May I first welcome all those students who are enrolled, or are contemplating enrolling, in the Faculty of Mathematics. I assure you that the staff of the Faculty will always be ready to help with your proposed course and to discuss other academic matters with you.

Your desire to study mathematics is, I am sure, 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. May I 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, the Faculty of Mathematics at the University of Newcastle was the first in Australia. This lead has now been followed by the University of Adelaide.

In constituting this Faculty the Council of the University recognised the central role of mathematics in most Universities, and especially in Newcastle.

The Senate, before recommending the proposal to Council, had considered very carefully two crucial questions:

* how best can the needs of students requiring studies in mathematics, supplementary and complementary to their principal subject of study, be met;
* how best can the needs of students reading mathematics as their major discipline, be met?

Senate concluded that the broad applicability and servicing aspects of mathematics constituted the strongest argument for the location of mathematics in an independent faculty. Such a faculty would be able to arrange appropriate joint degree courses emphasising these areas of application. The needs of the student specialising in mathematics would also be best met by an independent faculty.

This handbook details the manner in which the Faculty of Mathematics is implementing the wishes of Council and Senate. The postgraduate course leading to the award of the Diploma in Computer Science introduced in 1972, has proved particularly successful.

The needs of students whose interests lie in the application of mathematics to other fields is met by the provision of combined degrees, not only with the physical sciences but also with a variety of other disciplines.
The application of mathematics to physical problems has, of course, been well established for centuries, but mathematics is now used in a large number of other endeavours, and this number is rapidly increasing. This wide spectrum of applications is reflected in the membership of the Faculty Board on which almost all departments of the University are represented.

The needs of students who wish to specialise in mathematics are met not only by the provision of topics in the conventional disciplines of pure mathematics, applied mathematics and statistics, but also by the provision of topics in computing science, operations research and other aspects of modern applied mathematics. It is confidently expected that the number of topics offered will increase as the University expands. Summaries of all topics offered in 1974 appear in this handbook.

Finally, may I encourage you to take an active part in other facets of University life. You should find there is time available for these general activities without their interfering with your studies.

R. G. KEATS
Dean
Faculty of Mathematics
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PRINCIPAL DATES
1974

JANUARY

1 Tuesday
Public Holiday — New Year's Day

4 Friday
Last day for lodgement of Re-Enrolment Forms
— Continuing Students

14 Monday
Deferred Examinations begin

18 Friday
Last day for lodgement of Applications for
Admission from persons resident in Australia
who were enrolled in another Australian
University in 1973 or who are seeking admittance on
the basis of examination results which were not
available by 1st November, 1973 or who applied
to attempt The University of Sydney Matriculation
Examination in February 1974.

25 Friday
Deferred Examinations end

28 Monday
Public Holiday — Australia Day

FEBRUARY

8 Friday
Last day for lodgement of applications for
residence in Edwards Hall.

12 Friday
New students required to attend the University
in person to have their enrolment approved.

16 Tuesday
Charges applicable may be paid immediately
after the enrolment form is approved.

25 Thursday
Last day for lodgement of enrolment approvals
with the Cashier together with appropriate
charges, scholarship vouchers, or warrants.

MARCH

4 Monday
FIRST TERM begins

15 Friday
Graduation Day

APRIL

22 Monday
Last day for withdrawal without academic penalty
from Type A subjects in the Faculty of Engineering.

12 Friday
Public Holiday — Good Friday

13 Saturday to
16 Tuesday
Easter Recess

25 Thursday
Public Holiday — Anzac Day

MAY

18 Saturday
FIRST TERM ends

JUNE

10 Monday
SECOND TERM begins

14 Friday
Last day for acceptance of applications for
examinations.

17 Monday
Public Holiday — Queen's Birthday

JULY

15 Monday
Last day for withdrawal without academic penalty
from courses in all faculties, except half
year subjects in the Faculty of Engineering.

AUGUST

17 Saturday
SECOND TERM ends
PRINCIPAL DATES

SEPTEMBER

9 Monday
THIRD TERM begins

16 Monday
Last day for withdrawal without academic penalty from Type B subjects in the Faculty of Engineering.

OCTOBER

7 Monday
Public Holiday — Eight Hour Day

NOVEMBER

1 Friday
Third Term Lectures and other classes cease.

9 Saturday
THIRD TERM ends
Annual Examinations begin

30 Saturday
Annual Examinations end

1975

JANUARY

20 Monday
Deferred Examinations begin

31 Friday
Deferred Examinations end

MARCH

3 Monday
FIRST TERM begins

FACULTY OF MATHEMATICS

Dean
Professor R. G. Keats

Sub-Dean
Dr. P. K. Smrz

MATHEMATICS

Professor
R. G. Keats, B.Sc., Ph.D. (Adelaide), F.A.S.A.

Associate Professor
W. Brisley, B.Sc. (Sydney), M.Sc. (New South Wales), Ph.D.; Dip.Ed. (New England)

Senior Lecturers
W. Ficker, Prom. Mat., C.Sc., RNDr. (Comenius)
J. R. Giles, B.A. (Sydney), Ph.D.; Dip.Ed. (Sydney)
W. T. F. Lau, M.E. (New South Wales), Ph.D. (Sydney), M.A.I.A.A.
P. K. Smrz, Prom. Phys., C.Sc., RNDr. (Charles)
W. D. Wallis, B.Sc., Ph.D. (Sydney)

Lecturers
R. F. Berghout, M.Sc. (Sydney)
J. G. Couper, B.Sc., Ph.D. (New England)
A. J. Guttmann, M.Sc. (Melbourne), Ph.D. (New South Wales)
M. J. Hayes, B.A. (Cambridge)
L. Janos, C.Sc., RNDr. (Charles)
D. L. S. McElwain, B.Sc. (Queensland), Ph.D. (York, Canada)
T. K. Sheng, B.A. (Marian College), B.Sc. (Malaya & London), Ph.D. (Malaya)
E. R. Smith, M.Sc. (Melbourne), Ph.D. (London)
W. C. Summerfield, B.Sc. (Adelaide), Ph.D. (Flinders)
R. J. Vaughan, B.Sc., M.Eng.Sc., M.E. (New South Wales), Ph.D. (Adelaide)
W. P. Wood, B.Sc., Ph.D. (New South Wales)
Senior Tutors
G. W. Southern, B.A.(New South Wales)

Tutors
Winifred Frost, B.A.
L. Kavalieris, B.Math.

Honorary Associate
I. L. Rose, B.E.(Sydney), Ph.D.(New South Wales)

Secretary
Elvira Sprogis

Stenographers
Julie Latimer
Anne Nicholls

Research Assistant
P. D. Munro, B.Sc.(British Columbia)

ADMINISTRATIVE STAFF

Vice-Chancellor and Principal
Professor J. J. Auchmuty, C.B.E., M.A., Ph.D.(Dublin),

Vice-Principal and Deputy Vice-Chancellor
Professor B. Newton-John, M.A.(Cambridge), F.R.S.A.
(To 5 March 1974)
Professor A. D. Tweedie, M.A.(New Zealand)
(From 6 March 1974)

Deputy Vice-Chancellor
Professor E. O. Hall, M.Sc.(New Zealand), Ph.D.(Cambridge),
F.R.S.A.

Personal Assistant to Vice-Chancellor
A. Nell Emanuel, B.A.(New South Wales)

BURSAR’S DIVISION

Bursar
L. W. Harris, A.A.S.A.(Senior), A.B.I.A.

Deputy Bursar
L. F. Norberry, A.A.S.A.

Accountant
G. W. Walker, A.A.S.A.

Assistant Bursar — Staff
R. J. Goodbody
ADMINISTRATIVE STAFF

SECRETARY'S DIVISION

Secretary
P. D. Alexander, B.A., Dip. Ed.(Sydney)

Student Administration
P. H. Beckett, B.A.(Sydney)

Examinations
Glennie Jones, B.A.(New South Wales)
R. Weir, B.A.

Faculty Secretariat
J. S. Boydell, M.A.(Cambridge)
F. C. Hawkins, B.Com.
Christine Samojluk, B.A.(Sydney)

Publications and Publicity
J. W. Armstrong, B.A.
E. Joan Bale, B.A.(New South Wales)

Statistics and Systems
D. L. Farmer, B.Sc., Dip.Ed.(Sydney)
D. S. Dunlop

PLANNER'S DIVISION

University Planner
Associate Professor E. C. Parker, A.S.T.C., F.R.A.I.A.

Deputy Planner

Staff Architect
W. J. Crook, B.Arch.(New South Wales), A.R.A.I.A.

Assistant Staff Architect
A. Lee, A.S.T.C.

Staff Engineer

Assistant to Staff Engineer
J. D. O'Donohue

UNIVERSITY COUNSELLING SERVICE

Senior Student Counsellor
A. P. T. Loftus, B.A.(Melbourne), M.A., M.A.Ps.S.

Student Counsellors
B. E. Hazell, M.A.(Sydney), M.A.Ps.S.
(Seconded to the University of the South Pacific)
(Temporary Appointment)

OVERSEAS STUDENT ADVISOR

Overseas Student Advisor
Robin Loftus, B.A.(Adelaide)

AMENITIES OFFICE

Amenities Officer
H. Bradford

CAREERS AND STUDENT EMPLOYMENT OFFICE

Careers Officer
H. Floyer, B.Ec.(Sydney)
ADMINISTRATIVE STAFF

COMPUTER CENTRE

Director
J. A. Lambert, B.Sc.(Sydney), M.Sc.(New South Wales), M.B.C.S.

Programmers
M. Capek
F. C. P. Huang, B.Sc.(National University, Taiwan), Ph.D.(Australian National), A.A.I.P.
A. Loo Jansen, B.App.Sc.(Adelaide)
M. Wiseman, B.Sc., Ph.D.(Adelaide)

EDWARDS HALL

Warden

THE LIBRARY STAFF

University Librarian
E. Flowers, M.A.(Sydney), A.L.A.A.

Assistant University Librarian (Technical Services)
M. Elizabeth Guilford, B.A.(New England), A.L.A.A.

Assistant University Librarian (Reader Services)
Joan E. Murray, B.A.(New England), A.L.A.A.

Assistant University Librarian (Acquisitions)
Barbara R. Cook, B.A.; Dip.Lib.(New South Wales), A.L.A.A.

Assistant University Librarian (Serials)
B. Mitcheson, B.A., A.L.A.A.

Assistant Librarians
L. Faidiga, B.A.
Winifred Murdoch, B.Sc.(New England), A.L.A.A.
Mary E. Rabbitt, B.A.(New South Wales), A.L.A.A.
Barbara E. Samojluk, B.A., A.L.A.A.
C. I. Walsh, B.A.(Western Ontario), Dip.Lib.(New South Wales)

Graduate Library Staff
G. Baxter, B.A.
M. J. Fauchon, B.A.
Janet Fisher, B.A.(Hull)
The University of Newcastle began its existence as the Newcastle University College of the University of New South Wales, then known as the New South Wales University of Technology. The College was formally opened on 3rd December, 1951, and the first students were enrolled in the 1952 academic year. By the University of Newcastle Act of 1964 it became an autonomous institution on 1st January, 1965.

Enrolments in the first year of the College's existence totalled 370 of whom only five were starting degree courses — the others were seeking a diploma or were converting their diplomas into degrees. In 1954 courses in the Faculty of Arts were offered for the first time. As the New South Wales University of Technology, whose courses were given in the College, had no Faculty of Arts, supervision of these courses was entrusted to the University of New England. This relationship continued until 1959 by which time the New South Wales University of Technology had become the University of New South Wales and was empowered to offer courses in the Faculty of Arts. Enrolments have steadily increased, reaching 1000 in 1960 and 3871 in 1973.

The Newcastle University College was established on the site of the Newcastle Technical College at Tighe's Hill. In 1960 an area of some 200 acres was acquired at Shortland and building commenced in 1964. The transfer of the University began at the end of 1965. Courses in all faculties are now given on the Shortland Campus.

The University is governed by a Council of twenty-four members. The Chancellor, who acts as chairman, is chosen either within the twenty-four members or from outside, the size of the Council being increased to twenty-five in the latter instance. The Council comprises representatives of the University staff, Convocation, the students, the Legislative Council and the Legislative Assembly; nominees of the Governor; and the Vice-Chancellor, who is the chief executive officer of the University.

MATRICULATION

The By-laws governing matriculation and admission to courses are set out below. The University does not conduct its own matriculation examination but recognises the New South Wales Higher School Certificate Examination and the University of Sydney Matriculation Examination for this purpose.

By-law 5.1 — Matriculation

1. (1) Except as provided in By-law 5.3.3, a candidate, before being admitted to matriculation, shall:

   (a) have passed in the New South Wales Higher School Certificate Examination or the University of Sydney Matriculation Examination in at least five recognised matriculation subjects, one of which shall be English and any three of which shall be passed at least at second level; and

   (b) have attained in that examination the aggregate of marks prescribed by the Senate from time to time and calculated in the manner determined by the Senate.

2. The recognised matriculation subjects shall be:

   - English
   - Mathematics
   - Science
   - Agriculture
   - Modern History
   - Ancient History
   - Geography
   - Economics
   - Greek
   - Latin
   - French
   - German
   - Italian
   - Bahasa Indonesia
   - Spanish
   - Russian
   - Chinese
   - Japanese
   - Hebrew
   - Dutch
   - Art
   - Music
   - Industrial
   - Arts

3. Mathematics and Science, both passed as full courses, together shall, for the purpose of sub-section (1) (a) of this section, be counted as three subjects, but otherwise, each shall count as one subject.

4. The qualification for matriculation must be obtained at one examination.

2. A person who has applied to undertake a course of study as a matriculated student shall upon —

   (a) the approval of his admission to a Faculty and the payment of such fees as may from time to time be determined by the Council; and

   (b) signing the Matriculation Register of the University become a matriculated student of the University and shall be deemed to have accepted the privileges and obligations of membership of the University.

By-law 5.2 — Courses and Degrees

1. The Council may by resolution determine —

   (a) the requirements for courses of study in the University; and
   (b) the requirements for fellowships, scholarships, prizes, exhibitions, degrees and diplomas and the granting thereof.

By-law 5.3 — Admission to Courses

1. (1) A candidate for any first degree of the University shall satisfy the conditions for admission to matriculation set out in By-law 5.1.1 or shall have been admitted to matriculation under section 3 of this By-law before entering on any course for such degree. Compliance with the conditions for admission to matriculation shall not in itself entitle a person to enter upon a course.

   (2) A person who has satisfied the conditions for admission to matriculation may on the payment of such fees as may be determined by the Council from time to time be provided with a statement to that effect.

2. A candidate for any degree shall before entering on the course for that degree have satisfied any special conditions prescribed under By-law 5.2.

3. The Council may, with the advice of the Senate, admit as a matriculated student, under such conditions and with such standing as it may determine, any person who has satisfied the Council that he has reached a standard of education sufficient to enable him to pursue his proposed course.

4. The Council may, with advice of the Dean of the Faculty concerned, permit any person to enrol in a subject or subjects on payment of such fees as may be determined from time to time by the Council: Such a person, not being a matriculated student, shall not have the privileges of a matriculated student and shall not be eligible to proceed to a degree.
MATRICULATION

PREREQUISITES
Although prerequisites are not prescribed, lectures in the following faculties, courses or subjects will be given on the assumption that students will have studied for the New South Wales Higher School Certificate the subjects listed below to the level indicated:

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<td>Second level Short Course Mathematics and Science including Physics and Chemistry options.</td>
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<td><strong>ARCHITECTURE</strong></td>
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| **ARTS**              | Economics I — Second level Short Course Mathematics.  
                         English I — Second level English.  
                         French I — Second level French.  
                         German IN — Second level German. |
| **ECONOMICS AND COMMERCE** | Second level Short Course Mathematics. |
| **ENGINEERING**       | Second level Short Course Mathematics and Science including Physics and Chemistry options. |
| **MATHEMATICS**       | Second level Short Course Mathematics. |
| **SCIENCE**           | Second level Short Course Mathematics and Science. |

PROCEDURES

ENROLMENT
All forms relating to enrolment are obtainable from the Student Administration Office, Room G.63, Building “A”.

PERSONS SEEKING ADMISSION TO AN UNDERGRADUATE COURSE
Students seeking admission in the 1974 academic year will be required to lodge an “Application for Admission — 1974” with the Student Administration Office not later than

(a) **5.00 p.m. on Thursday, 1 November, 1973** in the case of:

--- Persons Resident in Australia who are seeking admission on the basis of qualifications which they already hold at 30 September, 1973;

--- Persons Resident outside Australia provided they already possess the results of the examination on which they are relying for admission in 1974.

Persons resident outside Australia whose examination results will not be available by 1 November, 1973 will not be considered for admission in 1974. They may inquire in September, 1974 for admission in 1975.
PROCEDURES

(b) 5.00 p.m. on Friday, 18 January, 1974 in the case of:
— Persons Resident in Australia who
(i) are seeking admission on the basis of the results of examinations taken after 30 September, 1973;
(ii) in 1973 have been enrolled in another Australian University; or
(iii) have applied to attempt the University of Sydney Matriculation Examination February, 1974.

No guarantee can be given that applications received after the prescribed dates will be considered.

Applications sent by post should be addressed to The Secretary, The University of Newcastle, N.S.W. 2308.

Students proposing to attempt the University of Sydney Matriculation Examination in February, 1974 should indicate on the application for admission the subjects and levels proposed to be offered for examination, and must advise the Secretary of their results as soon as they are known.

Documentary evidence must accompany each application where studies have been carried out at secondary educational institutions outside New South Wales or where previous University studies have been undertaken.

Each student will be advised by letter of the outcome of his application and those accepted will be informed of the procedures to be followed for the completion of enrolment. However, it should be noted that new students will be required to attend the University in person to have their enrolment approved and to pay the charges applicable. The days Friday 22 and Monday 25 February, 1974 have been set aside for this purpose.

PERSONS RE-ENROLLING IN AN UNDERGRADUATE COURSE

Undergraduates re-enrolling will be required to complete a re-enrolment form and lodge it with the Student Administration Office on or before Friday, 4 January, 1974. Students enrolled in 1973 will be sent a re-enrolment form with the advice of their examination results in December.

A student who has taken a deferred examination or special examination will be required to lodge a re-enrolment form with the Student Administration Office within one week from the day of publication of the examination results.

Approval of Re-Enrolment

When a student's re-enrolment programme has been approved the authorised re-enrolment form will be posted to the student at his home address unless he indicates that it should be posted to any other address.

PERSONS SEEKING READMISSION TO AN UNDERGRADUATE COURSE

Any student not enrolled in 1973 who wishes to re-enrol in 1974 should apply to the Student Administration Office for an Application for Readmission form.

DESIGNATION OF STUDENTS

FULL-TIME STUDENTS

A Full-Time Student is a student who enrols in more than half the subjects of a normal first year course and such a student remains classified as a full-time student until the written approval of the Dean of the Faculty is given that he be re-classified as a part-time student. This re-classification would be exceptional.

PART-TIME STUDENTS

A Part-Time Student is either one who enrols in half or less than half of the subjects of a normal first year course or one who enrols in a part-time course. In subsequent years, the enrolment as a part-time student requires the approval of the Dean of the Faculty.

