leave of Absence

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

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

Attendance at Classes

Students are expected to be regular and punctual in attendance at classes in the course or subjects in which they are enrolled.

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

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

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

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

General Conduct

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

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

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

Notices

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

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

Student Matters Generally

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

III EXAMINATIONS

Tests and assessments may be held in any subject from time to time. In the assessment of a student's progress in a university course, consideration will be given to laboratory work, tutorials and assignments and to any term or other tests conducted throughout the year.

The results of such assessments and class work may be incorporated with those of formal written examinations.

Examination Periods

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

- **End of First Term:** 25 to 29 May, 1981
- **Mid Year:** 6 to 10 July, 1981
- **End of Second Term:** 10 to 14 August, 1981
- **End of Year:** 3 to 20 November, 1981

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

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

Sitting for Examinations

Formal examinations, where prescribed, are compulsory. Students should consult the final timetable in advance to find out the date, time and place of their examinations and should allow themselves plenty of time to get to the examination room so that they can take advantage of the 10 minutes reading time that is allowed before the examination commences.

Formal examinations are usually held in the Great Hall area and (in November) the Auchmuty Sports Centre. The seat allocation list for each examination will be on a noticeboard outside the room.

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

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

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

Rules for Formal Examinations

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

- (a) candidates shall comply with any instructions given by a supervisor relating to the conduct of the examination;
- (b) before the examination begins candidates shall not read the examination paper until granted permission by the supervisor which shall be given ten minutes before the start of the examination;

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

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

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

Appeals against exclusion must be lodged together with re-enrolment forms by Friday 9 January 1981.

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

**Regulations Governing Unsatisfactory Progress**

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

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

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

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

2. (2) The enrolment of a student in a subject shall not be terminated pursuant to regulations 2 (1) of these Regulations unless he has been given prior written notice of the intention to consider the matter with brief particulars on the grounds for so doing and has also been given a reasonable opportunity to make representations either in person or in writing or both.

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

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

3. (1) A Faculty Board may review the academic performance of a student who does not maintain a rate of progress considered satisfactory by the Faculty Board and may determine:
   (a) that the student be permitted to continue the course;
   (b) that the student be permitted to continue the course subject to such conditions as the Faculty Board may decide;
   (c) that the student be excluded from further enrolment;
       (i) in the course; or
       (ii) in the course and any other course offered in the Faculty;
       or
       (iii) in the Faculty; or

(c) no candidate shall enter the examination room after thirty minutes from the time the examination has begun;

(d) no candidate shall leave the examination room during the first thirty minutes or the last ten minutes of the examination;

(e) no candidate shall re-enter the examination room after he has left it unless during the full period of his absence he has been under approved supervision;

(f) a candidate shall not bring into the examination room any bag, paper, book, written material, device or aid whatsoever, other than such as may be specified for the particular examination;

(g) a candidate shall not by any means obtain or endeavour to obtain improper assistance in his work, give or endeavour to give assistance to any other candidate, or commit any breach of good order;

(h) a candidate shall not take from the examination room any examination answer book, graph paper, drawing paper or other material issued to him for use during the examination;

(i) no candidate may smoke in the examination room.

Any infringement of these rules constitutes an offence against discipline.

**Examination Results**

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

No results will be given by telephone.

After the release of the annual examination results a student may apply to have a result reviewed. There is a charge of $8.00 per subject, which is refundable in the event of an error being discovered. Applications for review must be submitted on the appropriate form together with the prescribed review charge by 15 January 1982.

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

**Special Examinations**

When considering the examination results Faculty Boards take into consideration any circumstances such as illness or personal problems which may have seriously affected a student's work during the year or during the examinations. Any student who considers that his work has been affected in this way or who is unable to attend for any examination and who wishes to apply for special consideration should write to the Secretary explaining the circumstances and, in the case of illness, enclosing a medical certificate (see Regulation 12 (2) of the Examination Regulations, Calendar Volume 1).

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

**Deferred Examinations**

The Boards of the Faculties of Architecture, Engineering, and Mathematics may grant deferred examinations. Such examinations, if granted, will be held in January-February and candidates will be advised by mail of the times and results of the examinations.
(d) if the Faculty Board considers its powers to deal with the case are inadequate, that the case be referred to the Admissions Committee together with a recommendation for such action as the Faculty Board considers appropriate.

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

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

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

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

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

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

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

6. (1) The Admissions Committee shall consider any case referred to it by a Faculty Board and may:

(a) make any decision which the Faculty Board itself could have made pursuant to regulation 3 (1) (a) (b) or (c) of these Regulations; or

(b) exclude the student from enrolment in such other subjects, courses, or Faculties as it thinks fit; or

(c) exclude the student from the University.

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

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

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

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

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

(a) by the Faculty Board, where the student has been excluded from a single course or a single Faculty; or

(b) by the Admissions Committee, in any other case.

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

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

V CHARGES

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

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

For re-enrolling students at least 21 days notice is allowed from the date of mailing the Authority to Complete Enrolment form to the date by which charges must be paid. The actual date where a candidate for a single course, or a single Faculty, will be printed on the form. A later date will be set if approval of the proposed programme has been delayed or if the student has taken Special or Deferred examinations.

<table>
<thead>
<tr>
<th>Charges</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Services Charge</strong></td>
</tr>
<tr>
<td>(a) Students proceeding to a Degree or Diploma</td>
</tr>
<tr>
<td>Full-time students</td>
</tr>
<tr>
<td>Part-time students</td>
</tr>
<tr>
<td>Plus Students joining Newcastle University Union for the first time</td>
</tr>
<tr>
<td>(b) Non-Degree Students</td>
</tr>
<tr>
<td>Union charge</td>
</tr>
</tbody>
</table>

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

2. **Late Charges**

(a) **Late Lodgement of Enrolment Form**

Where a continuing student does not lodge application by Friday, 9 January, 1981: $14

Where a candidate for a special or deferred examination in January does not lodge re-enrolment application by Monday, 16 February, 1981: $14

(b) **Late Lodgement of Authority to Complete Enrolment Form with Cashier**

Where the Authority to Complete Enrolment Form together with:

(i) General Services Charge payable; or

(ii) Evidence of sponsorship (e.g. scholarship voucher or letter from Sponsor); or
Term, the General Services charge covers the period from the first day of the term to the Friday immediately preceding the first day of First Term in the following academic year. Where enrolment is on or after the first day of Third Term, the General Services charge paid will cover liability to the end of the long vacation following the next academic year.

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

Refund of Charges

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

Payment of Charges

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

Scholarship Holders and Sponsored Students

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

Extension of Time to Pay Charges

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

VI CAMPUS TRAFFIC AND PARKING

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

If the Vice-Principal, after affording the person a period of seven days in which to submit a written statement is satisfied that any person is in breach of Regulations, he may:
(a) warn the person against committing any further breach; or  
(b) impose a fine; or  
(c) refer the matter to the Vice-Chancellor.