NON-DEGREE STUDENTS

A Non-Degree Student is a student who is permitted to enrol in one or more subjects of a first degree course. Such a person is not eligible to proceed to a degree and cannot enjoy the privileges of a matriculated student. A student enrolled in the Professional Accounting Studies course in the Faculty of Economics and Commerce is classified as a Non-Degree student taking one subject.
CANDIDATES FOR POSTGRADUATE DIPLOMA COURSES

Intending candidates for the Postgraduate Diploma courses in Business Studies, Computer Science, Education and Industrial Engineering will be required to complete an Application To Register Form and lodge it with the Student Administration Office on or before Friday, 18 January, 1974.

Applicants for admission to the Diploma in Psychology are selected biennially. No new candidates will be accepted in 1974.

Each student whose undergraduate studies were undertaken in another University, will be required to provide a full transcript of his academic record with his application.

For further information, intending candidates should consult the entry for the appropriate Diploma course.

CANDIDATES FOR HIGHER DEGREES
(Doctor of Philosophy or Master Degrees)

Candidates Re-Enrolling
A letter will be sent by the University to each candidate whose re-registration is approved. A higher degree enrolment form will be enclosed with the letter and the candidate will be required to complete the form and return it to the Student Administration Office on or before Friday, 4 January, 1974.

Candidates Registering for the First Time

Doctor of Philosophy or Research Master's Candidate
Candidates wishing to register for the degree of Doctor of Philosophy or a Research Master's degree must lodge an Application to Register Form no later than one month prior to the commencement of the term in which registration is sought.

Dates by which Applications to Register must be Lodged
- Friday, 1 February, 1974
- Friday, 10 May, 1974
- Friday, 9 August, 1974

Course Work Master's Candidates
Candidates wishing to register for a Course Work Master's degree must lodge an Application to Register Form no later than Friday, 18 January, 1974.

NON-ACCEPTANCE
A student whose enrolment is not accepted will be notified in writing.

LATE ENROLMENTS
(i) Students who are unable to lodge their Re-Enrolment Form by the prescribed date, shall make written application to the Secretary for an extension of time. This application must be received by the Secretary on or before Friday, 4 January, 1974, otherwise the University reserves the right not to accept the student's enrolment.

(ii) No enrolments will be accepted after 31 March of each academic year without the approval of the Secretary which shall be given only in exceptional circumstances.

(iii) Deferred Examinations
A student who has taken a deferred examination or special examination will be required to lodge an Enrolment Form with the Student Administration Office within one week from the day of publication of the examination results.

"SHOW CAUSE" STUDENTS

Students who, after failure at the annual examinations, are required to "show cause" why they should be allowed to continue in a course will be informed of this fact in writing after notification of examination results in December. Such a student will be provided with a form on which he must state his "show cause" case.

A student who wishes to re-enrol in any subject which he has failed more than once shall be required to show cause why he should be allowed to re-enrol in the subject and must submit a "show-cause" statement with his re-enrolment form.

The student's "show cause" statement and completed re-enrolment form must be lodged with the Student Administration Office on or before Friday, 4 January, 1974.

UNIVERSITY SKILLS ASSESSMENT

As part of its service to students, the University Counselling Service holds a voluntary half day session in which a variety of skills relevant to university work, such as Reading Speed, Note-Taking, Study Skills etc. are tested. Attendance is voluntary and the results are held in confidence in the Counselling Service. This year it is intended to hold the University Skills Assessment on 15 March (Graduation Day). An evening session will be held for Part-Time students on the same date.

Many students derive benefit from later discussing their results with a
counsellor. Some students are later invited (on the basis of a weak result) to participate in a course designed to overcome their particular difficulty.

ENROLMENT IN CORRECT SUBJECTS
Considerable inconvenience is caused to the University and to the student if he attends classes in a subject in which he has not enrolled. It is essential that the student consider carefully the subjects he is required, or wishes, to enrol in before submitting his Enrolment Form.

WITHDRAWAL FROM COURSE OR SUBJECT REGARDED AS FAILURE
Approval to withdraw from a course or a subject is not automatic. It should be noted that a student is regarded as having failed in a course if he enrolls in it and does not pass the annual examinations—i.e. not sitting for the examination is regarded as not passing the examination (unless withdrawal without penalty has been approved).

A student is required to notify the Secretary to the University in writing of his withdrawal and the withdrawal shall take effect from the date of receipt of such notification in writing. Unless the Dean of his Faculty grants him permission to withdraw without penalty, a student who withdraws after the date shown below will be deemed to have failed in the subject or subjects from which he withdraws.

All Faculties except the Faculty of Engineering
Sixth Monday in Second Term

Faculty of Engineering
Type A Subjects
Eighth Monday in First Term

Type AB Subjects
Sixth Monday in Second Term

Type B Subjects
Second Monday in Third Term.
PROCEDURES

CHANGE OF ADDRESS

Students are responsible for notifying the Student Administration Office in writing of any change in their address as soon as possible. A Notification of Change of Address Form should be used. It is available from the Student Administration Office.

Failure to do this could lead to important correspondence or course information not reaching the student. The University cannot accept responsibility if official communications fail to reach a student who has not notified the Student Administration Office of a change of address.

It is essential that all students inform the University of an address for all correspondence from the end of the examination period to the end of the long vacation.

This is particularly important for students intending to travel overseas during this period.

A special form for this purpose will be available in October of each year.

IDENTITY CARDS

Each student wishing to obtain a travel concession, to borrow a book from the Library or to confirm his membership of the Newcastle University Union is required to produce on demand his identity card. Identity cards will be issued to students at the Student Administration Office and should be available for collection soon after the commencement of First Term. The student will be required to produce his enrolment receipt issued by the cashier before an identity card will be issued to him.

A notice will be displayed on notice boards and inserted in “University News” advising students when identity cards are available for collection.

Loss of Identity Card

If a student loses his identity card he should pay to the University Cashier the sum of 50 cents and present the receipt to the Student Administration Office for the purpose of obtaining a replacement card.

Return of Identity Card

Each student who during the academic year withdraws completely from his course will be required to hand his Identity Card to the Student Administration Office before leaving the University.

PROCEDURES

TRAVEL CONCESSIONS

The various transport authorities provide fare concessions for certain classes of students.

Application forms for these concessions may be obtained at the Student Administration Office.

The Student’s Identity Card has to be produced each time a concession is required.

OMNIBUS — Concessions are available to:

(a) students under 18 years of age irrespective of whether they are employed or receive income or remuneration.

(b) students who are 18 but under 30 years of age and who are not in employment nor in receipt of any income or remuneration. Note: Income or remuneration includes allowances paid to Colombo Plan students, Public Service trainees, etc. but does not include allowances paid under the Tertiary Allowances Scheme, or to holders of Teacher Education Scholarships or Bursaries granted by the State Bursary Endowment Board.

(c) Concessions are not available to students who are 30 years of age or over; or to married women or ordained clergymen.

TRAIN —

(a) Periodical tickets are available during term to full-time students not in employment nor in receipt of any remuneration.

(b) Daily concession fare tickets are available to part-time students, whether employed or otherwise, for the purpose of travelling to and from classes held in connection with their course of instruction.

(c) Vacation travel concessions are available to students qualifying under (a) above.

AIRCRAFT —

Concession fares for travel overseas, inter-state and intra-state are available under the conditions ruling for the various operating companies.

LOST PROPERTY

Inquiries regarding lost property should be directed to the Attendant (Patrol) between 9 a.m. and 5 p.m. Monday to Friday at the Attendants’ Office. This office is located in the north-eastern corner of the lowest floor of the Library building and may be reached from the pathway leading from the lower plaza to the footbridge.
CHARGES

GENERAL INFORMATION

COMPLETION OF ENROLMENT

Charges are determined by the University Council and are subject to alteration without notice. The due date for payment of charges for 1974 is 26 February, 1974.

Enrolment is not effective until appropriate charges have been paid. Enrolments will not be accepted after 31 March, 1974 without the Secretary's special written approval. This will be given only in exceptional circumstances.

PAYMENT OF CHARGES

The Entrance fee and General Services fee must be paid in full at the time of enrolment.

Payment by mail is encouraged. Money Orders should be made payable at the Newcastle University Post Office, New South Wales 2308. The Cashier's Office is located on the first floor of the Administration Building. A continuous service will apply from 9.00 a.m. to 4.30 p.m. Monday to Friday throughout the year with the exception of vacation periods when the Cashier's Office will be closed between 12.30 p.m. and 1.30 p.m.

Any alterations to the Cashier's hours during enrolment periods will be published in the press and displayed on selected University notice boards.

SCHOLARSHIP HOLDERS AND SPONSORED STUDENTS

Students holding scholarships or receiving other forms of financial assistance must attach to their authorised enrolment forms submitted to the Cashier warrants or other forms of documentary evidence that charges will be paid by sponsors. The University looks to sponsors to provide a separate voucher, warrant or letter for each student sponsored.

HIGHER DEGREE CHARGES

General Services Fee

Higher Degree candidates are required to pay the General Services fee, and Entrance fee if applicable. Where the enrolment for a Higher Degree candidate is effective from first or second term, the General Services fee covers a period of registration from the first day of the term to the Friday immediately preceding the first day of first term in the following academic year. Where a Higher Degree candidate enrols on or after the first day of third term, the General Services fee paid will cover liability in respect of this fee to the end of the long vacation following the next academic year.

1. General Services

(a) Students Proceeding to a Degree or Diploma

All registered students must pay a General Services fee of $52.00 per annum. In addition, students joining Newcastle University Union for the first time, are required to pay an amount of $12.00. These charges must be paid by the prescribed date.

(b) Non-Degree Students

Non-degree students must pay a Union annual fee of $32.00. This fee must be paid by the prescribed date. Non-degree students are not required to pay the General Services fee or the Union Entrance fee.

2. Late Enrolment and Re-enrolment Payments

(a) Late re-enrolment charge where a continuing student fails to lodge an enrolment form with the Student Administration office by the date approved by the Vice-Chancellor $14

(b) Late enrolment charge where a student does not lodge the approved section of the enrolment form with the Cashier by the time approved by the Vice-Chancellor $14

(c) Late payment charge where an application to sit for examination is accepted after closing date $6

(d) Late payment charge if relevant fees under (1) above are not paid within stipulated times approved by the Vice-Chancellor $8

(e) Additional amount payable if relevant fees under (1) above are not paid within an extended time approved by the Vice-Chancellor $6

3. Other

(a) Examination under special supervision, per paper $10

(b) Review of examination results, per subject $8

(c) Statement of matriculation status for non-members of the University $8

(d) Academic statements in excess of six per annum 15c a copy

(e) Replacement of student identity cards 50c each
GENERAL REQUIREMENTS

The University tries to function with a minimum of formal regulations. It is obvious, however, that there must be standard practice throughout the University in such diverse matters as examination procedures and car parking and an acceptance of certain requirements which are described in the following pages.

GENERAL CONDUCT

In accepting membership of the University the student undertakes 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 administration 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.

ACADEMIC REQUIREMENTS

The student is responsible for informing himself as to, and for complying with, University requirements, especially the requirements relating to admission and to the award of the degree to which he is proceeding.

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.

NOTICE BOARDS

EXAMINATIONS

A notice board has been placed on the wall opposite the entrance to the Main Lecture Theatre (B01) for the specific purpose of displaying examination timetables and notices concerning all procedural matters pertaining to examinations. Students are specifically requested to be acquainted with the notices periodically displayed thereon.

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 first floor at the top of the main staircase in Building "A".

GENERAL REQUIREMENTS

ATTENDANCE AT CLASSES

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

All applications for exemption from attendance at lectures or practical classes must be made in writing to the Head of the appropriate Department. If term examinations have been missed this fact should be noted in the application.

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

Applications for exemption from re-attendance at classes, either for lectures or practical work, may only be approved on the recommendation of the Head of the appropriate Department. The granting of an exemption from attendance does not carry with it exemption from payment of fees. Where a student has attended less than 80 per cent. of the possible classes, he may be refused permission to sit for the annual examination in that subject.

OWNERSHIP OF STUDENTS WORK

Unless other arrangements have been agreed upon the University reserves the right to retain at its own discretion the original or one copy of any drawings, models, designs, plans and specifications, essays, theses, or other work executed by students as part of their courses, or submitted for any award or competition conducted by the University.

PARKING OF CARS

TRAFFIC REGULATIONS

1. "Authorised Person" means a person authorised in writing by the Vice-Chancellor for the purposes of these Regulations.

"Notice" means a written advice signed by an authorised person on behalf of the Vice-Chancellor.

2. Any student, a member of staff of the University, or other person employed on the University site who wishes to bring a motor vehicle on to the Shortland site shall obtain a University parking permit. Upon receipt of a parking permit sticker the driver will fix this to the top left hand corner of the windscreen or in the case of a motorcycle in a prominent location on the cycle. Vehicles without this sticker may be refused entry to the campus.
3. No person shall park or leave any vehicle on the Shortland site except in places set aside from time to time for parking.

4. A person in charge of a vehicle entering or upon any part of the site shall:
   (a) Stop his vehicle at any manned control point or any other part of the site when signalled to do so by a Patrol Attendant.
   (b) Give to any such officer such information as he may reasonably require.
   (c) Obey any direction a Patrol Attendant may reasonably give in relation to the driving or parking of such vehicle.
   (d) Not drive at a speed greater than 20 m.p.h. or such speed limit as may be indicated by an appropriate sign for that section of road or part of the site.
   (e) Not commit or do any act which would be a breach of any Act or regulation of the State of New South Wales if he were driving or in charge of a vehicle upon a public road.
   (f) Not drive or park a vehicle on any lawn, grassed area, oval, garden, builders access road or undeveloped area of the site.
   (g) Comply with all other directions related to traffic indicated by appropriate signs installed on the site.

5. Any person who contravenes or fails to observe any of the above regulations may be advised in writing by a notice which may be posted or handed to the person or affixed to his vehicle by an authorised person.

6. Any person who contravenes or fails to observe any of these regulations shall be deemed guilty of a breach of regulations and may be dealt with accordingly.

7. The maximum penalty for the time being which may be applied under these regulations shall be the banning from the University site for a period of three months of any vehicle driven by the person concerned.

Note
Application forms for permits may be obtained from the Senior Attendant (Patrol) at the Attendants' Office. This office is located in the north-eastern corner of the lowest floor of the Library building and may be reached from the pathway leading from the lower plaza to the footbridge.

Examinations and other exercises may be held in any subject and at any time. In the assessment of a student's progress in a University course, consideration will be given to laboratory work and class exercises and to any term or other tests conducted throughout the year. The results of such examinations and class work may be incorporated with those of the annual examinations.

ANNUAL EXAMINATIONS
(Students in the Faculty of Economics and Commerce are referred to material in the Faculty of Economics and Commerce Handbook).

A student desiring to sit for an annual examination must lodge an application with the Secretary on the appropriate form by the prescribed date, 14 June, 1974.

A student who, because of religious convictions, would prefer not to sit for an examination on a particular day or particular day of the week should indicate this in writing when lodging his application to sit for examinations. While the University cannot guarantee to meet such requests it will be willing to co-operate where possible.

The cashier is authorised to receive application forms during the three weeks immediately following the prescribed closing date if they are accompanied by a late payment charge of $6.00. Applications submitted more than three weeks after the closing date will not be accepted except with the approval of the Secretary. Where an application is not accepted, the student concerned is not eligible to sit for the examination.

No student is eligible to attend the annual examination in any subject if any portion of fees or other charges due by him is outstanding by the end of the third week of third term.

The annual examinations take place in November-December. Timetables showing the time and place at which individual examinations will be held will be posted on the examinations notice board near the Main Lecture Theatre. Misreading of the timetable will not under any circumstances be an acceptable excuse for failure to attend an examination.

Examinations are conducted in accordance with the following rules and procedure:

(a) Candidates are required to obey any instruction given by a Supervisor for the proper conduct of the examination.

(b) Candidates are expected to be in their places in the examination room not less than ten minutes before the time for commencement of the examination.
(c) No bag, writing paper, blotting paper, manuscript or book, other than a specified aid, is to be brought into the examination room.

(d) No candidate shall be admitted to an examination after thirty minutes from the time for the commencement of the examination.

(e) No candidate shall be permitted to leave the examination room before the expiry of thirty minutes from the commencement of the examination.

(f) No candidate shall be re-admitted to the examination room after he has left it unless during the full period of his absence he has been under approved supervision.

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

(h) Smoking is not permitted during the course of an examination.

(i) A candidate who commits any infringement of the rules governing examinations is liable to disqualification at the particular examination and if detected at the time, to immediate expulsion from the examination room, and is liable to such further penalty as may be determined.

FURTHER EXAMINATIONS

After completion of the written annual examination papers, a student may be called upon by an examiner to complete further written, practical or oral tests as part of the annual examination. It is therefore important that the Examinations Section be advised of any change in address from that given on the Application for Admission to Examinations.

EXAMINATION RESULTS

Each student will be advised by mail of his examination results. A set of examination results will be offered to the newspapers for publication. No results will be given by telephone.

Examination results may be reviewed for 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 the date notified in the publication of results.

SPECIAL EXAMINATIONS

Special examinations may be granted according to the conditions contained in By-Law 5.9.3 which states:

5. When a candidate is prevented by illness or by any other serious cause from presenting himself for the annual examination the appropriate Faculty Board may order a special examination for that candidate in the subject or subjects in which he was unable to present himself. The result of a special examination may be graded.

6. When a candidate's studies during the academic year have been gravely hampered by illness or other serious cause, the appropriate Faculty Board upon application being made to the Secretary to the University before the commencing date of the examination supported by medical or other proper evidence may direct the examiners to take the circumstances into account in determining whether or not a special examination should be provided for the candidate in any subject in which he does not pass at the annual examination.

7. When a candidate at the annual examination is to a substantial degree affected by illness during the course of an examination in any subject the appropriate Faculty Board, upon application being made to the Secretary to the University within three days after such examination or within such further period as the Vice-Chancellor may consider reasonable in the circumstances supported by medical or other proper evidence, may direct the examiners in that subject to take the circumstances into account if the candidate does not pass therein in determining whether or not a special examination or test should be provided for him; provided that no such application shall be considered unless the candidate either during or immediately after such examination reports to the supervisor in charge the circumstances relied on in the application.

DEFERRED EXAMINATIONS

Deferred examinations may be granted in the Faculties of Applied Science, Architecture, Engineering, and Mathematics. The examinations will be held in January-February and results will be published in the same manner as for the annual examinations.
ACADEMIC PROGRESS REQUIREMENTS

GENERAL
The University has enacted certain By-laws relating to continuation in a course. The relevant By-laws are set out below.

BY-LAWS

By-law 5.4.1 — Unsatisfactory Progress

1. The Head of a Department in any Faculty may determine that a student taking a subject or course offered by the Department shall be excluded from any examination for which the Department is responsible for any or all of the following reasons:

(a) unsatisfactory attendance at lectures;
(b) failure to complete laboratory work;
(c) failure to complete written work or other assignments;

or

(d) failure to complete field work.

2. The Faculty Board may review the academic progress of any student enrolled in the Faculty concerned who fails in, or is absent from, or is excluded under section 1 of this By-law from any examination and may determine:

(a) that the student be excluded from further study in a subject;
(b) that the student may enrol in that Faculty only in such subject or subjects as the Faculty Board shall specify; or
(c) that the case be referred to the Admissions Committee if, in the opinion of the Faculty Board, the student should be excluded from a degree course, from the Faculty or from the University.

3. The Admissions Committee, in considering a referral under subsection (c) of section 2 and after giving the student an opportunity to be heard, may determine:

(a) that the student be excluded from a degree course or from the Faculty;
(b) that the student shall be permitted to continue his course, subject to such conditions as the Admissions Committee may determine; or
(c) that the case be referred to the Vice-Chancellor with the recommendation that the student be excluded from the University.

4. The Vice-Chancellor may, on the recommendation of the Admissions Committee exclude from the University any student whose academic record in the opinion of the Vice-Chancellor and the Admissions Committee demonstrates the student's lack of fitness to pursue University studies.

By-law 5.4.2 — Show Cause

1. A student shall show cause why he should be allowed to repeat a subject in which he has failed more than once. Failure in a deferred examination as well as the annual examination counts for the purposes of this By-law as one examination.

2. (1) A full-time student shall show cause why he should be allowed to continue a course if all subjects of the first year of his course are not completed by the end of his second year of attendance.

(2) A part-time student shall show cause why he should be allowed to continue a course if all subjects of the first two stages of his course are not completed by the end of his fourth year of attendance.

3. (1) A student who has a record of failure at another University shall show cause why he should be admitted to the University.

(2) A student admitted to a course at the University following a record of failure at another University shall show cause, notwithstanding any other provision in this By-law, why he should be allowed to continue in that course if he is unsuccessful in the annual examinations in his first year of attendance at the University.

4. A student required to show cause shall have his application considered by the Admissions Committee which shall determine whether the cause shown is adequate to justify the student's being permitted to continue his course or to re-enrol as the case may be.
ACADEMIC PROGRESS REQUIREMENTS

By-law 5.4.3 — Re-Enrolment

1. Any student who has been excluded from a Faculty shall not be allowed to enrol in another Faculty without the permission of the Faculty Board concerned.

2. Any student excluded from a degree course or from a Faculty or from the University may apply after two academic years to the Admissions Committee for re-admission to any such Faculty or to the University. If the Admissions Committee is satisfied that the condition or circumstances of any such student have so changed that there is reasonable probability that he will make satisfactory progress in his studies it may authorise the re-admission of that student under such condition as it may determine.

By-law 5.4.4 — Appeal Against Exclusion

1. A student who is refused permission to enrol under the provisions of section 1 of By-law 5.4.3 may appeal to the Senate.

2. A student who has been excluded from any degree course or from a Faculty or from the University may appeal to the Council.

PROCEDURES

The onus is on a student required to "Show Cause" to take the appropriate action should he wish to re-enrol. Such a student must lodge his "Show Cause" statement and completed re-enrolment form by the date prescribed each year to ensure consideration of his case.

THE LIBRARY

The Library, totalling approximately 240,000 volumes and made up of monographs, pamphlets, serials, microform sets and audiovisual materials, exists to acquire, preserve and make available for use all research materials needed by the staff and students of the University.

There is an almost complete freedom of access to the collections, and students are encouraged and aided to learn how to use, as soon as possible, the Library and its contents. On his first visit to the Library the student is provided with a brochure outlining the Library's resources, its services, such as the copying service, its special facilities, such as the microprint reading room, and its procedure for borrowing.

The Library occupies the central position on the site, next to the Union.

HOURS OF OPENING

During academic year

- Monday-Friday 8.30 a.m. to 10.00 p.m. (long vacation excepted)
- Saturday and Public Holidays 9.00 a.m. to 5.00 p.m. (all vacations excepted)
- Sunday 1.00 p.m. to 5.00 p.m. (all vacations excepted)

The Library is closed for the Easter Weekend, i.e., April 12-16, 1974 inclusive.

During long vacation

- Monday, Wednesday, Friday 9.00 a.m. to 5.00 p.m.
- Tuesday, Thursday 9.00 a.m. to 7.00 p.m.
UNIVERSITY SERVICES

AMENITIES

The Amenities Office is located in the temporary building adjacent to the main University building.

The Amenities Officer and his Staff assist students in the following fields:—

SPORT

The Amenities Officer, Mr. Bradford is liaison officer for all sporting matters between the Sports Union, the University and all outside sporting organisations.

The Amenities Office assists student Sporting Clubs in the arranging of Inter-varsity contests and travel as well as giving help when required at club level.

SPORTING FACILITIES

Administration of all sporting facilities on campus, which at present include four squash courts, two tennis courts and two ovals is the responsibility of the Amenities Office.

An outside basketball court, two further tennis courts and a Field House should be completed during 1974.

NON-COMPETITIVE PASTIMES AND DIVERSIONS

The Amenities Office arranges recreational activities on campus on behalf of the Non-Competitive Pastimes and Diversions Committee for both students and staff.

Classes in Pottery, Keep Fit, Leatherwork and Yoga have been held and further activities are planned.

ACCOMMODATION

The Amenities Office conducts a student accommodation service for students requiring housing and will deal with any accommodation problems which students may encounter while attending the University. A register is maintained of rooms, flats and private board available in Newcastle. Do not hesitate to use this service which is operated for the convenience of students.

INSURANCE

The Amenities section on behalf of the Sports Union and the Students’ Representative Council is responsible for the operation of the Personal Accident Insurance Scheme.

CAREERS AND STUDENT EMPLOYMENT OFFICE

The Careers and Student Employment Office (then the Appointments Office) was established in 1971 primarily to help students obtain information about careers and to assist graduating students to find employment.

Careers Counselling

All new students are invited to consult the Careers and Student Employment Office at some time during their first year at the University. Follow up consultations during second and third years may serve to bring the student to a state of mind where he or she feels confident that his or her chosen career is suitable and within the realms of possibility. The Careers and Student Employment Office would hope to have available or to obtain information for the student in order that by a little research in the early years, frustration and disappointment can be avoided after graduation. Students in the last year or stage of their degree, who may need help in finding suitable employment upon graduation, should consult the Careers and Student Employment Office during the July-September period prior to the final examinations.

Careers Library

1. A section of the Careers Library contains books, periodicals, articles, etc. giving general information about the various professional occupations.

2. Information is gradually being assembled about the manpower requirements of numerous employers — types of graduates needed, educational qualifications for appointment, experience gained, prospects etc.

3. Professional associations are being approached to supply information about the activities of their bodies, conditions of membership and application forms.

Employer Interviews

Some employers have representatives come to the University for the purpose of giving students first hand information about the kinds of graduates recruited, the job involvement, salaries, prospects etc. Students make appointments to interview the representatives singly or in small groups.

Employment Vacancies

Some Government Departments inform the University on a regular basis of vacancies within their organizations, other employers only as specific vacancies occur.
The 'Positions Vacant' columns of a major local newspaper are always on hand.

The Sydney University Appointments Board has indicated that where a Newcastle University student proves that he is a bona-fide student, he can obtain copies of the "Notices of Vacancies" prepared by that Board, upon payment of the current nominal fee.

Casual and Part-time Employment
Unfortunately, it is a fact of life that some students do not have enough money to sustain them during University studies, and have to supplement their financial resources by part-time or casual work. Students may call at the Careers and Student Employment Office at the commencement of each year and complete a card indicating their needs. As opportunities are notified to the Careers and Student Employment Office, appropriate students are informed.

Industrial Experience and Vacation Employment
The Careers and Student Employment Office will provide administrative assistance to the Faculties seeking professional vacation employment for their students. Vacation employment will be sought for those students seeking employment for financial reasons.

Graduate Careers Directory
The Graduate Careers Council of Australia prepares a Directory in three parts for distribution each year to graduating students. The Directory provides general background information on the types of appointments that will be available with a large number of employer organisations in the ensuing year. The Careers and Student Employment Office arranges distribution of this Directory; a few spare copies are available to undergraduates upon request.

All students are invited to consult and use the resources of the Careers and Student Employment Office; this service is free.

The Careers and Student Employment Office is located in Temporary Building, "T".

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A Chaplaincy Service within the University of Newcastle for the benefit of students and members of staff is provided by the Christian Churches of Newcastle.

The service offers personal counselling and guidance, and also assistance in biblical and doctrinal studies. Opportunities for liturgical worship are also provided.

The Chaplains' office is situated on the Lower Ground Floor of the Main Administration Building at Shortland.

The Chaplains are in regular attendance at the University but they may also be contacted at their private addresses.

**Names and Addresses of Chaplains**

**Anglican**
The Reverend Canon E. H. V. Pitcher, M.A. (Sydney), Th.Schol. (Acting Chaplain)
The Rectory, MEREWETHER. Telephone 63 1388

**Baptist**
The Reverend T. H. Binks, 133 Kemp Street, HAMILTON. Telephone 61 4048

**Methodist**
The Reverend W. D. Adams, B.A. (Sydney), B.D. (Melbourne) 23 William Street, HAMILTON. Telephone 61 4040

**Presbyterian**
The Reverend H. F. Kat, B.A., B.D. (Utrecht) 4 Gregory Parade, KOTARA. Telephone 57 1076

**Roman Catholic**
EDWARDS HALL

Edwards Hall is situated on the University Campus near the south-eastern boundary of the Sports Oval, close to the tennis and squash courts and is approximately one mile by road from the University Library. While the Hall is an integral part of the University and as such is subject to the decisions and directions of the University Council, major responsibility for the government of the Hall has been entrusted by Council to a Board of Trustees made up of three Council members, one Senate member, two senior resident students, one resident Subwarden and the Warden. Edwards Hall consists of three buildings, a central amenities building flanked by two identical residential buildings between them providing 222 residential places for students and staff of the University, including 6 positions for residential Subwardens.

The residential fees for 1974 have not been determined at the time of writing but as a guide to prospective applicants, the anticipated residential fees are as follows: Term 1 (11 weeks) $286; Term 2 (10 weeks) $260; Term 3 (12 weeks) $312. The term residential fee entitles a member to a bed/study room, the supply of all bedding and fresh linen, and maintenance of the room and 16 meals a week, being breakfast and dinner each day and lunch on Saturday and Sunday.

Application forms for residence may be obtained from and completed applications returned to the Warden, Edwards Hall, The University of Newcastle N.S.W. 2308. The closing date for applications for residence in 1974 will be February 8, 1974 and applications received after this date will not necessarily be considered.

WARDEN


OVERSEAS STUDENTS

The Overseas Student Advisor is on campus solely to help overseas students with any problems which may arise. Because of her specialized knowledge, she may be able to give direct assistance, may refer the student to someone in an appropriate field, (e.g., legal, health, insurance, etc.) or she may speak at the student's request and on his behalf with government officers, staff members or others.

Any discussion with the Overseas Student Advisor is completely confidential. She may be contacted either through the University Counselling Service or in the Temporary Building (T.10).

Overseas Student Advisor

Mrs. Robin Loftus, B.A. (Adelaide)

STUDENT LOAN FUND

The Council of the University has established a Student Loan Fund which is managed by a committee consisting of the Deputy Chairman of Senate, the Bursar and the Vice-Principal (Chairman). This loan is now supplemented by government grant.

Loans may be made to an undergraduate where the committee is of the opinion that his academic performance is of sufficient merit and his financial circumstances warrant a loan.

The total outstanding accommodation to any one undergraduate shall not normally exceed $600 at any one time and an undergraduate granted a loan is required to enter into an agreement.

Repayment must commence not later than twelve months after graduation or when the borrower fails or withdraws from his course or on demand as required by the University. No interest is charged while the borrower is an undergraduate but interest at a rate of not less than 5% per annum on the balance owing from time to time is charged from the date of graduation or the date on which an undergraduate fails or withdraws from a course.

In special circumstances the Committee may grant a loan to a student other than an undergraduate.

Any student wishing to seek assistance from the Fund may apply in person to the Vice-Principal or through the President of the Students' Representative Council or his nominee.
UNIVERSITY COUNSELLING SERVICE

The Student Counsellors assist students — past, present and future — in a wide variety of matters. Most students, whatever their academic level, at one time or another need help in dealing with difficulties which arise during the course of their University lives.

A student should not feel that he or she must have a major problem before consulting a Counsellor. Many worries take only a few minutes to clear up, and frequently the Counsellor’s function is simply to direct a bewildered student to the right source of information.

Students who are worried about inadequate study methods, personal difficulties, choice of courses or career planning are invited to arrange an appointment with a Student Counsellor. All contacts with a counsellor are regarded as completely confidential.

The University Counselling Service is divided into three major divisions — Personal Counselling, Study Skills Training, and Research with some inevitable overlap between the sections. Apart from individual counselling, courses in an increasing number of areas are held for groups of students.

Counselling is now a thoroughly established and widely accepted part of University life throughout Australia, and at this University, approximately one-third of all students utilise it.

STUDY AT THE UNIVERSITY LEVEL

The University Counselling Service published a brief but comprehensive book on this subject in 1967 and although it was produced specifically for the students of this University, and reflects the attitudes of several Heads of Departments here, it is already widely used in other Universities and tertiary institutions throughout Australia. A Revised Edition was published in November, 1969 as the first printing had sold out. It may be purchased from the Cashier at 40 cents per copy.

LOCATION

The Secretary to the University Counselling Service and two Counsellors are located in the Administration Building (Room G75—entrance at the N.W. end of building). It is generally most satisfactory for students, both full-time and part-time, to make appointments through the U.C.S. Secretary. Counsellors are available for evening appointments.

UNIVERSITY HEALTH SERVICE

Pending the establishment of a Health Centre, an interim service, located in the Union, functions during term time. The medical officer, Dr. John Raschke attends each Tuesday and Thursday morning and qualified nurses are on duty on the other days.

The service, which is free, is essentially diagnostic and does not undertake continuing treatments.

UNIVERSITY STUDENT LEGAL REFERRAL SERVICE

Students sometimes have problems of a legal nature. As from the beginning of Third Term, 1973, members of the Department of Legal Studies have introduced for a trial period a Student Legal Referral Service. At least one member of the Department will be available on the days and at the times indicated on the Legal Studies Notice Board, to give students, without liability, free legal advice and to explain how and where they may obtain appropriate legal aid and representation.
Convocation provides an opportunity for graduates to maintain a positive interest and influence in University affairs. It has the right to discuss and to pronounce an opinion on any matter relating to the University, and to communicate directly with the Council or Senate of its own volition or at the request of either body.

Public meetings at which topics of interest are discussed are conducted by Convocation as well as general meetings. Convocation is controlled through a Standing Committee of 14 elected members including the Chairman, who is called the Warden of Convocation, and the Immediate Past Warden, who is the Deputy Chairman.

Membership is automatic for graduates of this University, and for those graduates of the University of New England and of the University of New South Wales who spent at least three years as students of Newcastle University College; for present and past members of the University Council; and for present full time members of the academic staff and graduate permanent members of the administrative, library and technical staff.

Council may admit as members of Convocation upon payment of a fee determined by Council:—

(a) Graduates of other Universities who are resident in the Hunter Valley or North Coast areas; and

(b) such other University graduates as the Council may approve.

Five members of the University Council are elected by Convocation.

OFFICE BEARERS

Warden — Mr. W. G. Derkenne, LL.B.(Sydney), B.A.

Secretary — Mr. E. J. Buckman, B.Sc.(New South Wales), M.Eng.Sc., A.S.T.C., M.I.E.Aust.

Treasurer — Mr. R. W. Gibbins, B.Com (Queensland), A.C.A.

Immediate Past Warden — Mr. J. P. Talty, B.D.S.(Sydney)
NEWCASTLE UNIVERSITY UNION

The objects of the Union are to provide a common meeting ground and social centre for men and women who are members of the University; to promote the education and the intellectual culture of its members by debates and otherwise and generally, to secure the cooperation of University men and women in furthering the interests of the University.

The Union maintains a fine building on the campus and major extensions during 1973 have increased facilities for members. Such facilities include a complete range of catering services (a liquor licence is anticipated), recreational and common room areas, a reading room, rooms for meetings and functions of all kinds, for 16 mm film projection, for T.V., and for music practice. A games complex on the lower level provides billiards, table tennis, chess, and music listening outlets. The Student Counsellor is on this lower level whilst a Student Health Centre with a doctor in attendance is located in the main building. The new commercial area includes the Union Shop which provides for the academic needs of members, a University Co-operative Bookshop, an A.U.S. Travel Service and A.U.S. Pharmacy together with premises operated by the Bank of New South Wales. The office of the Students' Representative Council is located within the new extensions, together with Union administrative offices.

Membership of the Union, obligatory for all registered students, is open to graduates, members of the University Council and the permanent staff of the University.

The conduct of the affairs of the Union is vested in the Board of Management comprising:

Two members appointed by the Council of the University
Ten members of the Union (at least two of whom must be graduates) elected by the members of the Union
Two members of the Union who are members of the Students' Representative Council
One member of the Union who is a committee member of the Sports Union
One representative of the staff of the Union elected by the Union Staff

The Secretary Manager of the Union.

Elections for the Board are held in the month of April.

President — Mr. R. Robinson, B.A.
Secretary Manager — Mr. W. V. Bridgewater

THE UNIVERSITY OF NEWCASTLE COMPANY

The University of Newcastle Company is the Citizen Military Force's Unit affiliated with the University. The Company was formed in 1957 as a Sub-Unit of the University of Technology Regiment which is now called The University of New South Wales Regiment. The current strength of the Company is 100.

The function of the Company is to train graduates and undergraduates for commissioned rank in the C.M.F. and the training designed with this in view, is done on an Infantry basis and consists of:

(a) An Annual Camp for three weeks in February
(b) An optional camp of fourteen days in December
(c) Two weekend bivouacs a year
(d) Parades on Friday nights of two hours duration
(e) Weekend day parades

The training programme is designed to fit in with vacations, examinations, and deferred examinations and there is practically no commitment in third term. Leave is available from activities where a good reason exists.

Enlistment in the Company is voluntary and is open to all graduates or undergraduates who are 17 years of age or over.

Members of the University of Newcastle Company are eligible for the following benefits:

An opportunity to reach commissioned rank in 2-3 years.
Tax-free pay for all training undertaken.
Refund of travelling expenses.
Opportunities for attendance at Regular Army Courses and short time attachments to Army units in Malaysia or New Guinea.
Free meals and accommodation at camps and bivouacs.
Free Uniforms.

Enquiries regarding conditions of service, and enlistment procedure should be made at the Training Depot which is in King Street, Newcastle West (opposite Birdwood Park). Phone No. 612121.

OFFICERS AND STAFF

Officer Commanding — Capt. P. Groves
Full-time Staff — WO2 M. Grovenor
S/Sgt. P. Toohey
THE UNIVERSITY OF NEWCASTLE
SPORTS UNION

The Sports Union is the student organisation responsible for the promotion and control of sporting activities within the University. All students are automatically members of the Sports Union. There are twenty-six affiliated clubs: Athletics, Australian Rules, Badminton, Men's Basketball, Women's Basketball, Cricket, Fencing, Golf, Men's and Women's Hockey, Mountaineering, Netball, Men's and Women's Rowing, Rugby Union and Rugby League, Sailing, Ski-ing, Soccer, Softball, Squash, Surfing, Swimming, Scuba, Table Tennis, Taekwondo, Tennis, Volleyball, most of which participate in local competitions and send teams to Inter-varsity contests each year. Inter-Faculty Contests conducted throughout the year aim to stimulate friendly rivalry among the various Faculties, and to encourage a higher student participation in sport. Each club has a student representative on the Sports Union Committee, which meets monthly. The Executive consists of the President, Vice-President, Secretary, Treasurer, a representative of the University Council and the Amenities Officer. The Sports Union's annual income is derived from a portion of the General Services Fee and is used to meet such costs as equipment, affiliation fees and Inter-varsity contests.