The range of fines which may be imposed by the Vice-Principal in respect of various categories of breach include:
- Parking in areas not set aside for parking ........................................... $4  
- Parking in special service areas, e.g. loading bays, fire hydrants, etc.......................................................... $10  
- Failing to display a valid permit ....................................................... $4  
- Driving offences including speeding and dangerous driving ........... up to $25  
- Failing to stop when signalled to do so by an Attendant (Patrol) ...... up to $25  
- Refusing to give information to an Attendant (Patrol) ................. up to $25  
- Failing to obey the directions of an Attendant (Patrol) ................. up to $25

The Traffic and Parking Regulations are stated in full in the Calendar, Volume 1.
664106 Combinatorics — Not offered in 1981

Prerequisite
Topic K

Hours
About 27 lecture hours

Examination
One 2-hour paper

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

Text
Nil

References
Beckenback, E. F. (ed.) Applied Combinatorial Mathematics (Wiley 1964)
Hall, M. Combinatorial Theory (Blaisdell 1967)
Liu, C. L. Introduction to Combinatorial Mathematics (McGraw-Hill 1968)
Riordan, J. Combinatorial Analysis (Wiley 1958)

664134 Recursion Theory — Not offered in 1981

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 CO

Hours
About 27 lecture hours

Examination
One 2-hour paper

Content

Text
Nil

References

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

Text
Nil

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

Prerequisites
Topics CO and H

Hours
About 27 lecture hours

Examination
One 2-hour paper

Content

References
Kendall, M. G. & Kendall, M. G. & Moran, P. A. P. & Mardia, K. V. &

* Available for the Diploma in Environmental Studies (if offered) in 1981.

664149 Coding Theory — W. D. Wallis

Prerequisites
Topics D and K

Hours
About 27 lecture hours

Examination
One 2-hour paper

Content
Introduction to codes; Hamming distance; linear codes; the Slepian-Moore-Prange algorithm; Hamming codes; perfect codes; polynomial codes; BCH codes.

References
Denes, J. & Keedwell, A. D. &

Latin Squares and their Applications (English U.P. and Akademiai Kiadó 1974)

Hall, M. Jr. &

Combinatorial Theory (Blaisdell 1967)

Mann, H. B. &

Addition Theorems, The Addition Theorems of Group Theory and Number Theory (Interscience 1965)

Raghavarao, D. &

Constructions and Combinatorial Problems in Design of Experiments (Wiley 1971)

Ryser, H. J. &

Combinatorial Mathematics (Wiley 1963)

Wallis, W. D. et al. &

Combinatorics: Room Squares, Sum-Free Sets, Hadamard Matrices (Springer 1972)

Wallis, W. D. &

Combinatorial Designs (Univ. of Surrey 1977)

664168 Astrophysical Applications of Magnetohydrodynamics — W. P. Wood

Prerequisites
Topics CO, PD

Hours
About 27 lecture hours

Examination
One 2-hour paper
The normal state of matter in the universe is that of a plasma, or ionized gas, permeated by magnetic fields. Moreover, these fields (unlike that of the earth) may be dominant, or at least significant, in controlling the structure of the region. The aim of this course is to investigate the effects of astrophysical magnetic fields, ranging from $10^{-3}$ gauss in the galaxy to $10^4$ gauss in a neutron star.

**References**

Cowling, T. G. *Magnetohydrodynamics* (Interscience 1957)

**SUPPLEMENTARY LIST**

(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.)

**Department of Electrical Engineering**

EE443 Optimization Techniques — see page 92
EE447 Digital Communications — see page 93

**Department of Mechanical Engineering**

ME404 Mathematical Programming I — see page 102
ME407 Operations Research — Deterministic Models — see page 102
ME488 Operations Research — Probabilistic Models — see page 102

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

**COMPUTER SCIENCE SUBJECTS**

**PART II SUBJECT**

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**

A statement concerning the relation between the Diploma in Computer Science and the undergraduate subjects Computer Science II and III can be found on page 10.

**662401 Topic SI — Introduction to Structuring of Information** — P. J. Moylan

**Prerequisite**

Mathematics I

**Corequisite**

Topic SP

**Hours**

1 lecture hour per week and 1 tutorial hour per fortnight

**Examination**

One 2-hour paper

**Content**

Influence of structuring of information on design of programming languages.

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

**Text**

Nil

**References**

Elson, M. *Data Structures* (Science Research Associates 1975)
Grogono, P. *Programming in PASCAL* 2nd edn (Addison-Wesley 1980)
Wirth, N. *Algorithms + Data Structures = Programs* (Prentice-Hall 1976)

**662402 Topic SP — Systematic Programming** — R. J. Vaughan

**Prerequisite**

Mathematics I
662404 Topic ML — Introduction to Logic & Assembly Languages —
B. D. O. Anderson

Prerequisite
Mathematics I

Hours
2 lecture and practical work hours per week for first two terms

Examination
Progressive assessment and final examination

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

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

Texts
Eckhouse, R. H. Jr

Processor Handbook (PDP-11) 03/34/45/55/60 Digital Equipment Corporation

References
Chu, Y. H.

Computer Organization and Micro Programming (Prentice-Hall 1972)
Donovan, J. J.
Friedman, A. D.
Stone, H. S.

Introduction to Computer Organization and Data Structures (McGraw-Hill 1972)

662202 Topic F — Numerical Analysis and Computing — see page 39

PART III SUBJECT

663400 Computer Science III

Prerequisites
Computer Science II, Mathematics IIA and Mathematics IIC

Hours
See individual topics

Examination
See information given in descriptions of individual topics

Content
At least five topics from the list of topics given below, provided that at least two of the topics numbered 1, 3 and 7 are included. (It is recommended that a student should include all three of these topics in his programme).

Topics
1. Compiler Construction (*EE464)
†2. Commercial Programming & Systems Analysis (one topic composed of the combination of (i) Commercial Programming and (ii) Systems Analysis of the Diploma course)
3. Computer Operating Systems (*EE463)
4. Switching Theory & Logical Design (*EE362)
5. Mathematical Logic (**O)
6. Mathematical Principles of Numerical Analysis (**Z)
7. Programming Languages & Systems (*PL)
8. Theory of Computing (**TC)
†9. Systems Design (*CS — Diploma course)

Notes
* Not available for selection by students who have previously passed this course, or who are enrolled for it explicitly, extraneous to Computer Science III, in the year in which they are enrolled for Computer Science III.
** Not available for selection by students who have passed Mathematics IIA including the topic or who are enrolled for Mathematics IIA including the topic concurrently with Computer Science III, or who have passed (as an elective topic) the Part III Mathematics topic whose abbreviation is given following the asterisks.
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 first half year

Examination
Progressive assessment and final examination

Content

Text
Aho, A. V. & Ullman, J. D. Principles of Compiler Construction (Addison-Wesley 1977)

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

410129 Commercial Programming & Systems Analysis

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

Hours
4 lecture hours per week for 1st half year and associated practical work

Examination
Examination at mid-year

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

Texts
D.E.C. Feingold, C.

References
Chai, W. A. & H. W. Clifton, H. D.

Programming Standard COBOL (Academic)

Systems Analysis for Business Data Processing (Business Books)

Elementary Cobol Programming (McGraw-Hill)

Learning COBOL Fast (Reston)

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

Systems Design for Computer Applications (Wiley)

Programming Business Computers (Wiley)

Standard COBOL (S.R.A.)

Computers in Business (McGraw-Hill)

Computing with COBOL (Harper & Row)

Cobol Programming (Wiley)

Cobol Programming (Heinemann)

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

Texts
Gore, M. & Stubbe, J. Elements of Systems Analysis (W. C. Brown)
Gore, M. & Stubbe, J. Elements of Systems Analysis Workbook (William C. Brown)

References
Davis, W. Information Processing Systems (Addison-Wesley)
Davis, W. Information Processing Systems — Student Workbook (Addison-Wesley)
Gidlersleeve, T. Successful Data Processing Systems Analysis (Prentice-Hall)

534138 Computer Operating Systems — A. Cantoni

Prerequisite
EE264 Introduction to Logic & Assembly Languages or Topic ML

Hours
Three hours per week for the second half of the year

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

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

References
Coffman, E. G. & Denning, P. J. Operating Systems Theory (Prentice-Hall)
Madnick, S. E. & Donovan, J. J. Operating Systems Principles (Prentice-Hall)

533902 Switching Theory & Logical Design — K. K. Saluja
Prerequisite Mathematics I and Topic ML

Hours 3 hours of lectures, tutorials and practical work per week for first half year

Examination Progressive assessment and final examination

Content
Boolean algebra, combinational logic, logical circuits, minimization techniques, threshold logic. Data representation, binary arithmetic, codes, error checking and correcting. Sequential logic, flip-flops, state diagrams, state reduction, races and hazards. Logic subsystems: registers, adders, counters, converters, coders, etc. Basic architecture of digital computers.

Lectures will be supplemented by practical assignments on logic trainers and some tutorial sessions.

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

663401 Mathematical Logic — W. Brisley
Prerequisites Topics K & L

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

Examination One 2-hour paper

Content
Introduction: inference rules as a formalisation of deductive processes; sets; axiomatic theories; predicates. The sentential calculus, predicate calculus and predicate calculus with equality. First order theories; consistency, independence and completeness. Examples will be taken from the usual axiomatically defined Mathematical systems, and Gödel's undecidability theorem will be discussed.

Text
Mendelson, E. Introduction to Mathematical Logic 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 1977)
Hayden, G. E. & Kennison, J. F. Zermelo-Fraenkel Set Theory (Merrill 1968)
Hofstadter, D. R. Gödel, Escher, Bach: An Eternal Golden Braid (Harvester Press 1979)
Kleene, S. C. Mathematical Logic (Wiley 1967)

663402 Mathematical Principles of Numerical Analysis — W. Summerfield

Prerequisites Topics CO & D; Some experience in programming computers is assumed

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

Examination One 2-hour paper

Content
Solution of linear systems of algebraic equations by direct and linear iterative methods; particular attention will be given to the influence of various types of errors on the numerical result, to the general theory of convergence of the latter class of methods and to the concept of "condition" of a system. Solution by both one step and 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.

Text
Numerical Analysis (McGraw-Hill 1973)
Computer Methods for Mathematical Computations (Prentice-Hall 1977)
Analysis of Numerical Methods (Wiley 1966)
Numerical Analysis (Addison-Wesley 1977)
Computational Methods in Ordinary Differential Equations (Wiley 1973)
The Finite Element Method in Partial Differential Equations (Wiley 1977)
Theory and Applications of Numerical Analysis (Academic 1973)
Prerequisite
Knowledge of FORTRAN and PASCAL.

Hours
2 lecture hours per week and 1 tutorial hour per week in the latter part of the year.

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, C, APL, ALGOL 68. Review of the mutual influences between the design of languages and the nature of the applications for which the languages have originally been intended.

Text
Pratt, T. W. Programming Languages: Design and Implementation (Prentice-Hall 1975)

References
Elson, M. Concepts of Programming Languages (Science Research Associates 1973)
Griswold, R. E. et al. The SNOBOL 4 Programming Language 2nd edn (Prentice-Hall 1971)
Sammet, J. E. Programming Languages: History and Fundamentals (Prentice-Hall 1969)
Siklossy, L. Let's Talk LISP (Prentice-Hall 1975)
Tucker, A. B. Programming Languages (McGraw-Hill 1977)

663404 Theory of Computing — A. J. Guttmann

Prerequisites
Topics CO & F

Hours
2 lecture hours per week and 1 tutorial hour per week for the first half-year.

Examination
One 2-hour paper and assignments throughout the course.

Content
This course will attract science, mathematics and engineering students who are interested in the theoretical foundations of computer science. Topics studied include the following: Mathematical Models of Computers: Finite Automata are introduced as a first approximation to a model of a computer and some of their properties are studied. Three equivalent models of computation are then introduced and compared. These models are Turing machines, counter machines, and recursive functions. Some of the limits of models of computation (unsolvability) are also discussed. Algorithmic Aspects of Computation: How "good" an algorithm do we have for performing some computation? Is there any way in which we can say that some algorithm is the "best" for accomplishing some task? Program Correctness: Methods of program verification are introduced and discussed. Formal Languages and Parsing: Methods of systematically and formally specifying the syntax of programming languages are discussed. Some parsing methods are introduced.

Text
Nil

References
Garey, M. R. & Johnson, D. S. Computers and Intractability (Freeman 1979)
Hopcroft, J. E. & Ullman, J. D. Formal Languages and Their Relation to Automata (Addison-Wesley 1969)

410128 Systems Design

Prerequisites
Commercial Programming, Systems Analysis

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

Examination
An examination at end of year.

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

Text

References
Algorithms in SNOBOL 4 (Prentice-Hall 1971)
Sammet, J. E. Programming Languages: History and Fundamentals (Prentice-Hall 1969)
Siklossy, L. Let's Talk LISP (Prentice-Hall 1975)
Tucker, A. B. Programming Languages (McGraw-Hill 1977)

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

The Design and Analysis of Computer Algorithms (Addison-Wesley 1974)
Computers and Intractability (Freeman 1979)
Formal Languages and Their Relation to Automata (Addison-Wesley 1969)
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
Meriam, J. L.

(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; perspective projection.

Texts
Levens, A. S.
Graphics, Analysis and Conceptual Design (John Wiley & Sons)

—
Australian Standard Engineering Drawing Practice CZI 1976 (Inst. of Engineers, Australia)

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 CZI 1976 (Inst. of Engineers, Australia)

Krick, E. V.
An Introduction to Engineering and Engineering Design (John Wiley & Sons)

(v) 531203 EE131 Circuit Fundamentals

Prerequisites
Nil

Hours
To be advised

Examination

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

Part 2 (Resistive Circuits)

Part 3 (Transient Circuits)
Inductance and Capacitance, Natural and Forced Response, Transients in RL, RC Circuits.