For outstanding individual performances in sport, the University awards "Blues" each year at the Annual "Blues" Dinner.

The number of constituent clubs is increasing continually, and students interested in participating in any sport are urged to contact the Amenities Officer, Mr. Bradford, or one of the Sports Union Executive for further information. The Sports Union Amenities office is located in the temporary building adjacent to the main University building.

President — Professor R. G. Tanner, M.A. (Melbourne & Cambridge)

Secretary — Mr. P. Hunt

Amenities Officer — Mr. H. Bradford

THE UNIVERSITY OF NEWCASTLE
STUDENTS' ASSOCIATION

All students proceeding to a degree or a diploma are members of the Students' Association.

Included in the General Services fee, which you all pay or have paid for you, is $8.00 subscription to the Newcastle University Students' Association (N.U.S.A.). You are all financial members of this Association and have every right — and a duty to yourselves — to take part in the running of the Association and the administration of its collective assets.

Each year, the Students' Association elects a number of students (22 at present) to the Students' Representative Council. This Council's purpose is:

1. to give money and other aid to the various clubs and societies, including religious, political and social groupings on campus;
2. when needed, to act as the students' voice in submissions to the University administration, the mass media, and various government departments;
3. to work for student welfare. The S.R.C. provides automatic accident insurance cover for students. It is also responsible for printing various student publications such as OPUS, the student newspaper, the Orientation Handbook, Nimrod, the annual literary magazine and the weekly Bulletin;
4. to implement student association policy on matters academic, political or administrative. N.U.S.A. policy is decided at official lunchtime meetings where all students may attend and vote.

With its various committees, for example, the welfare and education committees, and its officers such as the education campaign director, the travel officer and so on, N.U.S.A. attempts to facilitate as many expressions of cultural activity as possible, as well as organizing action to effect student policy on environment, aboriginal rights, apartheid and so on.
UNIVERSITY ORGANISATIONS

Each year, the Association organises, with some help, Orientation week and early in July, Autonomy Day, which is the equivalent of Commem., Foundation Day, or similar activities at other universities.

As the Students' Association is a constituent member of the Australian Union of Students, students of the University may take part in the activities of this body. Some of these activities which affect students more directly are the several intervarsity cultural festivals, travel to New Zealand and many countries in Asia, village schemes in Papua/New Guinea, raising money for aboriginal scholarships and World University Service, national campaigns on education, and the national student newspaper, National 'U'.

The Association, via general student meetings, ad hoc committees, and its officers, pursues policy on a wide variety of social, political, educational and welfare activities both internal to the campus and affecting our society as a whole. Frequently, controversial issues are raised and discussed. The ultimate decision on what your Association does, and how your money is spent, depends on all of you. The executive officers of your association are not there to decide policy, but to carry out your decisions.

It is more important than ever that new students help run the association. At the moment too few students do much of the work, and as the older students leave, the new ones must fill the gap or the association will collapse as a functioning unit. How can you help? Come to the general student meetings and vote; vote also in the S.R.C. elections and stand for positions that interest you. In general, try not to be apathetic or disinterested.

President — Mr. D. Wallace
Secretary — Mr. M. Pavlovic

FACULTY OF MATHEMATICS

REQUIREMENTS FOR THE DEGREE OF BACHELOR OF MATHEMATICS

1. Definitions

In these Requirements, unless the contrary intention appears, "the Faculty" means the Faculty of Mathematics and "the Faculty Board" means the Faculty Board of the Faculty of Mathematics.

2. Grading of Degree

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

3. Approval of First Enrolment

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

4. Timetable Requirements

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

5. Annual Examinations

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

6. Special Examinations

A candidate may be granted a special examination in accordance with the provisions of By-law 5.9.3.

7. Examination Grades

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

(a) A candidate may withdraw from a subject only by notifying the Secretary of 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. 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 Schedule.

(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; Part III; or Part IV.

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 requirement.

11. 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 the previous clause and pass such examinations as the Faculty Board concerned shall require.

12. Degree Patterns

(a) To qualify for the ordinary degree a candidate shall pass nine subjects provided that:
   (i) at least five are subjects in Mathematics;
   (ii) at least two are Part III Mathematics subjects; and
   (iii) no more than five are Part I subjects.

(b) Notwithstanding the provisions of subsection (a) of this clause, a candidate may substitute for one Part III Mathematics subject another Part III subject from the Schedule of subjects with a substantial mathematical content. (Schedule B)

13. Prerequisites and Corequisites

No candidate may enrol in a subject unless he has satisfied the prerequisites and corequisites for that subject.

14. Progression

(a) Progression in the course is by subject. A full-time student is required to pass four subjects, of which three must be Part I subjects, and a part-time student is required to pass two Part I 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 a Part III subject.

(c) A degree will not be awarded if a course of study continues for more than nine years, unless special approval is obtained from the Faculty Board for an extension of time.

15. Standing

(a) A graduate or an undergraduate of another university, university college or other faculty of the University may be granted standing in recognition of the work completed in such other university, university college 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 university, or university college shall not receive credit for more than four subjects;
(iii) a graduate of another university, university college 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 included in his previous degree.

(b) Notwithstanding the provision of section (a) (i) of this clause, a graduate or undergraduate of another university or university college 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 these 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.

(c) A degree will not be awarded until the successful completion of at least two years of an approved course of study.

16. Preparation for Honours

(a) A candidate who wishes to enrol in an Honours course must obtain the approval of the Head of the appropriate Department, or Departments, by the dates specified.
(b) A candidate wishing to enrol in an Honours course will be required to complete extra work concurrently with work for the ordinary degree.

17. Honours in Mathematics

To qualify for admission to Honours in Mathematics a candidate shall:
(i) have satisfied the requirements for admission to the ordinary degree; the subjects Mathematics IIIA and Mathematics IIIB must be included;
(ii) have completed additional work concurrently with his ordinary degree, as prescribed by the Department of Mathematics;
(iii) pass the subject Mathematics IV.

18. Combined Honours

To qualify for admission to combined Honours, a candidate shall:
(i) have satisfied the requirements for admission to the ordinary degree and have included in his course such prerequisite subjects as may be prescribed for admission to the combined Honours subject or subjects;
(ii) have completed such additional work concurrently with his ordinary degree as may be prescribed by the Department of Mathematics and the other Department concerned;
(iii) pass the combined Honours subject or subjects. (Schedule C)

19. 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, provided that where it is deemed practical to allow a part-time student to become a candidate for Honours, the corresponding period shall be seven years.

A candidate wishing to proceed to Honours 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 Honours subject or subjects over two successive years.

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 Honours subject, including combined subjects, the most distinguished candidate of the year may be awarded a University Medal.
22. Equivalent Honours

(a) On the recommendation of a Head of Department in the Faculty and with the permission of the Dean, a graduate who, in the disciplines concerned, has not completed a fourth year Honours subject either as a full-time or a part-time student at this or at any other Australian University, may enrol in fourth year Honours as a full-time or a part-time student.

(b) Such a graduate who has completed all of the requirements of fourth year Honours 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 completing fourth year Honours.

DEGREE OF BACHELOR OF MATHEMATICS

SCHEDULE A — MATHEMATICS SUBJECTS

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>REMARKS INCLUDING PRE-REQUISITES AND COREQUISITES</th>
</tr>
</thead>
<tbody>
<tr>
<td>PART I</td>
<td>Mathematics I</td>
</tr>
<tr>
<td></td>
<td><strong>Prerequisite</strong> Mathematics I</td>
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<tr>
<td></td>
<td><strong>Prerequisite</strong> Mathematics IIA</td>
</tr>
<tr>
<td></td>
<td><strong>Corequisite</strong> Mathematics IIA and Mathematics IIB</td>
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<tr>
<td></td>
<td>Mathematics IIC</td>
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<tr>
<td></td>
<td><strong>Prerequisite</strong> Mathematics IIIA</td>
</tr>
<tr>
<td></td>
<td><strong>Prerequisite</strong> Mathematics IIIA and Mathematics IIIC</td>
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<tr>
<td></td>
<td>Mathematics IIIB</td>
</tr>
<tr>
<td></td>
<td><strong>Pre- or Corequisite</strong> Mathematics IIIA</td>
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<tr>
<td></td>
<td><strong>Pre- or Corequisite</strong> Mathematics IIIA</td>
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<tr>
<td></td>
<td>Mathematics IV</td>
</tr>
<tr>
<td></td>
<td><strong>Prerequisites</strong> Mathematics IIIA and Mathematics IIIB</td>
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</tbody>
</table>
SCHEDULE B — SUBJECTS WITH A SUBSTANTIAL MATHEMATICAL CONTENT

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>REMARKS INCLUDING PRE-REQUISITES AND COREQUISITES</th>
</tr>
</thead>
<tbody>
<tr>
<td>PART I</td>
<td></td>
</tr>
<tr>
<td>Civil Engineering IIM</td>
<td>It is assumed that students have studied Higher School Certificate Mathematics and Science, including Physics and Chemistry, at second level short course or higher.</td>
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<tr>
<td>PART II</td>
<td></td>
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<tr>
<td>Civil Engineering IIM</td>
<td>Prerequisites Civil Engineering IIM and Mathematics I</td>
</tr>
<tr>
<td>PART III</td>
<td></td>
</tr>
<tr>
<td>Accounting IIC</td>
<td>Prerequisites Mathematics IIA and either Accounting IIA or Accounting IIB</td>
</tr>
<tr>
<td>Economics IIC</td>
<td>Prerequisite Economics IIA</td>
</tr>
<tr>
<td>Chemical Engineering IIC</td>
<td>Prerequisites Chemical Engineering I, Mathematics IIA and Mathematics IIC (including Topics E and F)</td>
</tr>
<tr>
<td>Civil Engineering IIM</td>
<td>Prerequisites Civil Engineering IIM, Mathematics IIA and Mathematics IIC (including Topic E)</td>
</tr>
<tr>
<td>Industrial Engineering I</td>
<td>Prerequisite Mathematics I</td>
</tr>
<tr>
<td>Communications and Automatic Control</td>
<td>Prerequisites Mathematics IIA and Mathematics IIC (including Topics C, D and E)</td>
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</tbody>
</table>

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

DESCRIPTION OF SUBJECTS

PRELIMINARY NOTES

The Department offers and examines subjects. Each subject is composed of topics, each topic consisting of about 27 lectures and 13 tutorials throughout the year. Each of the part I, part II, and part III subjects consists of four topics. For Mathematics I, there is no choice of topics; for Mathematics IIA, IIB, IIC there is some choice available to students; for Mathematics IIA and IIB there is a wider choice. No topic may be counted twice in making up distinct subjects.

MATHEMATICS I

A subject of four lectures and two tutorial hours per week for three terms comprising the following topics. Summaries and booklists for these topics appear on page 77 et seq. of this handbook.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Corequisite or Prerequisite Topic</th>
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<tbody>
<tr>
<td>A</td>
<td>Mathematical Models</td>
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<td>C</td>
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<td>E</td>
<td>Differential Equations and Integral Transforms</td>
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<td>F</td>
<td>Numerical Analysis and Computing</td>
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<tr>
<td>G</td>
<td>Fourier series, Partial Differential Equations and Special Functions</td>
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<tr>
<td>H</td>
<td>Probability and Statistics</td>
</tr>
<tr>
<td>I</td>
<td>Topic in Statistics e.g. Non-parametric Methods</td>
</tr>
<tr>
<td>J</td>
<td>Topic in Applied Mathematics e.g. Mechanics</td>
</tr>
<tr>
<td>K</td>
<td>Topic in Pure Mathematics e.g. Group Theory</td>
</tr>
<tr>
<td>L</td>
<td>Analysis of Metric Spaces</td>
</tr>
</tbody>
</table>

The selection rules and definitions of the Part II subjects are:

MATHEMATICS IIA

A subject of four lectures and two tutorial hours per week for three terms comprising topics B, C, D, and E. In exceptional circumstances and with the consent of the Head of Department one topic from A, F, G, or H may be substituted for B.

MATHEMATICS IIB

A subject of four lectures and two tutorial hours per week for three terms comprising four topics chosen from A to H and approved by the Head of the Department. In exceptional circumstances, and with the consent of the Head of the Department one or more of the topics I, J, K or L may be included.

Part-time students in the Faculty of Mathematics may take Mathematics IIB in two parts, each of two lectures per week for three terms.

MATHEMATICS IIC

A subject of four lectures and two tutorial hours per week comprising either topics G, J, K and L or topics H, I, K and L. Subject to the consent of the Head of the Department one topic from A to J may be substituted for one of the topics I or J.

In exceptional circumstances, and with the consent of the Head of Department, a substitution may be made for topic L.
Notes

1. Mathematics II A is pre- or corequisite for Mathematics II C.

2. In order to take all three Part II subjects, a student must study all twelve topics.

3. Students whose course includes a Schedule B subject may have their choice of topics restricted further than is set out in the rules above.

4. Students whose courses include Physics IIIA are advised to include topics C, E, G, H in their Mathematics Part II subjects: this may require the use of the substitution rules.

5. 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 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.

PART III SUBJECTS
The Mathematics Department offers two Part III subjects, each comprising four topics chosen from the list below.

Students wishing to proceed to Honours in Mathematics are required to take both these subjects. Students wishing to proceed to Combined Honours are required to take Mathematics III A together with the appropriate subject from Schedule B. Students proceeding to Honours will also be required to study additional topics as prescribed by the Heads of the Departments concerned.

Passes in both Mathematics II A and II C are prerequisite for entry to Mathematics III A, and Mathematics III A is pre- or corequisite for Mathematics III B. It will be assumed that students taking a third-year subject in 1974 have already studied topics B, C, D, K in their Part II subjects.

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

Summaries of these topics, together with texts and references, appear on page 87 et sq. of this handbook.

LIST OF TOPICS FOR PART III

<table>
<thead>
<tr>
<th>Topic</th>
<th>Prerequisite</th>
<th>Corequisite</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>General Tensors</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>Variational Methods</td>
<td></td>
</tr>
<tr>
<td>O</td>
<td>Mathematical Logic</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>Differential and Integral Equations</td>
<td>E</td>
</tr>
<tr>
<td>PD</td>
<td>Theory of Partial Differential Equations</td>
<td></td>
</tr>
<tr>
<td>Q</td>
<td>Fluid Dynamics</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>Probability and Statistics</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>Geometry</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>Group Theory</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>Operations Research</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>Measure Theory and Integration</td>
<td>Analysis of Metric Spaces</td>
</tr>
<tr>
<td>W</td>
<td>Analysis of Normed Linear Spaces</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>Rings and Fields</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>Topic in Applied Probability e.g. Information Theory</td>
<td>H</td>
</tr>
<tr>
<td>Z</td>
<td>Mathematical Principles of Numerical Analysis</td>
<td></td>
</tr>
</tbody>
</table>

The selection rules and definitions of the Part III subjects are:

MATHEMATICS III A
A subject of four lectures and two tutorial hours per week for three terms, comprising four topics, which must include O, and at least one of P, Q, R, or U. In addition, students taking this subject will be required to complete an essay on a topic chosen from the history or philosophy of Mathematics. (Note that Mathematics III A is a pre- or corequisite for Mathematics III B).

MATHEMATICS III B
A subject of four lectures and two tutorial hours per week for three terms comprising four topics chosen from the fifteen listed above.

Notes

1. In order to take both Mathematics III A and Mathematics III B, a student must study eight topics from M to Z above with the restriction that Topic O, and at least one of P, Q, R or U must be included in these eight topics.

2. Students whose course includes a subject from Schedule B may have their choice of topics further restricted.

3. Students aiming to take Mathematics IV may be required to undertake study of more topics than the eight comprising the two part III subjects.
MATHEMATICS IV

A student desiring admission to this subject must apply in writing to the Head of Department before 7th December of the preceding year. This subject extends over one full-time or two part-time academic years and will be examined by about eight papers, each of two hours duration. Each student will be required to present a thesis; i.e. a study under direction of a special topic using relevant published material and presented in written form.

The topics offered may be from any branch of Mathematics including Pure Mathematics, Applied Mathematics, Statistics, Computing Science and Operations Research as exemplified in the publication Mathematical Reviews. In any one year a selection of topics, each of about 27 lectures, will be offered. Students will be expected to present about eight of these for examination. Summaries of topics which may be offered in 1974 appear on page 97 et seq. of this handbook.

DESCRIPTION OF SUBJECTS

SCHEDULE B

PART I SUBJECT

CIVIL ENGINEERING I\(\text{M}\)

This subject consists of the following four topics.

\begin{align*}
\text{CE111} & \quad \text{Statics} \\
\text{ME131} & \quad \text{Dynamics} \\
\text{CE231} & \quad \text{Fluid Mechanics I or ME251 Fluid Mechanics} \\
\text{CE212} & \quad \text{Mechanics of Solids I}
\end{align*}

PART II SUBJECT

CIVIL ENGINEERING II\(\text{M}\)

This subject consists of the following three topics.

\begin{align*}
\text{CE313A} & \quad \text{Structural Analysis I} \\
\text{CE332} & \quad \text{Fluid Mechanics II} \\
\text{ME301} & \quad \text{Engineering Computations}
\end{align*}

PART III SUBJECTS

ACCOUNTING II\(\text{IC}\)

A subject of four lectures and one tutorial hour per week comprising either Accounting IIIA or Accounting III\(\text{B}\) and two appropriately chosen Part III topics (e.g., topics U and R) offered by the Department of Mathematics and approved by the Head of the Department.

ECONOMICS II\(\text{IC}\)

In order to pass Economics II\(\text{IC}\) a student must study the topics Econometrics I, Growth and Development and one of the topics Public Economics or International Economics and offer them for examination.
CHEMICAL ENGINEERING IIIC
This subject consists of the following:
Separation Processes (2 units)
Particulate Systems — Granular Materials (1 unit)
Particulate Systems — Fluid-solid Separations (1 unit)
Transport Theory II (2 units)
Reaction Engineering I (1 unit)
Chemical Process Control (1 unit)

Note
Heat Transfer III (2 units) may be studied as an alternative to any two other topic units.

CIVIL ENGINEERING IIIM
In order to pass Civil Engineering IIIM a student must study topics CE414A and CE324, and any two of the other four topics and offer them for examination.
CE414A Structural Analysis II
CE324 Soil Mechanics
CE415A Structural Analysis — Continua
CE415B Structural Analysis — Plasticity
CE434A Fluid Mechanics — Theoretical Hydrodynamics
CE434B Fluid Mechanics — Open Channel Flow

COMMUNICATIONS AND AUTOMATIC CONTROL
This subject consists of the following four topics.
EE341 Automatic Control
EE342 Automatic Control
EE442 Modern Control
EE444 Communication Systems

DIGITAL COMPUTERS AND AUTOMATIC CONTROL
This subject consists of the following four topics.
EE341 Automatic Control
EE342 Automatic Control
EE361 Computer Structure: Machine and Assembly Languages
EE362 Logical Design and Switching Theory

MECHANICAL ENGINEERING IIIC
Students enrolling in this subject may choose one of the following alternatives (a), (b), (c) or (d). However it is not anticipated that all four alternatives will be available each year.

(a) ME361 Automatic Control
ME401 Systems Analysis
ME402 Systems Planning, Organisation and Control
ME487 Operations Research — Deterministic Models
(b) ME402 Systems Planning, Organisation and Control
ME487 Operations Research — Deterministic Models
ME488 Operations Research — Probabilistic Models
ME489 Operations Research — Applications in Industry
(c) ME402 Systems Planning, Organisation and Control
ME403 Resources Planning and Allocation
ME404 Mathematical Programming
ME488 Operations Research — Probabilistic Models
(d) ME361 Automatic Control
ME434 Advanced Kinematics and Dynamics of Machines
ME449 Reliability Analysis for Mechanical Systems
and either
ME446 Introduction to Plastic Analysis
or
ME448 Introduction to Photomechanics

PHYSICS IIIA
This subject consists of the following topics.
1. Analytical Mechanics
2. Electromagnetic Field Theory
3. Relativity
4. Quantum Mechanics
5. Statistical Mechanics
6. Electronics
7. Solid State Physics
8. Nuclear Physics

PSYCHOLOGY IIIC
This subject consists of the following topics.
1. Factor Analysis
2. Personality Assessment
3. Personality
4. Cognition
5. Perception
6. Physiological Psychology
7. One or more other topics chosen in consultation with the Head of the Department.
DESCRIPTION OF SUBJECTS

SCHEDULE C

MATHEMATICS/PHYSICS IV

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, and must have completed the subjects Mathematics IIIA and Physics IIIA and such additional work as is required for combined honours students by the Department of Mathematics.

Each student shall present a minor thesis in Mathematics, written with physical applications in view, and complete a major project in Physics, which will be experimental. The student shall also complete four topics from Mathematics IV, chosen for their application to Physics. He must also attend selected topics in Physics IV. Examinations will be held on the Mathematics and Physics topics.

MATHEMATICS/PSYCHOLOGY IV

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, and must have completed the subjects Mathematics IIIA and Psychology IIIIC and such additional work as is required for combined honours students by the Departments of Mathematics and Psychology.

Each student shall present a minor thesis in Mathematics, written with psychological applications in view, and complete a major project in Psychology, which will be experimental but will be based on a mathematical model of the phenomenon being studied. The student shall also complete four topics from Mathematics IV, chosen for their application to Psychology. He must also attend a seminar on measurement (which meets for 1½ hours each week). Examinations will be held on the four Mathematics topics, the measurement seminar, and prescribed reading in the area of the major project.

SUMMARIES OF TOPICS, TEXT BOOKS AND REFERENCE BOOKS

SCHEDULE A

MATHEMATICS I

TOPIC AN — REAL ANALYSIS — M. J. Hayes

Text
Calculus Vol. I 2nd ed. T. Apostol
(Ginn Blaisdell 1967)

Real Analysis J. R. Giles
(Wiley 1973)

It is recommended that students intending to major in Mathematics should have this book.

Reference
Calculus M. Spivak
(W. A. Benjamin Inc. 1967)

TOPIC AL — ALGEBRA — W. Brisley
Introduction to basic algebraic objects and ideas. Matrices, permutations, complex numbers. Linear Algebra: vector spaces, homomorphisms, matrices, determinants; algorithms for solution of equations; rank, nullity; eigenvectors and eigenvalues; applications various.

Text
A Basis for Linear Algebra W. Brisley
(Wiley 1973)

References
Algebra for Scientists and Engineers H. Liebeck
(Wiley 1971)
Linear Algebra A. Mary Tropper
(Nelson 1973)
Introduction to Modern Algebra N. McCoy
(Allyn & Bacon 1968)
CA — CALCULUS — E. R. Smith


Text
Calculus Vol. I 2nd ed.
T. Apostol
(Ginn Blaisdell 1967)

References
Calculus and Analytic Geometry J. R. Britton, R. B. Kriehg & L. W. Rutland
(Freeman 1966)
First Year Calculus E. Hille & S. Salas
(Ginn Blaisdell 1968)
(International Textbook Series)
Calculus and Linear Algebra Vol. I W. Kaplan & D. J. Lewis
(Wiley 1970)

TOPIC NM — NUMERICAL MATHEMATICS — A. J. Guttmann

Introduction to computers, flowcharts and Fortran coding. Elementary data analysis: calculations of sample moments of discrete distributions and programming of these operations. Introduction to statistical analysis and numerical analysis with computer illustrations. The writing of successful computer programs is a required part of this topic.

Text
Basic Fortran IV Programming J. M. Blatt
(Computer Systems of Australia Pty. Ltd. 1969)

References
A First Course in Numerical Analysis A. Ralston
(McGraw-Hill 1965)
Introduction to Mathematical Statistics 3rd ed. P. G. Hoel
(N.Y., Wiley 1963)

TOPIC A — MATHEMATICAL MODELS — D. L. S. McElwain

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. For example, models involving applications of operations research, probability and differential equations will be developed.

Text
No prescribed text

References
Prisoner’s Dilemma Anatol Rapoport & A. M. Chammah
(University of Michigan Press 1965)
Mathematical Models in Social Sciences J. G. Kemeny & J. L. Snell
(Ginn Blaisdell 1963)
Operations Research — an Introduction H. A. Taha
(Macmillan 1971)
Principles of Operations Research H. M. Wagner
(Prentice-Hall 1969)
Applications of Undergraduate Mathematics in Engineering B. Noble
(M.A.A./Collier-MacMillan 1967)
PART II TOPICS

TOPIC B — COMPLEX ANALYSIS — W. C. Summerfield

Text
Complex Variables with Physical Applications
Arthur A. Hauser
(Simon & Schuster 1971)

OR
Complex Variables
N. Levinson & R. M. Redheffer
(Holden Day 1970)

OR
Theory and Problems of Complex Variables
Murray R. Spiegel
(McGraw-Hill 1964)

References
Elements of Complex Variables
Louis L. Pennisi
(Holt, Rinehart & Winston 1963)

Theory of Functions of a Complex Variable
A. I. Markushevich
3 Vols.

TOPIC C — CALCULUS AND VECTOR CALCULUS —
R. J. Vaughan

Text
Theory and Problems of Advanced Calculus
M. R. Spiegel
(McGraw-Hill 1963)

Reference
Calculus Vol. II 2nd ed.
T. Apostol
(Xerox 1969)

TOPIC D — LINEAR ALGEBRA — W. Brisley

Text
No set text.

References
A Basis for Linear Algebra
W. Brisley
(Wiley 1973)

Elementary Linear Algebra
L. H. Lange
(Wiley 1968)

Linear Algebra
A. Mary Trotter
(Nelson 1969)

Matrices
F. Ayres
(Schaum 1962)

Linear Algebra
S. Lipschutz
(Schaum 1968)

Linear Algebra and Matrix Theory
E. D. Nering
(Wiley 1964)

Matrix Methods for Engineering
L. A. Pipes
(Prentice-Hall 1964)

TOPIC E — DIFFERENTIAL EQUATIONS AND INTEGRAL TRANSFORMS — J. G. Couper

Text
Elementary Differential Equations and Boundary Value Problems
W. E. Boyce & R. C. DiPrima
(N.Y., Wiley 1969)
PART II TOPICS

TOPIC F — NUMERICAL ANALYSIS AND COMPUTING —
D. L. S. McElwain


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

OR

Applied Numerical Methods
B. Carnahan, H. A. Luther & J. O. Wilkes
(Wiley 1969)

The Elements of Fortran Style
C. B. Kreitzberg & B. Shneiderman
(N.Y., Harcourt, Brace & Jovanovich Inc. 1972)

Reference

Elementary Numerical Analysis
S. D. Conté
(McGraw-Hill 1965)

TOPIC G — FOURIER SERIES, PARTIAL DIFFERENTIAL EQUATIONS AND SPECIAL FUNCTIONS — E. R. Smith


Solution of partial differential equations with two-dimensional space coordinates, separation of variables in polar and rectangular coordinates. The Bessel equation and Bessel functions. Gamma and Beta functions.

Solution of partial differential equations with three dimensional space coordinates, separation of variables in spherical coordinates and other co-ordinate systems, spherical harmonics, Legendre equations and Legendre polynomials.

Texts
A First Course in Partial Differential Equations
H. F. Weinberger
(Ginn Blaisdell 1965)

AND

Fourier Series
I. N. Sneddon
(Routledge 1961)

Reference

Advanced Calculus
W. Kaplan
(Addison-Wesley 1965)
PART II TOPICS

TOPIC H — PROBABILITY AND STATISTICS — R. G. Keats

This topic is an introduction to the Theory of Probability and Statistics. No previous knowledge of Probability or Statistics will be assumed. The lectures will include a discussion of the following. Finite probability space, simple random variable, expectation, mean, variance, covariance, correlation, independence, frequency function, distribution function, joint frequency function, moments and binomial variates. Error propagation. Tchebichev inequality and the weak law of large numbers. Normal variates. Classification of experimental data, histograms, empirical moments, measures of location and scatter. Statistical inference, hypothesis testing, types of error, power Tunction, sampling theory, maximum likelihood estimation; frequency functions of the mean ($\bar{X}$), difference or two means ($X - Y$), and the statistics $X^2$, $S^2$, $T$ and $F$ with applications.

Text

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

OR

P. G. Hoel
(N.Y., Wiley 1963)

References

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

An Introduction to Probability Theory
P. A. P. Moran
(Oxford University Press 1968)

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

W. Feller
(N.Y., Wiley 1968)

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

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

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

TOPIC I — TOPIC IN STATISTICS — W. Ficker

e.g. NON-PARAMETRIC METHODS — W. Ficker

This topic is an introduction to some non-parametric methods in statistics which are used to test hypotheses and also to estimate parameters of probability distributions. The lectures will include tests concerning one-sample, two-sample, and k-sample problems, randomized blocks, goodness-of-fit tests, and tests involving independence, correlation, and regression.

Text

Practical Non-parametric Statistics
W. J. Conover
(Wiley 1971)

References

Statistical Tables
F. J. Rohlf & R. R. Sokal
(W. H. Freeman 1969)

Nonparametric Statistical Inference
J. D. Gibbons
(McGraw-Hill 1971)

A Non-parametric Introduction to Statistics
C. H. Kraft & C. van Eeden
(Collier-Macmillan 1968)

Elements of Non-parametric Statistics
G. E. Noether
(Wiley 1967)

TOPIC J — TOPIC IN APPLIED MATHEMATICS — E. R. Smith

e.g. MECHANICS — E. R. Smith


Text

Theory and Problems of Theoretical Mechanics
M. R. Spiegel
(New York, Schaum Publishing Co.)

References

Mechanics — Lectures in Theoretical Physics Vol. I
A. Sommerfeld

The Feynman Lectures in Physics
Vol I
R. F. Feynman, R. B. Leighton & M. Sands
(Addison-Wesley Publishing Co.)
PART II TOPICS

TOPIC K — TOPIC IN PURE MATHEMATICS
e.g. GROUP THEORY — M. J. Hayes


Text
The Theory of Groups
I. D. Macdonald
(Edward University Press 1968)

OR

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

Reference
The Theory of Groups: an Introduction
J. J. Rotman
(Allyn & Bacon 1966)

TOPIC L — ANALYSIS OF METRIC SPACES — J. R. Giles

Examples of metric and normed linear spaces; the topology of metric spaces, equivalent metrics. Convergence of sequences, completeness. Cluster points and closure, density and separability. Continuity of mappings and of linear mappings on normed linear spaces, uniform continuity. Uniform convergence of sequences and series of real mappings, applications to differentiation and integration of sequences and series of real mappings, power series; Weierstrass’ Approximation Theorem. Compactness, the equivalence of the various forms of compactness for metric spaces, application to the topological equivalence of finite dimensional normed linear spaces.

Text
Metric Space Analysis
J. R. Giles

References
Real Analysis
A. J. White
(Addison-Wesley 1968)

Introduction to Topology
B. Mendelson
(Pankey 1963)

Introduction to Topology and Modern Analysis
G. F. Simmons
(McGraw-Hill 1963)

Foundations of Modern Analysis
J. Dieudonné
(Academic Press 1960)

Methods of Real Analysis
R. R. Goldberg
(Ginn Blaisdell 1964)

Real Analysis — an Introductory Course
J. R. Giles
(Wiley 1973)

PART III TOPICS

TOPIC M — GENERAL TENSORS — P. K. Smrz


Text
Tensor Calculus
J. Abram
(Butterworths 1965)

References
Elements of Tensor Calculus
A. Lichnerowicz
(Methuen 1962)

Applications of Tensor Calculus
A. J. McConnel
(N.Y., Dover 1957)

Tensor Calculus
B. Spain
(Oliver & Boyd 1953)

TOPIC N — VARIATIONAL METHODS — W. P. Wood


Text
Calculus of Variations
L. E. Elsgolc
(Pergamon Press 1963)

References
Calculus of Variations
R. Weinstock
(N.Y., McGraw-Hill 1952)

Complementary Variational Principles
A. M. Arthurs
(Oxford, Pergamon Press 1964)

Variational Methods in Mathematical Physics
S. G. Mikhlin
(Oxford, Pergamon Press 1964)

Variational Methods in Economics
G. Hadley & M. C. Kemp
(Amsterdam, North-Holland 1971)
PART III TOPICS

TOPIC O — MATHEMATICAL LOGIC — W. Brisley
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 theorem will be discussed briefly.

Text
No prescribed text — Duplicated notes will be available.

References
First Order Mathematical Logic A. Margaris (Mass., Ginn Blaisdell 1967)
Elements of Mathematical Logic P. S. Novikov (Addison-Wesley 1963)
Mathematical Logic S. C. Kleene (Wiley 1967)
Symbolic Logic I. Copi (Macmillan 1967)
Notes on Logic R. C. Lyndon (Van Nostrand 1966)

TOPIC P — DIFFERENTIAL AND INTEGRAL EQUATIONS — J. G. Couper
Differential equations: existence and uniqueness theorem for first order differential equations; linear equations with constant coefficients; autonomous systems and phase space; stability for non-autonomous equations; Liapunov’s direct method. Integral equations: introduction; existence and uniqueness theorems; solution of Fredholm’s equation expressed as a ratio of two integral series; Hilbert-Schmidt theory of integral equations with symmetric kernels.

Texts
Ordinary Differential Equations and Stability Theory: an Introduction D. A. Sanchez (Freeman 1968)
AND
Linear Integral Equations W. V. Lovitt (N.Y., Dover 1950)

TOPIC PD — THEORY OF PARTIAL DIFFERENTIAL EQUATIONS — T. K. Sheng
An exhaustive study of the simplest linear homogeneous equations of second order in two independent variables presented as an “outline” of the field of boundary value problems and followed by the presentation of successively more difficult and general theorems. Theory of characteristics and type classification, Picard iteration, Riemann method, Cauchy-Kovalevski theorem, classical potential theory, Green’s function in n-dimensions, variational principles for estimating eigenvalues and other quadratic functionals, retarded potentials and the wave equation in n-dimensions.

Text
No prescribed text.

References
Foundations of Potential Theory O. D. Kellogg (Dover 1953)
Generalized Functions and Partial Differential Equations A. Friedman (Prentice-Hall 1963)
A First Course in Partial Differential Equations with Complex Variables and Transform Methods H. F. Weinberger (Ginn Blaisdell 1965)
PART III TOPICS

TOPIC Q — FLUID DYNAMICS — W. T. F. Lau

Introduction; basic equations; potential flow. Two-dimensional motions: flow involving sources, sinks, doublets and vortices; the method of images; Milne-Thomson's circle theorem; Blasius' theorem and Lagally's theorem. Conformal transformation and its applications to two-dimensional problems: elementary transformations; Joukowski's transformation; the theorem of Kutta and Joukowski; the Schwarz-Christoffel transformation. Axisymmetric motions: Stokes' stream function; motions involving sources, sinks and doublets.

Text
Elementary Classical Hydrodynamics B. H. Chirgwin & C. Plumpton
(Pergamon Press 1967)
OR
Theoretical Hydrodynamics 5th ed. L. M. Milne-Thomson
(London, Macmillan 1968)

TOPIC R — PROBABILITY AND STATISTICS — P. K. Smrz

This topic consolidates and extends the study of probability and statistics made in Topic H. Items studied include random vectors, generating functions of random vectors, multinomial and multivariate normal random vectors. Sampling theory, the t and F distributions. Point and interval estimation. Decision theory, Bayes decision rules. Hypothesis-testing, Neyman-Pearson Lemma, likelihood ratio. Linear regression and analysis of variance.

Text
Probability Distributions and Statistics Peter W. Zehna
(Allyn & Bacon 1970)
References
Statistics and Experimental Design in Engineering and the Physical Sciences (2 Vols.) N. L. Johnson & F. C. Leone
(Wiley 1964)
The Advanced Theory of Statistics (3 Vols.) M. G. Kendall & A. Stuart
(Griffin 1958-1966)
Statistical Theory 2nd ed. B. W. Lindgren
(Collier-Macmillan 1968)
Problems in Probability Theory, Mathematical Statistics and Theory of Random Functions A. A. Sveshnikov (ed.)
(W. B. Saunders 1968)
Mathematical Statistics 2nd ed. S. S. Wilks
(Wiley 1962)

TOPIC S — GEOMETRY — T. K. Sheng

Origins of projective geometry; projective space; duality; projectivities; Desargues' theorem; Pascal's theorem. Axiomatic approach: notions from algebra; incidence axioms in the plane; groups of transformations of the plane; invariance; affine and projective planes; Desargues' and Pappus' configurations; coordinates in the plane.

Texts
An Introduction to Finite Projective Planes A. A. Albert & R. Sandler
(Holt-Rinehart-Winston 1968)
Projective Geometry F. Ayres
(Schaum 1967)
References
Lectures on Modern Geometry B. Segre
(Cremonese 1961)
Transformations and Geometries D. Gans
(Appleton Century Crofts 1969)
Projective and Euclidean Geometry W. T. Fishback
(Wiley 1962)
Axiomatic Projective Geometry A. Heyting
(Noordhoff-North Holland 1963)

TOPIC T — GROUP THEORY — L. Janos

Finite Abelian groups.
Infinite Abelian groups; torsion, torsion-free, free Abelian, finitely generated and divisible groups.
Finite groups; Sylow theorems and their application to an analysis of isomorphism classes.
Series; Jordan-Hölder theorem, soluble and nilpotent groups.

Text
The Theory of Groups I. D. Macdonald
(Oxford University Press 1968)
OR
Group Theory B. Baumslag & B. Chandler
(Schaum 1968)
Reference
The Theory of Groups J. J. Rotman
(Allyn & Bacon 1966)
PART III TOPICS

TOPIC U — OPERATIONS RESEARCH — W. D. Wallis

In 1974, this course will consider mainly the mathematics of deterministic models in operations research. Topics covered will include game theory; linear programming; graphs, flows and networks; activity analysis; dynamic programming.

Text
No prescribed text.