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

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

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

Text
Hayt, W. H. & Kemmerly, J. E.
Engineering Circuit Analysis 3rd edn. (McGraw-Hill)

(vi) 511108 ChE141 Industrial Process Principles

Hours
To be advised

Examination
Contents

Texts
Wall, T. F. An outline of Industrial Process Principles (Department of Chemical Engineering, University of Newcastle) Metric Conversion and the Use of S.I. Units 2nd edn (University of Newcastle)

(vii) 501102 GE151 Introduction to Materials Science

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

PART II

412700 Accounting II C

Prerequisites Accounting I, Mathematics I

Hours 4 lecture hours and 4 tutorial hours per week

Examination 4 3-hour papers at end of year 1 3-hour paper mid-year

Content Accounting IIA and Accounting IIB

Accounting IIA

Theory and practice of company accounting; accounting for the formation, reconstruction, amalgamation, take-over, official management, receivership and liquidation of companies; the preparation of holding company and group financial statements; equity accounting; presentation, analysis and interpretation of financial statements; the valuation of shares and goodwill; funds statements; accounting for inflation; accounting for executoryship, bankruptcy, hire purchase and instalment-purchase, lease agreements and tax-effect accounting.

Texts
Johnson, T. R. et al. The Law and Practice of Company Accounting in Australia 4th edn (Butterworths)
Taylor, R. B. & O'Shea, B. P. Questions on the Law & Practice of Company Accounting 2nd edn (Butterworths)
— Accountants Exercises 2nd edn (University of Newcastle)
— Companies Act, 1961 (N.S.W. Govt. Printer)
DeCoste, D. T. et al. Accounting for Managerial Decision Making 2nd edn (Wiley)
Horngren, C. T. Cost Accounting — A Managerial Emphasis 4th edn (Prentice-Hall)

522700 Civil Engineering II M

Prerequisites Mathematics I, CE111, ME131, GE112 and ME112

Hours 5 lecture hours & 2½ tutorial hours per week

Examination Five 3-hour papers

Content
(f) CE212 Mechanics of Solids I
(ii) CE213 Mechanics of Solids II
(iii) CE231 Fluid Mechanics I
(iv) CE232 Fluid Mechanics II
(v) CE222 Materials Technology

(f) 522102 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

Content
Stress, strain, axial load problems; states of stress and strain; stress-strain relationships; internal actions, internal stresses in beams; deflexion of beams; torsion in circular sections; combined stresses.
(ii) 522111 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

Content: Buckling of columns, introduction to theory of elasticity; non uni-planar bending; shear centre; torsion of non-circular sections; lateral instability of beams; energy methods.

Text: As for CE212

(iii) 522202 CE231 Fluid Mechanics I

Prerequisites: MATH 411, 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.


(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, similitude 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.
Preliminary Reading
Henderson, S. & Perison, G.

Text
Anthony, N. V. et al. (eds)

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)
Financial Accounting Standards Board
Goldberg, L.
Hendriksen, E. S.
Jager, M. O. et al.
Moonitz, M.
Parker, R. H. & Harcourt, G. C.
Sprouse, T. R. & Moonitz, M.
Vatter, W. J.

413200 Accounting IIIB

Prerequisite
Accounting II B

Hours
2 lecture hours per week

Examination
One 3-hour paper

Content
Selected contemporary problems in the theory and practice of managerial accounting. Topics studied include 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.

Texts
To be advised. Articles in Accounting Journals

413602 Financial Management

Prerequisites
Accounting I

Hours
2 lecture hours per week

Examination
One 3-hour paper

Content
An examination of some of the decision-making aspects of finance, such as, its goals and functions; financial planning, evaluation of capital projects; methods of capital budgeting; cost of capital; risk analysis and capital budgeting; capital structure; dividend policy; management of current assets; short and intermediate term financing; mergers and takeovers; liquidation and abandonment of assets. A critical evaluation of the role accountants adopt in providing relevant information for financial decisions.

Texts
Brigham, E. F. et al.
Cases in Managerial Finance (Holt, Rinehart & Winston)
Pierson, G. & Bird, R.
Business Finance (McGraw-Hill) OR
Weston, J. F. &
Managerial Finance (Holt, Rinehart & Winston)
Brigham, E. F.

References
Boudreaux, K. J. & Long, H. W.
Decisions in Financial Management (McGraw-Hill)
Brigham, E. F. et al.
Accounting, Finance and Management (Butterworths)
Chambers, R. J.
The Analytical Theory of Finance (Holt, Rinehart & Winston)
Jean, W. H.
Lerner, E. M.
Pollard, A. H.
Quirin, G. D.
Samuels, J. M. & Wilkes, F. M.
Solomon, E. & Pringle, J. J.
Van Horne, J.
Weston, J. F.
Weston, J. F. &
Brigham, E. F.

Contemporary Problems in Cost Accounting
(Houghton Mifflin 1966)
Pricing Practices and Strategies
(Conference Board)
Contemporary Cost Accounting and Control
(Dickenson 1970)
Production and Operations Management (Irwin)

Costs (Wiley)
Normative Models in Managerial Decision-Making
(N.A.A.)
Impediments to the Use of Management Information
(N.A.A.)
Planning Under Uncertainty: Multiple Scenarios and Contingency Planning (Conference Board)
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 Ecology and Quantitative Genetics.

(i) 713201 Environmental Physiology

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

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

**Animals**
Biology of reproduction in vertebrates with particular emphasis on gamete physiology.

**Texts**
Nalbandov, A. V. *Reproductive Physiology* 3rd edn (Freeman 1976)

**References**
Austin, C. R., & Short, R. V. *Reproduction in Mammals* Vols 1–6 (Cambridge 1972)

(ii) 713202 Animal Ecology and Quantitative Genetics

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

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

**Quantitative Genetics**

**Texts**
Krebs, C. J. *Ecology* 2nd edn (Harper & Row)
Stewart, J. (ed.) *S299 Genetics, Units 11, 12, 13* (Open University Press 1976)
Zar, J. H. *Biostatistical Analysis* (Prentice-Hall)

523700 Civil Engineering IIIH

**Prerequisite**
Civil Engineering IIIH, 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**
Rekrens
Capper, P. L. & Cassie, W. F.
Lambe, T. W.
SAA
Wu, T. H.

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

Prerequisites
CE212, CE213 & Maths I

Hours
2 lecture hours & 1 tutorial hour per week

Content

Text
Nil

(iii) 523306 CE333 Fluid Mechanics III

Prerequisite
CE232

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

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

Text
As for CE231

(iv) 523307 CE334 Fluid Mechanics IV

Prerequisite
CE333

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

Content
Open channel flow, basic concepts, energy and momentum principles, flow resistance, non-uniform flow, channel controls, channel transitions. Unsteady flow; surges in conduits, water hammer, elements of unsteady flow in open channels.

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

(v) 523107 CE351 Civil Engineering Systems I

Hours
1 lecture hour & ½ tutorial hour per week

Content
General introduction to the systems approach. Techniques available as aids to the identification of optimal policies — mathematical modelling, computer simulation, various mathematical programming techniques, heuristics. Choice of techniques, problem formulation. Example applications of the systems approach to civil engineering problems.