References

Operations Research — an Introduction
H. A. Taha
(Macmillan 1971)

Introduction to Operations Research
F. S. Hillier & G. J. Lieberman
(Holden-Day 1967)

Flows in Networks
L. Ford & D. Fulkerson
(Princeton University Press 1962)

Combinatorial Theory
M. Hall Jr.
(Ginn Blaisdell 1967)

Mathematical Programming
S. Vajda
(Addison-Wesley 1961)

Linear Programming and Extensions
G. B. Dantzig
(Princeton 1963)

Applied Dynamic Programming
R. E. Bellman & S. E. Dreyfus
(Princeton 1962)

Games and Decisions
R. D. Luce & H. Raiffa
(Wiley 1957)
PART III TOPICS

TOPIC W — ANALYSIS OF NORMED LINEAR SPACES — J. R. Giles

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

Text
Elements of Functional Analysis A. L. Brown & A. Page
(Van Nostrand Reinhold 1969)

References
Introduction to Topology and Modern Analysis G. F. Simmons
(McGraw-Hill 1963)

Functionals Analysis
A. Wilansky
(Blaidsell 1964)

Introduction to Functional Analysis
A. E. Taylor
(Wiley 1958)

Théorie des Opérations Linéaires 2nd ed.
S. Banach
(Chelsea)

Elements of Functional Analysis
L. A. Liusternik & U. J. Sobolev
(N.Y., Frederick Unger 1961)

Elements of the Theory of Functions and
Functional Analysis Vol. I A. N. Kolmogorov & S. V. Fomin
(Rochester N.Y., Grayloch Press 1957)

TOPIC X — RINGS AND FIELDS — M. J. Hayes

This course arises from some classical geometric and algebraic problems such as the trisection of arbitrary angles and the solution of polynomials by radicals. The setting is provided by the study of some fundamental properties of rings and ideals, in particular rings of polynomials and fields of rational functions. This leads to the study of extension fields, algebraic and transcendental elements, automorphisms of fields of polynomials, relations between fields and groups of automorphisms and finally Abel's theorem on the insolvability of the general quintic equation by radicals.

Text
Topics in Algebra
I. N. Herstein
(N.Y., Ginn Blaisdell 1965)

References
Fields and Rings
I. Kaplansky
(Univ. of Chicago 1969)

Galois Theory
E. Artin
(Univ. of Notre Dame Press 1944)

A Survey of Modern Algebra
G. D. Birkhoff & S. MacLane
(Macmillan 1953)

Introduction to Field Theory
I. T. Adamson
(Oliver & Boyd 1964)

Structures of Algebra
S. Lang
(Addison-Wesley 1967)

Fundamentals of Galois Theory
M. Postnikov
(Netherlands, P. Noordhoff 1962)

Oeuvres Mathématiques
E. Galois
(Gauthiers-Villars 1951)

TOPIC Y — TOPIC IN APPLIED PROBABILITY — W. P. Wood

e.g. INFORMATION THEORY — R. Ash

This topic is an introduction to that theory of information which originated in the work of C. E. Shannon in 1948. The uniqueness theorem for the information content H will be proved followed by proof of several inequalities involving this function. The concept of a channel and its capacity will be introduced and Shannon's fundamental theorem for discrete channels without memory will be proved.

If time permits some other aspects of information theory, e.g. Wiener prediction and filtering, will be discussed.

Text
Information Theory
R. Ash
(N.Y., John Wiley 1965)
PART III TOPICS

References

Foundations of Information Theory  A. Feinstein
(N.Y., McGraw-Hill 1958)

An Introduction to Information Theory  F. M. Reza
(N.Y., McGraw-Hill 1961)

Information Theory and Reliable Communication  R. G. Gallagher
(Wiley 1968)

Recent Results in Information Theory  S. Kotz
(London, Methuen 1966)

Science and Information Theory  L. Brillouin
(Academic Press 1962)

Mathematical Foundations of Information Theory  A. I. Khinchin
(Dover 1957)

TOPIC Z—MATHEMATICAL PRINCIPLES OF NUMERICAL ANALYSIS—W. C. Summerfield

The general theory of convergence of linear iterative methods for approximating solutions of linear systems of algebraic equations and its efficient utilization to approximate solutions of boundary value problems by way of finite difference or “continuous” discretizations. Adaptation to the understanding of asymptotic stability of linear marching schemes and the general importance of numerical stability in the numerical handling of initial-value problems. Numerical treatment of non-linear systems of algebraic equations and non-linear marching schemes. The existence question for certain initial value problems and the importance for associated marching schemes. Serious fluid, elastic, and electric applications are completely analyzed, an attempt being made throughout to motivate all developments by a discussion of the sort of application areas that bred them. Some analysis background is assumed but no prerequisites of numerical analysis courses will be expected.

Text

A Course in Numerical Analysis  H. M. Lieberstein
(Harper & Row 1968)

References

Analysis of Numerical Methods  E. Isaacson & H. M. Keller
(Wiley 1966)

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

Computation and Theory in Ordinary Differential Equations  J. W. Daniel & R. E. Moore
(Freeman & Co. 1970)

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

Numerical Solution of Partial Differential Equations  G. D. Smith
(Oxford University Press 1969)

PART IV TOPICS

ALGEBRA AND GROUP THEORY — W. Brisley

A course of about twenty-seven lectures on “Universal Algebra” and the theory of groups, which will discuss some of the important and basic algebraic notions and ideas, with illustrations and applications drawn mainly from group theory, lattice theory, and set- and category-theory. Topics covered will include: Ω-algebras, congruences, homomorphisms, Ω-word algebras, free objects, products, properties of “properties”, Krull-Schmidt decomposition, Jordan-Holder resolution, the concepts of a variety of objects.

Prerequisites

Topics AL, D, K, O.

Text

No prescribed text.

References

Universal Algebra  P. M. Cohn
(Harper & Row 1965)

Algebra  Serge Lang
(Addison-Wesley 1965)

The Theory of Groups  M. Hall Jr.
(Macmillan 1962)

Group Theory  W. R. Scott
(Prentice-Hall 1964)

The Theory of Groups Vols. I & II  A. G. Kurosh
(Chelsea 1960)

Universal Algebra  G. Gratzer
(Van Nostrand 1968)

and various other articles and books mentioned during the course.

ORDINARY DIFFERENTIAL EQUATIONS — J. G. Couper

This topic is about the geometric theory of autonomous systems in the plane, and will include the following material:

Trajectories, continuity and analyticity properties. Critical points, elementary critical points, the index of a critical point. Closed trajectories, limit cycles. Limit sets of paths, the Poincaré-Bendixson theorem. The stability index of Poincaré. Structurally stable systems and their phase portraits, density theorem.

Text

No prescribed text.

97
PART IV TOPICS

BANACH ALGEBRA — J. R. Giles

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

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

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

Applications of Banach algebra theory.

Text
No prescribed text.

References
Introduction to Topology and Modern Analysis G. F. Simmons (McGraw-Hill 1963)
Functional Analysis A. Wilansky (Blaisdell 1964)
General Theory of Banach Algebras C. E. Rickart (Van Nostrand 1960)
Normed Rings M. A. Naimark (Noordhoff 1959)
Commutative Normed Rings I. M. Gelfand, D. A. Raikov & G. E. Shilov (Chelsea 1964)
ANALYSIS OF TOPOLOGICAL AND LINEAR TOPOLOGICAL SPACE — J. R. Giles

A topological space is the most general mathematical structure for study by the analyst; the most useful class of topological spaces for study by the analyst is the class of linear topological spaces.

For both topological and linear topological spaces we discuss the generation of topologies, bases and subbases, and for linear topological spaces locally convex topologies. For topological spaces we discuss continuity of mappings and for linear topological spaces the continuity of linear mappings. For both topological and linear topological spaces we treat product and quotient spaces. For topological spaces we treat the separation axioms and relate them to linear topological spaces. We examine questions of duality theory for linear topological spaces and the weak topologies. We deal with the different forms of compactness in topological spaces.

Prerequisites

References

**Functional Analysis**
A. Wilansky
(Blaisdell 1964)

**Topological Vector Spaces 2nd ed.**
A. P. & W. J. Robertson
(Cambridge 1973)

**References**

**General Topology**
J. L. Kelly
(Van Nostrand 1955)

**Linear Topological Spaces**
J. L. Kelly & I. Namioka
(Van Nostrand 1963)

**Introduction to Topology and Modern Analysis**
G. F. Simmons
(McGraw-Hill 1963)

**Functional Analysis**
A. E. Taylor
(Wiley 1958)

**Introduction to General Topology**
H. F. Cullen
(D. C. Heath 1968)

MATHEMATICAL MODELS OF PHASE TRANSITIONS — A. J. Guttmann


Text
No prescribed text.

References

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

**Statistical Physics. Phase Transitions and Superfluidity**
M. Chretien, E. P. Gross & S. Deser (eds.)
(Brandes Summer Institute 1966)

**On the Theory of Cooperative Phenomena in Crystals**
C. Domb
(Advances in Physics 9 (149) 1960)

**Phase Transitions and Critical Phenomena Vols. I, II, III, IV**
C. Domb & M. S. Green (eds.)

**The Theory of Equilibrium Critical Phenomena**
M. E. Fisher
(Rep. Prog. Phys. 30 (615) 1967)

**Statistical Mechanics**
K. Huang
(Wiley 1963)

**Introduction to Phase Transitions and Critical Phenomena**
H. E. Stanley
(Oxford Uni. Press 1971)

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

**Lectures in Statistical Mechanics**
G. E. Uhlenbeck & G. W. Ford
(American Mathematical Society 1963)
LINEAR OPERATORS — M. J. Hayes

The course will discuss the various spectral decomposition theorems for linear operators on Hilbert space, giving some applications to integral equations.

References

Functional Analysis

G. Bachman & L. Narici
(Academic Press 1966)

W. Rudin
(McGraw-Hill 1973)

A. Taylor
(Wiley 1958)

N. Dunford & J. Schwartz
(Interscience 1958)

E. Lorch
(Oxford University Press 1962)

Linear Operator Theory in Engineering and Science

A. Naylor & G. Sell
(Holt, Rinehart & Winston 1971)

Elements of Functional Analysis

A. Brown & A. Page
(Van Nostrand Reinhold 1970)

Linear Operators in Hilbert Space

W. Schneider
(Academic Press 1954)

Integral Equations

G. Hoheisel
(Thomas Nelson 1963)

Methods of Mathematical Physics

R. Courant & D. Hilbert
(Interscience 1953)

STOCHASTIC PROCESSES — R. G. Keats

This topic will cover the theory of stochastic processes and some of its applications. It will be assumed that students have studied Topic H and are studying or have studied Topics R and V. The topic will include the concepts of stationarity, covariance function, regular process, mean square continuity, differentiation, integration, ergodicity, spectrum, processes with uncorrelated or orthogonal increments, Wiener process, Poisson process. Applications to prediction, filtering or signal detection, will also be studied.

Text

No prescribed text.

References

Stochastic Processes

J. L. Doob
(Wiley 1953)

Probability 3rd ed.

M. Loève
(Van Nostrand 1963)

Stochastic Processes

E. Parzen
(Holden-Day 1962)

Theory of Stationary Random Functions

A. M. Yaglom
(Prentice Hall 1965)

Random Processes in Automatic Control

J. H. Laning & R. H. Battin
(McGraw-Hill 1956)

Stochastic Processes

M. S. Bartlett
(Cambridge University Press 1955)

Introduction to the Statistical Dynamics of Automatic Control

V. V. Solodovnikov
(Dover 1960)

Statistical Analysis of Stationary Time Series

U. Grenander & M. Rosenblatt
(Wiley 1957)

Time Series Analysis

E. J. Hannan
(Methuen 1960)

An Introduction to Probability Theory and its Applications Vols. I & II

W. Feller
(Wiley 1957 & 1966)

Introduction to the Theory of Random Processes

I. I. Gikhman & A. V. Skorokhod
(W. B. Saunders Co. 1969)
(translated by Scripta-technica)

THEORY OF FIXED POINTS AND ITS APPLICATIONS IN FUNCTIONAL ANALYSIS — L. Janos

Banach fixed point theorem as a tool for establishing existence and uniqueness of solutions. Brouwer fixed point theorem and its generalization to infinite dimensional spaces. Schauder fixed point principle and its application to differential equations in Banach spaces. New results on condensing mappings and their fixed point properties.
PART IV TOPICS

SIGNAL DETECTION — R. G. Keats
This topic will cover the detection and processing of signals with applications. It will be assumed that students have studied Topic H and are studying or have studied Topic R. 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 colored Gaussian noise. The Shannon sampling theorem, Karhunen-Loève expansion, sequential detection and the effect of clipping will also be discussed.

Text
No prescribed text.

References
Statistical Theory of Signal Detection
C. W. Helstrom
(N.Y., Pergamon Press 1960)

Detection, Estimation & Modulation Theory
H. L. Van Trees
(Wiley 1967)

Signal Theory
L. E. Franks
(Prentice-Hall 1969)

Detection Theory
I. Selin
(Princeton University Press 1965)

Introduction to Statistical Communication Theory
J. B. Thomas
(Wiley 1969)

Topics in Communication Theory
D. Middleton
(McGraw-Hill 1965)

Introduction to The Theory of Random Signals and Noise
W. B. Davenport & W. L. Root
(McGraw-Hill 1958)

An Introduction to the Principles of Communication Theory
J. C. Hancock
(McGraw-Hill 1961)

Signals and Noise in Communication Systems
H. E. Rowe
(D. Van Nostrand 1965)

Signal Detection Theory
J. C. Hancock & P. A. Winz
(McGraw-Hill 1966)

Introduction to Statistical Communication Theory
D. Middleton
(McGraw-Hill 1960)

Probability and Information Theory with Application to Radar
P. M. Woodward
(Pergamon Press 1960)

Selected Papers on Noise and Stochastic Processes
N. Wax (ed.)
(Dover 1954)

PART IV TOPICS

VISCOS FLOW THEORY — W. T. F. Lau

Prerequisite
Topic Q.

Text
Viscous Flow Theory Vol. I
S. I. Pai
(Van Nostrand 1956)

References
The Laminar Boundary Layer Equations
N. Curle
(Oxford University 1962)

Lectures on Fluid Mechanics
S. Goldstein
(Interscience 1960)

Similarity Analysis of Boundary Value Problems in Engineering
A. G. Hansen
(Blackwell 1965)

Slow Viscous Flow
W. E. Langlois
(Macmillan 1964)

Theory of Laminar Flows
F. K. Moore (ed.)
(Princeton University 1964)

Laminar Boundary Layers
L. Rosenhead (ed.)
(Oxford University 1963)

Boundary Layer Theory
H. Schlichting
(McGraw-Hill 1968)

CHEMICAL RATE PROCESSES — D. L. S. McElwain
A review of statistical mechanics applied to gases. The dissociation of a diatomic gas will be studied in detail. The simple harmonic oscillator model of Montroll and Shuler, the Lighthill ideal dissociating gas and the classical oscillator of Keck and Carrier will be compared and the consequences of the models discussed. Also included will be an outline of the use of perturbation methods in the description of relaxation phenomena in gases and an introduction to the theory of laser action in gases.

Text
No prescribed text.
PART IV TOPICS

References

**Diffusion Theory of Nonequilibrium Dissociation and Recombination**
J. Keck & G. Carrier
*(J. Chem. Phys. 43, 2284, 1965)*

**Dynamics of a Dissociating Gas**
M. J. Lighthill
*(J. Fluid Mech. 2, 1, 1957)*

**The Application of the Theory of Stochastic Processes to Chemical Kinetics**
E. W. Montroll & K. E. Shuler

**Introduction to Physical Gas Dynamics**
W. G. Vincenti & C. H. Kruger
*(Wiley 1965)*

**PERTURBATION THEORY — D. L. S. McElwain**

Classical perturbation techniques — the fundamental technique — Lagrange expansion — linear differential equations — inhomogeneous linear equations — linear perturbation series — perturbation techniques — multi-dimensional considerations — Poincaré-Lyapunov theorem — asymptotic behaviour — periodic solutions of non-linear differential equations and re-normalisation techniques — secular terms — the Van der Pol equation — the Shohat expansion — self-consistent techniques — the Carleman linearization — asymptotic series, the Liouville transformations. The methods developed will be applied to problems in applied mathematics and science.

**Text**

*Perturbation Techniques in Mathematics, Physics and Engineering*  
Richard Bellman  
*(Holt, Rinehart & Winston 1966)*

**Reference**

*Perturbation Methods in Applied Mathematics*  
J. D. Cole  
*(Blaisdell Publishing Co. 1968)*

**RATIONAL ANALYSIS — T. K. Sheng**

Rational numbers, approximation by rationals, rational points in the real line, rational points on curves, the group of Heron angles, group of K-rational angles, rational polygons, Schoenberg's rational polygon problem, distribution of algebraic numbers and algebraic integers in the complex plane, dispersiveness and explosiveness of linear operators over the rationals.

**COMPLEX ANALYSIS — T. K. Sheng**

The complex numbers, continuous and differentiable functions, power series functions, contour integration, Cauchy's theorem and applications, the Poisson integral formula, the Jensen and Poisson-Jensen formulas, infinite products, canonical products, entire functions, order of an entire function, the Hadamard factorization theorem, meromorphic functions, analytic continuation, general analytic functions, elliptic functions, the gamma and zeta functions.

**References**

*Complex Analysis*  
L. V. Ahlfors  
*(McGraw-Hill 1966)*

*Complex Variables*  
R. B. Ash  
*(Academic Press 1971)*

*Complex Analysis*  
J. Duncan  
*(John Wiley & Sons 1968)*

*Real and Complex Analysis*  
W. Rudin  
*(McGraw-Hill 1966)*

*Analytic Function Theory Vols. I & II*  
E. Hille  
*(Ginn & Co. 1959, 1962)*

**ELLIPTIC FUNCTIONS AND INTEGRALS — E. R. Smith**

Doubly periodic functions, Weierstrass's elliptic function and its integrals. Physical problems which give rise to elliptic functions and integrals. Elliptic integrals. Jacobian Elliptic functions and their inverses, the connection between Weierstrass's elliptic function and the Jacobian elliptic functions. The theta functions and their connections with other elliptic functions. Emphasis will be placed on representations of elliptic functions which are useful in their numerical evaluation, and on the application of elliptic functions to the study of physical phenomena. A knowledge of basic complex variable theory will be assumed.

**References**

*Handbook of Elliptic Integrals for Engineers and Scientists 2nd ed.*  
P. F. Byrd & M. D. Friedman  
*(N.Y., Springer-Verlag)*

*Higher Transcendental Functions Vol. II*  
The Bateman Manuscript Project  
A. Erdelyi  
*(New York, McGraw-Hill)*
ERGODIC THEORY — E. R. Smith
This course will be an introduction to the classical theorems of ergodic theory, and the ideas of Bernoulli systems, K-systems, mixing systems and ergodic systems. It is hoped to include a discussion of the recent work of Sinai on the ergodicity of hard-sphere gas systems.

Text
No prescribed text.