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

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

533900 Communications and Automatic Control

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

Hours
6 lecture, tutorial & laboratory hours per week

Content
Four of the following:
(i) 533213 EE341 Automatic Control
(ii) 533110 EE342 Linear System Theory
(iii) 534132 EE443 Optimization Techniques
(iv) 534136 EE444 Communications
(v) 534134 EE447 Digital Communications

(i) 533313 EE341 Automatic Control — G. C. Goodwin

Hours
3 lecture, tutorial & laboratory hours per week for first half year

Content

Description of components of servo-mechanisms and process control systems.
(ii) 533110 EE342 Linear System Theory — K. L. Hitz

Hours 3 lecture, tutorial & laboratory hours per week for second half year

Examination Progressive assessment & final examination


The course consists mainly of lectures which are supplemented by laboratory work and tutorial sessions.

Text As for EE341 Automatic Control

(iii) 534132 EE443 Optimization Techniques — Not offered in 1981

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)
3. A number of the calculus of variation, game theory and concludes with a discussion of the theory and economic application of the structure of an advanced economy.

2. The second section of the course deals with the theory and economic application of difference and differential equations, the mathematical reformulation and interpretation of traditional macro-theory (including matrix algebra), the techniques of input-output analysis, linear (and to a limited extent non-linear) programming, game theory and concludes with a discussion of the theory and economic application of the calculus of variation.

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)

Content
The first part 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 economies of the typical underdeveloped country will be investigated in order to understand underdevelopment and hence discuss development strategies. Theoretical models will be supplemented with case studies from Asia, Africa and Latin America 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)
Hicks, J. R. A Contribution to the Theory of the Trade Cycle (Clarendon 1967)
(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)
Gill, R. T.
Higgins, B.
Kindleberger, C.
Economic Development 2nd edn (McGraw-Hill 1965)
Meier, G. M. (ed.)
Myrdal, G.
Asian Drama (Twentieth Century Fund 1968)
Myint, H.
The Economics of Developing Countries 4th edn (Hutchinson 1973)
Szentes, T.
The Political Economy of Underdevelopment (Budapest: Akademiai Kiado 1973)
Todaro, M. P.
Economic Development in the Third World (Longmans 1977)

(iv) 423102 International Economics

Hours
2 lecture hours per week

Examination
One 3-hour paper and progressive assessment

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

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

References
Bhagwati, J. (ed.)
International Trade (Penguin 1972)
Caves, R. E. & Johnson, H. G. (eds)
Readings in International Economics (Allen & Unwin 1968)
Chacholiades, M.
Cooper, R. R. (ed.)
International Finance (Penguin 1969)
Ellsworth, P. T. & Leith, J. C.
The International Economy 5th edn (Macmillan 1975)
Grubel, H. C.
International Economics (Irwin 1977)

Heller, H. R.
Heller, H. R.
International Monetary Economics (Prentice-Hall 1974)
Kindleberger, C. P. & Lindert, P. H.
Overseas Economics 6th edn (Irwin 1978)
McCull, G. D. (ed.)
International Trade and Investment (Pelican 1972)
Snape, R. H.
International Trade and the Australian Economy 2nd edn (Longman 1973)

(v) 423103 Public Economics

Hours
2 lecture hours plus seminars

Examination
One 3-hour paper

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

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

Texts
Nil

References
Buchanan, J. M. & Flowers, M. R.
Public Economics (Irwin)

Macroeconomic Theory and Stabilisation Policy (McGraw-Hill)

Groenewegen, P. D. (ed.)
Australian Taxation Policy (Longman-Cheshire)

Public Finance in Australia: Theory and Practice (Prentice-Hall)

Johansen, L.
Reading in Macroeconomics (Prentice-Hall)

Keiser, N. F.
Cost-Benefit Analysis (Allen & Unwin)

Mishan, E. J.
Public Finance in Theory and Practice (McGraw-Hill)

Musgrave, R. A. & P. B.
Public Finance (Weidenfeld & Nicholson)

733300 Geology IIC

Prerequisites
Physics IIA, Mathematics IIA, IIC & Geology IIA

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

Examination
Two 3-hour papers plus assessment

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

Texts
Consult lecturers concerned

543500 Industrial Engineering I

Prerequisites
Mathematics IIA & IIC

Hours
Approximately 6 lecture hours per week

Examination
Progressive assessment & examination

Content
Four of the following:
(i) 543501 ME381 Methods Engineering
(ii) 543502 ME383 Quality Engineering
(iii) 543503 ME384 Design for Production
(iv) 544425 ME419 Bulk Materials Handling Systems Analysis and Design
(v) 544418 ME449 Reliability Analysis for Mechanical Systems
(vi) 544405 ME482 Engineering Economics I
(vii) 544463 ME483 Production Engineering
(viii) 544464 ME484 Engineering Economics II

(i) 543501 ME381 Methods Engineering

Hours
1½ hours per week

Examination
Progressive assessment

Content

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

(ii) 543502 ME383 Quality Engineering

Hours
1½ hours per week

Examination
Progressive assessment & examination

Content

Text
(vii) 544105 ME482 Engineering Economics I

**Hours**  
42

**Examination**  
To be advised

**Content**  

**Text**  
Smith, G. W.  
*Engineering Economy: Analysis of Capital Expenditures*  
3rd edn (Iowa State U.P. 1979)

(vii) 544463 ME483 Production Engineering

**Hours**  
42

**Examination**  
Progressive assessment & examination

**Content**  
Production systems; job shop, line production, group technology; Computer aided manufacture, numerically controlled systems; Materials handling. Production scheduling and sequencing. Computer algorithms for scheduling and sequencing problems.

**Text**  
Nil

(vii) 544464 ME484 Engineering Economics II

**Hours**  
1½ hours per week

**Examination**  
Progressive assessment

**Content**  

**Text**  
Smith, G. W.  
*Engineering Economy: Analysis of Capital Expenditures*  
3rd edn (Iowa State U.P. 1979)

553900 Mechanical Engineering IIIC

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

**Hours**  
6 hours per week

**Examination**  
Progressive assessment

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

(a) (i) ME361 Automatic Control  
(ii) ME401 Systems Analysis  
(iii) ME505 Systems Analysis, Organisation & Control  
(iv) ME487 Operations Research — Deterministic Models

(b) (ii) ME505 Systems Analysis, Organisation & Control  
(iv) ME487 Operations Research — Deterministic Models  
(v) ME488 Operations Research — Probabilistic Models

(c) (iii) ME505 Systems Analysis, Organisation & Control  
(vi) ME404 Mathematical Programming I  
(v) ME488 Operations Research — Probabilistic Models

(d) (i) ME361 Automatic Control  
(vii) ME434 Advanced Kinematics & Dynamics of Machines  
(viii) ME448 Introduction to Photomechanics  
(ix) ME449 Reliability Analysis for Mechanical Systems

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

**Hours**  
1½ hours per week

**Examination**  
Progressive assessment & examination

**Content**  

**Text**  
Fortmann, T. E. & Hitz, K. L.  
*Introduction to Linear Control Systems Theory*  
(Dekker 1977)

(ii) 544451 ME401 Systems Analysis

**Hours**  
1½ hours per week

**Examination**  
Progressive assessment & examination

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

**Texts**  
Berdat, J. S. & Piersol, A. G.  
*Measurement and Analysis of Random Data*  
(Wiley 1968)  
Schwarzenbach, J. & Gill, K. F.  
*System Modelling and Control*
(iii) 540126 ME505 Systems Analysis, Organization & Control

Hours 1½ hours per week

Examination Progressive assessment & examination

Content

Text
Nil

(iv) 544841 ME487 Operations Research — Deterministic Models

Hours 1½ hours per week

Examination Progressive assessment

Content
Concept of optimisation; optimisation approaches; formulation of models; linear programming; allocation and assignment; simplex method; duality; theory of games, parametric programming; integer programming; zero-one programming; quadratic programming; decomposition principle. Network theory; dynamic programming. Geometric programming. Applications.

Texts
Ackoff, R. L. & Sasienji, M. W. or Taha, H. A. or Wagner, H. W.

Fundamentals of Operations Research (Wiley)
Operations Research (Macmillan)
Principles of Operations Research (Prentice-Hall)

(v) 544842 ME488 Operations Research — Probabilistic Models — G. D. Butler

Hours 1½ hours per week

Examination Progressive assessment

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

Text
As for ME487

(vi) 544427 ME404 Mathematical Programming I — K. L. Hitz

Hours 1½ hours per week

Examination Progressive assessment

Content
Introduction to static optimization problems. Linear programming and its applications; the Simplex algorithm and its revised form; duality theory; sensitivity analysis. Transportation and assignment problems. Some problems involving networks: shortest paths and maximal flows. Introduction to linear programs in integers.

Text
Murty, K. G. Linear and Combinatorial Programming (Wiley 1976)

(vii) 544419 ME434 Advanced Kinematics and Dynamics of Machines

Hours 1½ hours per week

Examination To be advised

Content
Dynamic Motion Analysis: energy distribution method, equivalent mass-and-force method, the rate-of-change-of-energy method. Advanced Kinematics of the Plane Motion; the inflection circle, Euler-Savary equation, Bobillier’s construction, Hartmann’s construction. Introduction to synthesis: graphical and analytical methods.

Text
Hirschorn, J. Kinematics and Dynamics of Plane Motion (McGraw-Hill)

(viii) 544420 ME448 Introduction to Photomechanics

Hours 1½ hours per week

Examination Progressive assessment

Content

Text
Nil

(ix) 544418 ME449 Reliability Analysis for Mechanical Systems — A. J. Chambers/A. W. Roberts

Hours 1½ hours per week

Examination To be advised

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

743100  Physics IIIA
Prerequisites  Physics II, at least one Mathematics II subject which should include, in addition to topic CO (which counts as two topics), topic B and one of the topics D, F and H
Hours  Approximately 4 lecture hours & 8 laboratory hours per week
Examination  Assessment to the equivalent of 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.

753300  Psychology IIIIC
Prerequisites  Mathematics IIA, IIC & Psychology IIIC
Hours  4 lecture hours & 3 laboratory hours per week
Examination  To be advised

Content
Computer Assisted Data Analysis
Personality Assessment
Vision
Human Information Processing
Cognition
Perception
Two additional topics to be selected from Psychology IIIA or IIIIB. Students will also be required to complete an independent investigation in mathematical psychology under supervision.

Text  To be advised
References  To be advised

SCHEDULE C

664300  Mathematics/Physics IV
Prerequisites  Mathematics IIIA & Physics IIIA & such additional work as is required for combined honours students by the Dept of Mathematics. A student desiring admission to this subject must apply in writing to the Dean of the Faculty of Mathematics before 7th December of the preceding year.
Hours  To be advised. A project of mathematical and physical significance, jointly supervised.
Examination  Assessment will be in the appropriate Mathematics & Physics topics selected. In addition the research project will be evaluated and normally an oral examination conducted.

Content
The student shall complete four topics from Mathematics IV, chosen for their application to Physics, and topics from Physics IV, as approved by Head of Department of Physics. Project work will normally begin in the first week of February.

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 55 et seq.) Psychological Measurement (see below).
Mathematical Models in Perception and Learning (see below).
(i) Psychological Measurement — J. A. Keats

Prerequisites
Nil

Hours
1½ hours per week

Examination
To be advised

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

Text
Nil

References
To be advised

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

Prerequisites
Part II Mathematics Topic H recommended

Hours
1½ hours per week

Examination
To be advised

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

Text
To be advised

References
To be advised

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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</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</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>CS—Programming &amp; Algorithms</td>
<td>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>Systems Analysis</td>
<td>Commerce</td>
<td>—</td>
<td>1</td>
</tr>
</tbody>
</table>

General Notes

A student is referred to page 10 for information on the concurrent degree/Diploma programme.

The subjects listed below are approved pursuant to Section 7 of the Requirements for the Diploma in Computer Science. The Board may approve from time to time additions to the lists of subjects shown below. A candidate may count not more than two Group B subjects towards the Diploma.

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

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

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

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.

<table>
<thead>
<tr>
<th>Quantitative Business Analysis II</th>
<th>ME487—Operations Research-Deterministic Models</th>
</tr>
</thead>
</table>
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 Systems Analysis</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 EE361 - Automatic Control</td>
<td>1</td>
</tr>
<tr>
<td>EE325 - Introduction to Digital Technology</td>
<td>Electrical Engineering</td>
<td>EE264 or CS - Introduction to Logic &amp; Assembly Languages</td>
<td>1</td>
</tr>
<tr>
<td>EE447 - Digital Communications</td>
<td>Electrical Engineering</td>
<td>EE344 Communications</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>EE362 or CS - 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, H 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</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>ME505 - 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 I</td>
<td>Mechanical Engineering</td>
<td>ME361 - Automatic Control</td>
<td>1</td>
</tr>
<tr>
<td>ME581 - Mathematical Programming II</td>
<td>Mechanical Engineering</td>
<td>ME404 - Mathematical Programming I</td>
<td>1</td>
</tr>
</tbody>
</table>

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>CES10 - Elastic Continua</td>
<td>Civil Engineering</td>
<td>CE212 - Mechanics of Solids I</td>
<td>1</td>
</tr>
<tr>
<td>Theories of Organisation</td>
<td>Commerce Engineering</td>
<td>Organisational Behaviour</td>
<td>1</td>
</tr>
<tr>
<td>EE323 - Linear Electronics</td>
<td>Electrical Engineering</td>
<td>EE205 - Introduction to Electrical Information</td>
<td>1</td>
</tr>
<tr>
<td>EE324 - Electronics Laboratory</td>
<td>Electrical Engineering</td>
<td>EE211 - Electromagnetics &amp; Quantum Mechanics</td>
<td>1</td>
</tr>
<tr>
<td>EE342 - Linear System Theory</td>
<td>Electrical Engineering</td>
<td>EE341 - Automatic Control</td>
<td>1</td>
</tr>
<tr>
<td>EE344 - Communications</td>
<td>Electrical Engineering</td>
<td>EE331 - Circuits</td>
<td>1</td>
</tr>
<tr>
<td>EE421 - Electronic Design A</td>
<td>Electrical Engineering</td>
<td>EE333 - Linear Electronics</td>
<td>1</td>
</tr>
</tbody>
</table>

DESCRIPTION OF SUBJECTS

CORE SUBJECTS

410136 CS - Commercial Programming

Assumed Standard of Attainment

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

Hours

2 lecture hours per week for first half year

Examination

One 3-hour paper at mid year

Content

Basic concepts of file handling and file maintenance, including file creation and processing.