References
Lectures on Ergodic Theory P. R. Halmos (New York, Chelsea)
Ergodic Problems of Statistical Mechanics V. I. Arnold & A. Avez (New York, Benjamin)

RIGOROUS STATISTICAL MECHANICS — E. R. Smith

Text
Statistical Mechanics K. Huang (Wiley 1963)

References
Mathematical Statistical Mechanics C. J. Thompson (Macmillan 1971)
Statistical Mechanics: Rigorous Results D. Ruelle (Benjamin 1969)
Statistical Physics G. H. Wannier (Wiley 1966)

TOPOLOGICAL GROUPS — P. K. Smrz
Topological or continuous groups play a special role in group theory: this is where differential geometry and algebra come to a close contact. The course will cover the following subject matter: The concept of a group. Fundamentals of the abstract group theory. The concept of a topological space and topological group. Elementary representation theory of compact topological groups. Manifolds and the concept of a Lie group. Exponential mapping. Integrability conditions. Structural coefficients. Weights and roots. Classification of Lie groups. Examples of applications of the theory in physical sciences.

Text
No prescribed text.

References
Topological Groups L. Pontryagin (Princeton University Press 1946)
Lectures on Lie Groups J. F. Adams (W. A. Benjamin 1969)

DYNAMIC OCEANOGRAPHY — W. C. Summerfield
Structure and physical properties of the oceans. Kinematics; conservation laws; rotating frame of reference; coriolis acceleration. Dynamics; Boussinesq approximation; dimensionless parameters; turbulent flow; vorticity. Geostrophic motion; "thermal wind" equations; Ekman drift. Ocean circulation; Sverdrup relations; potential vorticity; theories of the large scale circulations. Upper layers of the sea; heat balance; momentum balance. Wave motions; surface waves; long waves; planetary waves; specification.

Text
No prescribed text.
References

An Introduction to Fluid Dynamics  G. K. Batchelor
(Cambridge University Press 1967)

An Introduction to Physical Oceanography  W. S. von Arx
(Addison-Wesley 1962)

Dynamical Oceanography  J. Proudman
(Methuen 1963)

Atmosphere-Ocean Interaction  E. Kraus
(Oxford 1972)

Waves on Beaches  R. E. Meyer (ed.)
(Academic Press 1972)

Principles of Physical Oceanography  G. Neumann & W. J. Picerson
(Prentice-Hall 1966)

The Dynamics of the Upper Ocean  O. M. Phillips
(Cambridge University Press 1966)

The Gulf Stream  H. Stommel
(University California Press 1966)

The Oceans: Their Physics, Chemistry and General Biology  H. V. Sverdrup, M. W. Johnson & R. H. Fleming
(Prentice-Hall 1963)

The Sea Vol. I  M. N. Hill (ed.)
(Interscience 1962)

The Theory of Rotating Fluids  H. P. Greenspan
(Cambridge University Press 1968)

Wind-driven Ocean Circulation  A. R. Robinson (ed.)
(Ginn Blaisdell 1963)

GEOMETRIC PROBABILITY — R. J. Vaughan

The course will examine some properties of points and lines distributed in two dimensional Euclidean space. The quadrivariate normal distribution will be used to describe possible connections between two different sets of points on a plane. Shortest path curves will be examined when cost varies with both direction and position. Applications to traffic movement and urban geography will be emphasised. The course will rely heavily on continuous probability distributions and a knowledge of Topics C and H will be assumed.

Text
No prescribed text.

References

Geometrical Probability  M. G. Kendall & P. A. P. Moran
(Griffin 1963)

Families of Bivariate Distributions  K. V. Mardia
(Griffin 1970)
PART IV TOPICS

GRAPH THEORY — W. D. Wallis

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

References
Graphs and Their Uses
O. Ore
(Random House 1963)

Theory of Graphs
O. Ore
(Amer. Math. Soc. 1967)

The Connectivity of Graphs
W. T. Tutte
(Toronto U.P. 1967)

The Four-Colour Problem
O. Ore
(Academic Press 1967)

Theory of Graphs and Its Applications
C. Berge
(Methuen 1962)

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

Theory of Graphs
D. König
(Chelsea 1970)

DIFFERENCE SETS — W. D. Wallis
Existence theorems, properties and construction of difference sets in groups (especially cyclic and abelian groups), generalized difference sets and supplementary difference sets. Applications to Hadamard matrices, finite geometries and experimental designs.

Text
No prescribed text.

References
Addition Theorems
H. B. Mann
(Interscience 1965)

Combinatorial Mathematics
H. J. Ryser
(New York, Wiley)
(Math. Association of America 1963)

Cyclic Difference Sets
L. D. Baumert
(Springer 1971)

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

Text
No prescribed text.
PART IV TOPICS

References
Asymptotic Methods in Analysis 3rd ed.  N. G. De Bruijn
(North Holland 1970)
Asymptotic Expansions  E. T. Copson
(Cambridge University Press 1965)
Asymptotic Solutions of Differential Equations and
Their Applications  C. Wilcox (ed.)
(N.Y., Wiley 1964)
Asymptotic Estimates and Entire Functions  M. A. Evgrafov
(N.Y., Gordon & Breach 1961)
Asymptotic Methods in the Theory of Linear
(N.Y., Elsevier 1967)

RANDOM AND RESTRICTED WALKS — W. P. Wood
Problem of Random walk; lattice walks; walks in continuous time; spatial
restrictions; correlated walks; self-avoiding walks; diffusion and Brownian
motion; applications to polymer physics, astronomy, numerical analysis and
solid state physics.

Text
No prescribed text.

References
Random and Restricted Walks  M. N. Barber & B. W. Ninham
(Gordon & Breach 1970)
Selected Papers on Noise and Stochastic Processes  N. Wax (ed.)
(N.Y., Dover 1954)
Introduction to Probability Theory and Its Application  W. Feller
Principles of Random Walk  F. Spitzer
(N.Y., Van Nostrand 1964)
PART I TOPICS

TOPIC CE231 — FLUID MECHANICS I — F. M. Henderson

Fluid properties and definitions. Fluid statics: statics of moving systems, forces on surfaces, buoyant forces, stability of floating and submerged bodies. Fluid flow concepts:

Types of flow, continuity equation, Euler's equation of motion along a streamline. Bernoulli equation, energy equation. Linear momentum equation. The moment of momentum equation. Linear and angular momentum applications. Introduction to dimensional analysis. Viscous effects: fluid resistance, laminar and turbulent flow, flow in pipes and conduits. Fluid measurement.

Texts
CE231

ME251
Force and Motion A. K. Johnston & B. J. Hill (University of Newcastle)

References


TOPIC ME251 — FLUID MECHANICS — A. J. Chambers

PART II TOPICS

CIVIL ENGINEERING HM

TOPIC CE313A — STRUCTURAL ANALYSIS I — N. O. Betts

Analysis component of CE313, viz.

Analysis of elastic statically determinate and indeterminate systems by classical methods; plastic analysis.

Texts
Structural Analysis R. C. Coates, M. G. Coutie & F. K. Kong (Nelson 1972)

TOPIC CE332 — FLUID MECHANICS II — W. G. Field

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

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

References
Engineering Hydraulics H. Rouse (Wiley 1958)
Applied Hydraulics in Engineering H. M. Morris (Ronald Press 1963)
Applied Hydrodynamics H. R. Vallentine (Butterworths 1959)

TOPIC CE212 — MECHANICS OF SOLIDS I — P. W. Kleeman

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

Text
TOPIC ME301 — ENGINEERING COMPUTATIONS —
L. W. B. Browne

Text
Numerical Methods and Fortran Programming
D. P. McCracken & W. S. Dorn
(Wiley International 1964)

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

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

ACCOUNTING IIIC  EITHER

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

References
A Statement of Basic Accounting Theory
American Accounting Assn.
(Evanston 1966)

Accounting Research Studies
American Institute of C.P.A.'s

Modern Accounting Theory
M. Buckler (ed.)
(Prentice-Hall 1966)

Ethics and the Accountant
M. Barradell
(Gee 1969)

Studies in Accounting Theory 2nd ed.
W. T. Baxter & S. Davidson (eds.)
(Sweet & Maxwell 1962)

The Effectiveness of Accounting Information
A. J. Briloff
(Praeger 1967)

Contemporary Accounting and its Environment
J. W. Buckley
(Dickenson 1969)

Corporate Financial Reporting: Conflicts and Challenges
J. C. Burton (ed.)
(A.I.C.P.A. 1969)

The C.P.A. Plans for the Future
J. L. Carey
(A.I.C.P.A. 1965)

Accounting, Evaluation and Economic Behaviour
R. J. Chambers
(Prentice-Hall 1966)

The Accounting Frontier
R. J. Chambers, L. Goldberg & R. L. Mathews
(Cheshire 1965)

An Income Approach to Accounting Theory
S. Davidson, D. Green, C. T. Horgan & G. H. Sorter
(Prentice-Hall 1965)

Accountants and the Law of Negligence
R. W. V. Dickerson
(Canadian Institute of Chartered Accountants 1966)

The Theory and Measurement and Business Income
E. O. Edwards & P. W. Bell
(California University Press 1961)

Readings in Accounting Theory
P. Garner & K. B. Berg (eds.)
(Houghton Mifflin 1966)
PART III TOPICS

References (cont.)

Accounting
Concepts of Profit
S. Gilman
(Ronald)

Concepts of Depreciation
L. Goldberg
(Law Book Co. 1960)

*An Inquiry into the Nature of Accounting
L. Goldberg
(American Accounting Assn. 1965)

Accounting Theory
E. S. Hendriksen
(Irwin 1970)

Government Accounting in Australia
W. R. C. Jay & R. L. Mathews
(Cheshire 1967)

Law and Practice of Company Accounting in Australia 2nd ed.
T. R. Johnston, M. O. Jager & R. B. Taylor
(Butterworths 1966)

Financial Accounting
Theory Vol. II
T. F. Keller & S. A. Zeff (eds.)
(McGraw-Hill 1969)

*Public Financial Administration
V. M. Levy
(Law Book Co.)

Structure of Accounting Theory
A. C. Littleton
(American Accounting Assn. 1953)

Accounting and Analytical Methods
R. Mattessich
(Irwin 1964)

Financial Accounting Theory —
A Distillation of Experience
G. O. May
(Macmillan 1957)

Government Accounting 4th ed.
R. M. Mikesell & L. E. Hay
(Irwin 1969)

Significant Accounting Essays
M. Moonitz & A. C. Littleton
(Prentice-Hall 1965)

Advanced Public Accounting Practice
M. E. Murphy
(Irwin 1966)

The Accountability and Audit of Governments
E. L. Normanton
(Manchester University Press 1966)

Accounting Theory
H. Norris
(Pitman 1946)

An Introduction to Corporate Accounting Standards
W. A. Paton & A. C. Littleton
(American Accounting Assn. 1965)

Financial Statements: A Crusade for Current Values
H. Ross
(Pitman 1969)

Note — Essential books which students should possess are marked with an asterisk.

PART III TOPICS

References (cont.)

A Theory of Accounting to Investors
G. J. Staubus
(California University Press 1964)

The Search for Accounting Principles
R. K. Storey
(A.I.C.P.A. 1964)

The Fund Theory of Accounting
W. J. Vatter
(Chicago University Press 1951)

Accountants' Handbook
5th ed. R. Wixon, W. G. Kell & N. M. Bedford (eds.)
(Ronald 1970)

Financial Accounting Theory
S. A. Zeff & T. F. Keller (eds.)
(McGraw-Hill 1969)

ACCOUNTING IIIIB

Selected contemporary problems in the theory and practice of managerial accounting. Topics studied include the theories of behavioural budgeting, programme budgeting, break-even analysis, direct costing, transfer pricing, the impact of computers on management and general concepts of management accounting.

References

Articles are selected from Abacus, The Accounting Review, Journal of Accounting Research, Journal of Business, etc. Text books should not be purchased until the course has commenced. The following list is of text books that are usually consulted.

Contemporary Problems in Cost Accounting
H. R. Anton & P. A. Firmin
(Houghton Mifflin 1966)

Contemporary Cost Accounting and Control
G. J. Benston
(Dickenson 1970)

Topics in Cost Accounting and Decisions
H. Bierman
(McGraw-Hill 1964)

Managerial Cost Accounting
H. Bierman & T. R. Dyckman
(Collier-Macmillan 1971)

The Firm: Micro-Economic Planning and Action
N. W. Chamberlain
(McGraw-Hill 1962)

Case Problems in Management Accounting
W. C. Greene
(Holt, Rinehart & Winston 1964)

The Game of Budget Control
G. H. Hofstede
(Associated Book Publishers 1967)

Research Reports
National Association of Accountants
(New York)

Management Accounting: An Historical Perspective
R. H. Parker
(Macmillan 1969)
References (cont.)

Topics in Managerial Accounting
L. S. Rosen
(McGraw-Hill 1970)

Studies in Cost Analysis 2nd ed.
D. Solomons (ed.)
(Sweet & Maxwell 1968)

Budget Control and Cost Behaviour
A. C. Stedry
(Prentice-Hall — Ford Foundation Series 1961)

Readings in Cost Accounting
and Control 3rd ed.
W. E. Thomas (ed.)
(South-Western 1968)

ECONOMICS IIC

GROWTH AND DEVELOPMENT — N. J. Dickinson/C. W. Stahl
The first two terms of this course 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 third term will be devoted to an examination of some problems of economic growth in developing countries. This part of the course will involve a discussion of some simple models of economic development and will continue with reference to some case studies from countries in Asia.

Preliminary Reading

The Economics of Cycle and Growth
Stanley Bober
(New York, Wiley 1968)

Business Fluctuations, Growth and Economic Stabilisation:
A Reader
John G. Clark & M. Cohen (eds.)
(New York, Random House 1963)

Economics for Development
S. Enke
(London, Dobson 1963)

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

A Contribution to the Theory of the Trade Cycle
J. R. Hicks
(Oxford, Clarendon 1967)

A Neoclassical Theory of Economic Growth
J. E. Meade
(London, George, Allen & Unwin 1962)

Leading Issues in Economic Development 2nd ed.
G. M. Meier
(New York, Oxford University Press 1970)

Economic Growth and Development — A Mathematical Introduction
Phillip A. Neher
(New York, Wiley 1971)

ECONOMETRICS I — G. R. Keating

A knowledge of matrix algebra and of the mathematical statistics dealt with in Statistical Analysis I is recommended for students attempting this course. The course is concerned with examining the usefulness of single equation regression analysis in applied economic research and also with providing an introduction to simultaneous estimation procedures.

Reading Guide

Intermediate Economic Statistics
K. A. Fox
(John Wiley & Sons)

Econometrics
A. Goldberger
(John Wiley & Sons)

Linear Algebra
G. Hadley
(Addison-Wesley)

Regression and Econometric Methods
D. S. Huang
(John Wiley & Sons)

Econometric Methods
J. Johnston
(2nd ed. McGraw-Hill 1972)

Elements of Econometrics
J. Kmenta
(Macmillan)

Econometrics
R. J. Wonnacott & T. H. Wonnacott
(John Wiley & Sons)

AND ONE OF EITHER

PUBLIC ECONOMICS — W. Sheehan/N. J. Dickinson
The course considers the effect of government intervention in the economy through the budget and through the operation of various publicly-owned business undertakings. At the microeconomic level there is an analysis of tax and expenditure policies. In particular, the effects of these policies on community welfare and on incentives are examined.

The macro-economic aspects of the budget are also discussed. Aggregative models are used to analyse the relation of fiscal policy to other economic policies for stability and growth. Inter-governmental fiscal relationships and the place of fiscal policy in less developed countries are briefly considered.

Preliminary Reading

*Public Finance
O. Eckstein
(Prentice-Hall)

* Recommended for purchase.
The course begins with an analysis of balance of payments problems and of various policies of adjustment, such as internal expenditure changes, devaluation and revaluation, flexible exchange rates and direct controls. The course then considers certain theoretical aspects of international capital movements and the implications of Australia’s capital inflow. It goes on to examine the present international monetary system and its reform. This is followed by a study of the theories of international trade in its non-monetary aspects. From the traditional analysis the theory is extended to examine such problems as the effect of economic growth on trade and the role of international trade in economic development. The theory of restrictions on trade is discussed with particular emphasis on the role of tariffs and of customs unions. The final section reviews Australia’s changing pattern of foreign trade and capital movements and assesses relevant economic policies.

(2 hours per week)

Reading Guide

*International Trade

Bhagwati, Jaydish (ed.)

(Penguin Modern Economics Readings 1969)

*International Finance

Richard R. Cooper (ed.)

(Penguin Modern Economics 1969)

* Recommended for purchase.
PART III TOPICS

TOPIC PARTICULATE SYSTEMS — GRANULAR MATERIAL
— I. McC. Stewart
Breakage of solid materials, size separation, classification, crushing and grinding, analytical and matrix methods of handling size distributions; flow of granular materials, drying of solids, systems analysis of furnaces and kilns.

Text
Chemical Engineering Vol. II J. M. Coulson & J. F. Richardson (Pergamon 1966)

TOPIC PARTICULATE SYSTEMS — FLUID-SOLIDS SEPARATIONS — J. Roberts
Fluid dynamics of packed beds, fluidization, filtration sedimentation, cyclones, gas-cleaning; evaporation and crystallization.

Text
Chemical Engineering Vol. II J. M. Coulson & J. F. Richardson (Pergamon 1966)

References
Fluidisation Engineering D. Kunii & O. Levenspiel (Wiley 1960)
Mechanics of Aerosols N. A. Fuchs (Pergamon 1964)

TOPIC TRANSPORT THEORY II — K. L. Smith/I. McC. Stewart
Heat and mass transfer in unsteady state conditions, analytical and numerical analysis; approximate methods. Generalized transport theory for momentum, mass and heat transfer in laminar, turbulent and simple boundary layer conditions; correlations of transfer coefficients.

Reference

TOPIC REACTION ENGINEERING I — K. L. Smith
Thermodynamics of reactions, reaction kinetics. Kinetics of reactors and reactor systems, mixing in reactors, Rate equations.

Text
Chemical Reaction Engineering O. Levenspiel (Wiley 1964)

TOPIC CHEMICAL PROCESS CONTROL — W. G. Kirchner
Relationship between measurement and control information display; plant response; types of controllers; transfer functions; analogue computer.

Text
Introduction to Chemical Process Control D. D. Perlmutter (Wiley 1965)

TOPIC HEAT TRANSFER III — I. McC. Stewart

Text
Radiative Transfer H. Hottel & A. Sarofin (McGraw-Hill 1967)

Reference

CIVIL ENGINEERING IIIIM

TOPIC CE414A — STRUCTURAL ANALYSIS II — P. W. Kleeman

Texts
The Stability of Frames M. R. Horne & W. Merchant (Pergamon 1965)

References
Matrix Methods of Structural Analysis R. K. Livesley (Pergamon 1964)
TOPIC CE324 — SOIL MECHANICS — R. J. Wilson
Index properties, classification of soils, permeability, capillarity, seepage
and flow nets; stresses in soils; settlement and consolidation; compaction,
shrinkage strength and failure, criteria; stability of retaining walls, slopes
and footings.

Text
Soil Mechanics
T. W. Lambe & R. V. Whitman
(Wiley 1969)

References
Problems in Engineering
Soils
P. L. Capper, W. F. Cassie & J. D. Geddes
(Spon 1966)
The Measurement of Soil Properties in the
Triaxial Test
A. W. Bishop & D. J. Henkel
(Edward Arnold 1964)

Further references to Journals will be given in the lectures.