Flow charting; file merging and updating of transactions; tape blocking and buffering. General run types including editing, searching and sorting. Direct access versus serial; random or sequential organisation; re-run techniques; verifying programme accuracy; table lookup; programme documentation and use of test data.

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

Texts

Feingold, C. D.E.C.

References
Chai, W. A. & H. W. Clifton, H. D.
Davis, G. B. & Lichtecky, C. R.
DeRossi, C. J.
Kapur, G. K.
Laden, H. N. & Gildersleeve, T. R.
McCacken, D. D.
Murach, M.
Sanders, D. H.
Sprowls, R. C.
Stern, N. B. & R. A.
Watters, J. L.

532112  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
Number Systems: Representation and Arithmetic
Hardware components, processor structure, addressing modes, Assembly Language.
Instruction set, pseudo ops, Machine Language programming, Subroutines, Co-routines,
use of stacks, interrupts, macros, recursion, re-entry, linkers and loaders.
Lectures will be supplemented with practical assignments using the PDP-11 computer.

Texts
Processor Handbook PDP-11/20 (DEC)

References
Chu, Y.
Computer Organization and Micro Programming (McGraw-Hill)
Donovan, J. J.
Systems Programming (McGraw-Hill)
Friedman, A. D.
Logical Design of Digital Systems (Computer Science)
Stone, H. S.
Introduction to Computer Organization and Data Structures (McGraw-Hill)

533211  CS — Switching Theory & Logical Design — K. K. Saluja

Assumed Standard of Attainment
Mathematics I

Hours
3 hours of lectures, tutorials & practical work per week for the first half year

Examination
Progressive assessment & final examination

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

Text
An Introduction to Computer Logic (Prentice-Hall)

660111  CS — Programming and Algorithms — R. J. Vaughan

Assumed Standard of Attainment
Mathematics I

Hours
1 lecture hour & ½ tutorial or practical hour per week throughout the year.

Examination
One 2-hour paper.

Content
Systematic programming and modular design. An introduction to Pascal. Overview and
comparison of several high level languages, including BASIC, FORTRAN, ALGOL 60,
PL/I and COBOL.
The course will be run in parallel with Computer Science II, topic SP, with additional
reading and assignment work required on selected topics from decision tables, random
numbers, simulation and use of some of the other high level languages discussed in
lectures.

Text
Programming in PASCAL 2nd edn (Addison-Wesley 1979)

References
Day, A. C.
Fortran Techniques: with Special Reference to Non-numerical Applications (Cambridge U.P.
1972)
Guttmann, A. J.
Programming and Algorithms (Heinemann 1977)
Jensen, K. & Wirth, N.
Kernighan, B. W. & Plauger, P. J.
The Elements of Programming Style (McGraw-Hill 1974)
Kernighan, B. W. & Plauger, P. J.  
Knuth, D.  
Yourdon, E.  

Software Tools (Addison-Wesley 1976)  
Techniques of Program Structure and Design (Prentice-Hall 1975)

660112 CS — Data Structures and Programming — P. Moylan  

Corequisite  
CS — Programming & Algorithms  

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

Examination  
One 2-hour paper

Content  

The course will be run in parallel with Computer Science II, topic SI, with additional reading and assignment work required on selected topics from topological sorting, manipulation of algebraic formulae, symbolic differentiation and subroutine linkage and loading.

Text  
Nil

References  
Berztiss, A. T.  
Day, A. C.  
Galler, B. A. & Perlis, A. J.  
Gear, W.  
Knuth, D. E.  
McCameron, F. A.  
Page, E. S. & Wilson, L. B.  
Sammet, J. E.  

Data Structures: Theory and Practice 2nd edn (Academic 1975)  
Fortran Techniques: with Special Reference to Non-numerical Applications (Cambridge U.P. 1972)  
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 — R. W. Gibberd  

Assumed Standard of Attainment  
Mathematics I

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

Examination  
One 2-hour paper

Content  

Text  
Nil

References  
Forsythe, G. & Moler, C. B.  
Ralston, A.  
Steinberg, D. I.  

Computer Solution of Linear Algebraic Systems (Prentice-Hall 1967)  
A First Course in Numerical Analysis (McGraw-Hill 1965)  
Computational Matrix Algebra (McGraw-Hill 1974)

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. 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.  
Gane, C. & Sarson, T.  

Elements of Systems Analysis (W. C. Brown)  
Elements of Systems Analysis Workbook (William C. Brown)  
Structured Systems Analysis: Tools and Techniques (Prentice-Hall)
GROUP A

Subjects in the main-stream of Computer Science

Offered by the Department of Commerce

413611 Information Systems

Assumed Standard of Attainment: Commercial Electronic Data Processing

Hours: 2 lecture hours per week, 1 tutorial/group meeting hour per week

Examination: Progressive assessment/group assignments and 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:
- The University of Newcastle
- Information Systems: Theory and Practice 2nd edn (Wiley)

References:
- Davis, W.
- Gildersleeve, T.
- Semprevivo, P. C.
- Cockrill, B.

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. Thesis and Assignment Writing (Wiley)
- Pollard, A. H. et al. Demographic Techniques (Pergamon)
- Starr, M. K. & Stein, I. The Practice of Management Science (Prentice-Hall)

410128 Systems Design

Assumed Standard of Attainment: CS — Commercial Programming, Systems Analysis

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

Examination: An examination at end of year

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

Texts

References: As for Systems Analysis

Offered by Department of Electrical Engineering

533213 EE341 Automatic Control — see page 91.

533116 EE345 Digital Signal Processing

Assumed Standard of Attainment: EE341 or ME361 Automatic Control
Hours
3 hours of lectures & tutorials per week for second half year

Examination
Progressive assessment & final examination

Content

Discrete Random Signals, Power Spectrum Estimation; Application of Fast Fourier Transforms to Covariance and Spectrum estimation.

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

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

References
Gold, B. & Rader, C.  
Kuo, B. C.  
*Discrete Data Control Systems* (Prentice-Hall 1970)
Oppenheim, A. V. & Schafer, R. W.  
*Digital Signal Processing* (Prentice-Hall 1975)

53115  Introduction to Digital Technology  — A. Cantoni

Assumed Standard of Attainment
EE264 Introduction to Logic & Assembly Languages and EE362 Switching Theory & Logical Design

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, micro-programmed systems, microprocessor systems.

Lectures will be supplemented by practical assignments on a micro-processor 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)
**Hours**
3 hours per week for the first half year

**Examination**
Progressive assessment & final examination

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

**Text**
Aho, A. V. & Ullman, J. D. *Principles of Compiler Design* (Addison-Wesley)

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

Further references will be given in class.

534145 EE462 Topics in Switching Theory

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

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

**Content**

**Offered by Department of Mathematics**

660127 CS—Theory of Computing
— Mathematics III Topic TC, see page 50

660128 CS—Mathematics Principles of Numerical Analysis
— Mathematics III Topic Z, see page 54

660135 CS—Programming Languages & Systems
— Mathematics III Topic PL, see page 47

664403 CS—Concurrent Programming Techniques
— Mathematics IV, (not offered in 1981)

660133 CS—High Level Software Development
— Mathematics IV, see page 61

**Offered by Department of Mechanical Engineering**

540136 ME505 Systems Analysis, Organization & Control — see page 102
544427 ME404 Mathematical Programming I — see page 102

540132 ME381 Mathematical Programming II

**Assumed Standard of Attainment**
ME404 or equivalent

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

**Texts**

**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**

520137 CE510 Elastic Continua —
For details consult the Engineering Faculty Handbook

**Offered by Department of Commerce**

413612 Theories of Organisation

**Assumed Standard of Attainment**
Organisational Behaviour

**Hours**
2 lecture hours per week

**Examination**
Two 3-hour papers

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

**Texts**
Poole, 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)
Albrow, M. *Bureaucracy* (Macmillan)
Offered by Department of Electrical Engineering

533107 EE323 Linear Electronics
533108 EE324L Electronics Laboratory
533110 EE342 Linear System Theory — see page 92
533113 EE344 Communications — see page 92
534109 EE421 Electronic Design A
534110 EE422 Electronic Design B
534140 EE442 Non-Linear Optimal Control — not offered in 1981
534132 EE443 Optimization Techniques — not offered in 1981

Offered by Department of Mathematics

660114 CS—Mathematical Logic — See Mathematics III, Topic O page 46
660129 CS—Theory of Statistics — See Mathematics III, Topic R page 49
660119 CS—Random and Restricted — not offered in 1981
660120 CS—Signal Detection — See Mathematics IV, page 63
660122 CS—Combinatorial Designs — See Mathematics IV, page 69
660123 CS—Combinatorics — not offered in 1981
660125 CS—Graph Theory — not offered in 1981

Offered by Department of Mechanical Engineering

544418 ME449 Reliability Analysis for Mechanical Systems — see page 103
544417 ME407 Operations Research — Deterministic Models — see page 102
544422 ME408 Operations Research — Probabilistic Models — see page 102
540183 ME503 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 — not offered in 1981

Assumed Standard of Attainment

Physics IA or IB

Hours

1 hour per week & a 12-hour project

Examination

Project assessment & one 2-hour paper

1 For details consult the Engineering Faculty Handbook.
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**

Associate Professor P. Smrz is working on generalizations of Einstein's theory of relativity using modern differential geometry — in particular, the theory of Lie groups and fibre bundles.

**Dynamical Systems**

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

**Environmental and Urban Studies**

Dr R. W. Gibberd is studying the art of population projections and various 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.

**History of Mathematics**

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

Mr Berghout is working on Greek algebra.

**Information Theory**

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

**Lexicostatistics**

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

**Mathematical Biology**

Dr D. L. S. McElwain is developing mathematical models of biological systems including solid tumours, transporting epithelia and leukocyte chemotaxis.

**Mathematical Models of Tumour Growth**

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

**Medical Statistics and Epidemiology**

Dr A. J. Dobson and Dr R. W. Gibberd collaborate with the Faculty of Medicine to investigate various problems in epidemiology and biostatistics. Current research includes: regional variations in mortality and morbidity; age and sex-specific death rates from ischaemic heart disease in Australia; collection and analysis of data from the Hunter Valley Heart Attack Study; 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 application of dispersive and explosive linear operators, distribution of algebraic numbers in the complex plane, and functions defined on rational numbers. Lines determined by lattice points and application of the results obtained to statistical mechanics are studied. Convexity indices and their applications to transport networks, etc.

**Statistical Mechanics**

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

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

Associate Professor A. J. Guttmann is working on the theory of equilibrium critical phenomena. He is particularly interested in the analysis of power series expansions which are frequently used to study systems exhibiting phase transitions.

Associate Professor A. J. Guttmann and Dr J. S. Reeve are using renormalisation group methods to study the critical behaviour of systems with free surfaces.

**Transportation Problems**

Dr R. J. Vaughan is continuing his work on the application of mathematics to traffic engineering, traffic accidents and transportation planning.
### Computer Numbers for Bachelor of Mathematics Subjects

Computer Numbers must be shown on enrolment and course variation forms in the following manner:

Candidates wishing to enrol in any subjects not listed should consult the Faculty Secretary.

<table>
<thead>
<tr>
<th>Computer Number</th>
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Introduction to Mathematical Computer

Mechanical Engineering III
Mathematics IIIA
Industrial Engineering I
Computer Science

(4 components)

(2 components including Econometrics I &/or Mathematical Economics)

(4 components)

(4 components check subject description)

533203 EE341 Automatic Control
533110 EE342 Linear System Theory
534132 EE443 Optimization Techniques
534136 EE444 Communications
534134 EE447 Digital Communications

534137 Compiler Construction
410129 Commercial Programming and Systems Analysis
534138 Computer Operating Systems
533902 Switching Theory & Logical Design
663401 Mathematical Logic
663402 Mathematical Principles of Numerical Analysis
663405 Programming Languages & Systems
663404 Theory of Computing
410128 Systems Design

533213 EE341 Automatic Control
533110 EE342 Linear System Theory
532111 EE264 Introduction to Logic & Assembly Languages
533220 EE362 Switching Theory & Logical Design

423208 Econometrics I
423204 Mathematical Economics
423104 Growth & Development
423102 International Economics
423103 Public Economics

543501 ME381 Methods Engineering
543502 ME383 Quality Engineering
543503 ME384 Design for Production
544425 ME419 Bulk Handling Systems Analysis & Design
544418 ME449 Reliability Analysis for Mechanical Systems
544105 ME482 Engineering Economics I
544663 ME483 Production Engineering
544664 ME484 Engineering Economics II

543204 ME361 Automatic Control
544451 ME401 Systems Analysis
540126 ME505 Systems Planning, Organisation & Control
544427 ME404 Mathematical Programming I
544419 ME434 Advanced Kinematics & Dynamics of Machines
544420 ME408 Introduction to Photomechanics
544418 ME449 Reliability Analysis for Mechanical Systems
544841 ME487 Operations Research — Deterministic Models
544842 ME488 Operations Research — Probabilistic Models

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</table>

* Not offered in 1981.