TOPIC CE415A — STRUCTURAL ANALYSIS — CONTINUA —
P. W. Kleeman
Introduction to classical methods of solution of problems in elasticity
and plate bending. Development of numerical methods for solving
continuum problems using finite elements. Derivation of some stiffness matrices
for simpler elements.

TOPIC CE415B — STRUCTURAL ANALYSIS — PLASTICITY —
P. W. Kleeman
The nonlinear behaviour of beam columns. The stability of partially
yielded frames from elastic-plastic analyses. Linear programming techniques
in frame analysis and minimum weight design.

TOPIC CE434A — FLUID MECHANICS — THEORETICAL
HYDRODYNAMICS — F. M. Henderson
General treatment of stresses and rates of strain in a moving fluid,
derivation of the Navier-Stokes equations, the vorticity equation; Kelvin’s
circulation theorem, the generation and diffusion of vorticity, with engineering
applications. Irrotational flow theory in two and three dimensions,
with engineering applications.

TOPIC CE434B — FLUID MECHANICS — OPEN CHANNEL
FLOW — F. M. Henderson
Numerical methods for the solution of unsteady non-uniform flow problems
in irregular channels. The equations of unsteady flow, the method of
characteristics, with engineering applications, e.g., the dam break problem.
Theories of flood wave movement and techniques for its prediction.
Sediment transport, river channel formation and stability.

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

COMMUNICATIONS AND AUTOMATIC CONTROL

TOPIC EE341 — AUTOMATIC CONTROL (First half year) —
K. L. Hitz
A topic of lectures, tutorials and practical work.
Mathematical models of systems and components: linear differential equa-
tions, block diagrams, Laplace transforms, state-space formulation.
Transients: response: characteristic roots, transition matrix, system stability.
Forced response: transfer functions, impulse and step responses, input-output
stability, steady-state behaviour. Feedback and compensation: effects of
feedback on characteristic roots, root-locus technique, Nyquist stability
criteria, series and feedback compensation.

References
Notes for a Second Course on Linear Systems
C. A. Desoer
(Van Nostrand Reinhold 1970)
Linear Control Systems
J. L. Melsa & D. Schultz
(McGraw-Hill 1969)
Fundamentals of Automatic Control
S. C. Gupta & L. Hasdorff
(Wiley 1970)
Modern Control Engineering
K. Ogata
(Prentice-Hall 1969)
Automatic Control Engineering 2nd ed.
F. H. Raven
(McGraw-Hill 1968)

TOPIC EE342 — AUTOMATIC CONTROL (Second half year) —
K. L. Hitz
A continuation of EE341 consisting of lectures and tutorials. Controllable
and observable states: effects of feedback, placement of closed-loop poles,
determination of states from outputs, duality. Canonical decomposition of
state-space: minimal realization of transfer functions, pole-zero cancellations,
canonical forms. Optimization theory for linear systems with quadratic
performance indices.
TOPIC EE442 — MODERN CONTROL (Second half year)
A topic of lectures, tutorial and laboratory work including computer analysis covering the general area of Optimal Control Theory and in particular Dynamic Programming, the Calculus of Variations and the Pontryagin's Minimum Principle and various iterative numerical techniques for finding optimal controls and trajectories.

Text
Optimal Control Theory
D. R. Kirk
(Prentice-Hall 1971)

Reference
Optimum Systems Control
A. P. Sage
(Prentice-Hall 1968)

TOPIC EE444 — COMMUNICATION SYSTEMS (Second half year)
J. B. Moore
This topic introduces the common forms of analog modulation, as well as pulse modulation systems including pulse code modulation. Performance in the presence of noise is considered.

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

TOPIC EE341 — AUTOMATIC CONTROL (First half year)
K. L. Hitz
See page 129.

TOPIC EE342 — AUTOMATIC CONTROL (Second half year)
K. L. Hitz
See page 129.

TOPIC EE361 — COMPUTER STRUCTURE: MACHINE AND ASSEMBLY LANGUAGES (First half year)
Basic computer elements and peripherals, representation and organization of information, number systems and arithmetic, logical operations. Hardware components, processor structure, addressing modes and instruction set, machine-language programming, subroutines, traps and interrupts, use of the stack. Assembly: pseudo-ops, macros, recursion and re-entry, relocation, linking and loading. System software: assemblers, linkers, loaders, dumpers, interpreters, simulators, compilers.

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

Text
To be decided.

References
Introduction to Computer Organization and Data Structures
H. S. Stone
(McGraw-Hill 1972)

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

Systems Programming
J. J. Donovan
(McGraw-Hill 1972)

PDP-11 Handbook

TOPIC EE362 — LOGICAL DESIGN AND SWITCHING THEORY (Second half year)
A course of lectures, tutorial, and practical work.

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.

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

References
Introduction to Switching Theory and Logical Design
F. J. Hill & G. R. Peterson
(Wiley 1968)

Digital Electronics with Engineering Applications
T. P. Sifferlen & V. Vartanian
(Prentice-Hall 1970)

Theory and Design of Digital Computers
Douglas Lewin
(Nelson 1972)
PART III TOPICS

INDUSTRIAL ENGINEERING

TOPIC ME381 — METHODS ENGINEERING — G. D. Butler

Text
Motion and Time Study

References
Methods Engineering
Motion and Time Study
Production Handbook
Industrial Engineering Handbook

TOPIC ME382 — PRODUCTION ENGINEERING — G. D. Butler/J. W. Hayes
Production planning, Inventory functions, Forecasting; Scheduling and control of production. Design of a production control system. Quality and quantity control. Production inventory systems.

Text
Production Systems

References
Management Decision for Production Operations
Modern Production Management
Production Planning & Inventory Control
Production Handbook
Industrial Engineering Handbook

TOPIC ME383 — QUALITY ENGINEERING — D. S. R. Karamchetty

References
Quality Control and Industrial Statistics
Handbook of Industrial Metrology
Statistical Quality Control
Industrial Engineering Handbook
Quality Control for Managers and Engineers

TOPIC ME384 — DESIGN FOR PRODUCTION — J. W. Hayes
The application of economics, methods engineering, ergonomics and mechanical engineering to the development and design of a product. Its production (particularly in quantity), distribution and marketing.

References
Principles of Jig and Tool Design
Designing for Production
Value Engineering in Manufacturing
Production Handbook
Industrial Engineering Handbook
Fundamentals of Tool Design
MECHANICAL ENGINEERING III

PART III TOPICS

TOPIC ME361 — AUTOMATIC CONTROL I — K. L. Hitz

An introductory topic in linear control systems.

Description of components of servomechanisms and process control systems.

References

Linear Control Systems  
J. L. Melsa & D. G. Schultz  
(McGraw-Hill 1967)

Fundamentals of Automatic Control  
S. C. Gupta & L. Hasdorff  
(Wiley 1970)

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

Automatic Control Engineering 2nd ed.  
F. H. Raven  
(McGraw-Hill 1968)

TOPIC ME401 — SYSTEMS ANALYSIS — A. Roberts


References

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

Systems Analysis, A Computer Approach to Decision Models  
C. McMillan & R. F. Gonzalez  
(Irwin-Dorsey 1968)

Engineering Systems Analysis  
C. Haberman  
(Merrill 1965)

TOPIC ME402 — SYSTEMS PLANNING, ORGANIZATION AND CONTROL — A. Roberts/G. D. Butler


Use of analogue and digital computers, data processing.

References

Production Systems, Planning Analysis and Control  
J. L. Riggs  
(Wiley 1970)

Formal Organization, A Systems Approach  
R. Carzo & J. U. Yanouzas  
(Irwin-Dorsey 1965)

A Mathematical Theory of Systems Engineering  
A. Wayne-Weymore  
(Wiley 1967)

A Concept of Corporate Planning  
R. L. Ackoff  
(Wiley 1970)

TOPIC ME403 — RESOURCES PLANNING AND ALLOCATION — K. L. Hitz

Types of resources. Resources availability, approach and classification. Analysis and projection for world, national and corporate levels of operation. Tactical and strategic problems, conservation of resources. Generation of resources. Capital and technological resources. The planning, organisation and control of resources, with particular emphasis on long-range planning. The need at levels for a resources policy. Optimal use of resources allocation. The importance of mineral resources to Australia. Prediction of resources.

Notions of corporate planning with special reference to the steel industry.

References

A Concept of Corporate Planning  
R. L. Ackoff  
(Wiley-Interscience 1970)

World Resources and Industries  
E. W. Zimmerman  
(N.Y., Harper 1951)

Man, Mind and Land  
W. Firey  
(N.Y., Free Press 1960)

World Prospects for Natural Resources  
J. L. Fisher & N. Potter  
(John Hopkins Press 1964)

Minerals and Men  
J. McDevitt  
(John Hopkins Press 1968)

Resources and Mass  
National Academy Science  
(Freeman 1969)
PART III TOPICS

TOPIC ME404 — MATHEMATICAL PROGRAMMING —
K. L. Hitz

Introduction to the solution of static optimisation problems. Dynamic programming; computational refinements of the basic algorithm.

Linear programming; the Simplex algorithm and its revised form; duality theory; sensitivity analysis; decomposition algorithms. Transportation and assignment problems.

Texts

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

Linear Programming
S. I. Gass
(3rd ed., International Student Edition

References

Applied Dynamic Programming
R. E. Bellman & S. E. Dreyfus
(Princeton 1962)

Operations Research
H. A. Taha
(Macmillan 1971)

Non-Linear Programming
H. P. Kunzi, W. Krelle & W. Oettli
(Blaisdell 1966)

Mathematical Programming
C. Macmillan
(Wiley 1970)

Note

This subject is identical with the first part of ME581G.

TOPIC ME446 — INTRODUCTION TO PLASTIC ANALYSIS
A. J. Carmichael/E. Betz

Plastic behaviour materials — idealizations.
Applications where there exists: (i) no elastic-plastic interface; (ii) an elastic-plastic interface.


References

Advanced Mechanics of Materials 1st ed.
H. Ford
(Longmans 1963)

Plasticity
R. Hill
(Oxford 1950)

Introduction to Plasticity
W. Prager
(Addison-Wesley 1959)

TOPIC ME448 — INTRODUCTION TO PHOTO-MECHANICS
A. J. Carmichael/E. Betz


Model analysis for two and three dimension problems which may involve static, dynamic or thermal loading conditions.

Calibration of material and solution of disc problem.

References

Photoelasticity Vols. I & II
M. M. Frocht
(Wiley 1945 & 1948)

Introduction to Photo-Mechanics
A. J. Durelli & W. F. Riley
(Prentice-Hall 1965)

Experimental Stress Analysis
J. W. Daily & W. F. Riley
(McGraw-Hill 1965)

TOPIC ME434 — ADVANCED KINEMATICS AND DYNAMICS OF MACHINES — E. Betz

A topic of lectures and tutorials.

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

Kinematics and Dynamics of Plane Motion
J. Hirschhorn
(McGraw-Hill 1962)

References

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

Kinematics and Linkage Design
A. S. Hall
(Prentice-Hall 1960)
TOPIC ME449 — RELIABILITY ANALYSIS FOR MECHANICAL SYSTEMS — A. J. Chambers


References


Engineering Reliability and Long Life Design R. P. Haviland (Van Nostrand 1964)

TOPIC ME487 — OPERATIONS RESEARCH — DETERMINISTIC MODELS — G. D. Butler/J. W. Hayes

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.

References

Operations Research H. A. Taha (Macmillan)

Introduction to Operations Research I. S. Hillier & G. J. Lieberman (Halden-Day)

Mathematical Programming C. McMillan (Wiley)


TOPIC ME488 — OPERATIONS RESEARCH — PROBABILISTIC MODELS — G. D. Butler/J. W. Hayes

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, multi-server queues. Queues in series. Transients in queues; simulation of systems. Applications.

References

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

Management Research H. A. Taha (Macmillan)


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

TOPIC ME489 — OPERATIONS RESEARCH — APPLICATIONS IN INDUSTRY — G. D. Butler

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

References

Excercises in Industrial Management S. Eilon, R. I. Hall & J. R. King (Macmillan 1966)


Case Analysis and Business Problem Solving K. E. Schnelle (McGraw-Hill 1967)


A Guide to Operational Research E. Duckworth (Methuen 1965)
PART III TOPICS

PHYSICS IIIA
A basic Physics subject organized under the following main topics:
1. Analytical mechanics, including the elements of Lagrangian and Hamiltonian mechanics.
2. Electromagnetic field theory, including guided waves and transmission lines.
3. Relativity, the special theory.
4. Quantum mechanics, including applications.
5. Statistical mechanics, including principles and application.
6. Electronics, theory and applications.
7. Solid-state Physics
8. Nuclear Physics

Text book lists will be displayed on the Physics notice board towards the end of 1973 and lists will also be available from the Cashier. Students should retain all their Physics II texts.

PSYCHOLOGY IIIC — A. C. Hall
This subject will cover the topics factor analysis and personality assessment of Psychology IIIB but students will be expected to study them at a higher level of mathematical sophistication. Other topics will include the study of personality, cognition, perception and physiological psychology and students must select one or more additional topics from Psychology IIIA or Psychology IIIB in consultation with the Head of the Psychology Department to complete their lecture programme of an average of four hours per week. In addition to lectures, students will be required to complete an independent investigation in mathematical psychology under supervision and to complete the normal laboratory programme of Psychology IIIA.

Text
No prescribed text.

References
Modern Factor Analysis
H. H. Harman
(University of Chicago Press 1960)
Problems in Human Assessment
D. N. Jackson & S. Messick
(McGraw-Hill 1967)
The Developmental Psychology of Jean Piaget
J. H. Flavell
(Van Nostrand 1963)
Thinking: From Association to Gestalt
J. M. Mandler & G. Mandler
(Wiley 1964)

SUMMARIES OF TOPICS, TEXT BOOKS AND REFERENCE BOOKS

SCHEDULE C

MATHEMATICS/PHYSICS IV
In addition to the experimental and thesis work for this subject, the student is required to complete selected topics from those offered for Mathematics IV and Physics IV. The thesis, topics to be studied and experimental work will be decided in consultation with the Heads of Departments of Mathematics and Physics.

MATHEMATICS/PSYCHOLOGY IV
In addition to the experimental and thesis work for this subject, the student is required to complete four Mathematics topics chosen from the Part IV Mathematics topics in Schedule A. Syllabuses for these topics appear on page 97 of this handbook. An additional topic, Psychological Measurement, described below must also be studied.

TOPIC PSYCHOLOGICAL MEASUREMENT — J. A. Keats
This seminar series involves one weekly meeting of approximately 1½ hours. The series is introduced by lectures on the logic of measurement and its application to psychological phenomena after which each student is required to present at least one paper on one of the more recently developed psychological scaling methods.

Text
No prescribed text.

References
Studies in Mathematical Psychology
R. C. Atkinson (ed.)
(Stanford University Press, Cal. 1964)
Foundations of Science: The Philosophy of Theory and Experiment
N. R. Campbell
(N.Y., Dover 1957)
A Theory of Data
Clyde H. Coombs
(John Wiley 1964)
Statistical Theories of Mental Test Scores
F. M. Lord & M. R. Novick
(Addison-Wesley 1968)
Logical Foundations of Psychological Measurement
S. Ross
(Aarhus Stiftsbogtrykkerie A-S, Denmark 1964)
Theory and Methods of Scaling
W. S. Torgerson
(John Wiley 1958)
1. Students have received approval to enrol in the following non-mathematics subjects in the past.

**PART I**

| Accounting I | Geology I | Chemistry IIA |
| Biology I | German Introductory | Economics IIA |
| Chemistry I | German I | Economics IIB |
| Classical Civilization I | Greek I | Education II |
| Economic History I | Legal Studies I | English IIA |
| Microeconomics | Philosophy I | Geology II |
| Engineering I | Physics IA & IB | History IIA & IIB |
| English I | Psychology I | Philosophy IIA |
| French I | Sanskrit I | Physics II |
| Geography I | | Psychology IIA |

2. Students transferring to the Faculty of Mathematics in the past have been granted standing in the following non-mathematics subjects, completed while enrolled in other Faculties.

**PART I**

| Accounting I | Geology I | Economics IIA |
| Chemistry I | German I | Education IIA |
| Economics I | History I | Geography IIA |
| Engineering I | Philosophy I | History IIA |
| English I | Physics IA or IB | Philosophy IIA |
| French I | Psychology I | Physics II |
| Geography I | | Psychology IIA |

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

**Accounting I** — Students who include this subject in their course as a Part I subject are advised to discuss with the Dean the possibility of including Accounting IIA or Accounting IIB in their Part II subjects.

**Economics IIA** — Students should study Macroeconomics and Money and Banking. They should also include the Part II Mathematics topic H, Probability and Statistics, in their course.

**Economics IIB** — This subject would not normally be included in the Bachelor of Mathematics course. However if permission is given to include this subject then the content should be discussed with the Dean.

A student may not include both Physics IA and Physics IB in his course.

A student may not include both Engineering I and Civil Engineering IM in his course.

A student who passes both Microeconomics and Economic History I may be credited with one Part I subject towards the degree of Bachelor of Mathematics.

4. Permission will normally be given for the inclusion in a student's course of subjects which are prerequisites or corequisites of subjects appearing in the schedules.

**REQUIREMENTS FOR THE DIPLOMA IN COMPUTER SCIENCE**

1. In these requirements, unless the contrary intention appears, “the Faculty Board” means the Faculty Board of the Faculty of Mathematics and “the Board” means the Board of Studies established to supervise the course of the Diploma in Computer Science.

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

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

4. An applicant for registration as a candidate for the diploma may be granted standing on conditions to be determined by the Board of Studies.

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

6. (a) Before enrolling in a subject, a candidate shall have passed in any prerequisite subject or subjects specified in the Schedule of Subjects.
   (b) A candidate shall not enrol in a subject unless he is concurrently enrolled in, or has completed, any corequisite subject or subjects specified, in the Schedule of Subjects.

7. The Board shall approve a programme of studies for each candidate. This programme may be varied only with the approval of the Board.
8. (a) A candidate may withdraw from a subject in which he has enrolled only by notifying the Secretary of the University in writing.
(b) A candidate who withdraws from a subject in which he has enrolled shall be deemed to have failed unless he has obtained the written permission of the Dean of the Faculty of Mathematics to withdraw without penalty; the Dean shall consult with the Board before granting such permission.

9. *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 study, complete satisfactorily a course of studies, comprising 12 units of work chosen from the Schedule of Subjects appended to these requirements provided that the subjects passed:
(a) shall include all of the subjects in Group I, unless, in order to satisfy provisions of sub-section (c) of this clause, the Board has prescribed for the candidate concerned an alternative subject or subjects for one or more of the subjects in this Group;
(b) shall not include more than two subjects from Group III;
(c) shall not include a subject which, in the opinion of the Board, substantially overlaps the content of a course completed or work presented for another degree or diploma; and
(d) shall be those prescribed in the programme approved by the Board.

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

11. In order to provide for exceptional circumstances arising in particular cases, the Senate, on the recommendation of the Faculty Board, may relax any requirements.

* Students enrolled in the course in 1972 may complete the course not later than the end of 1974 under the requirements existing in 1972.

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**SCHEDULE OF SUBJECTS FOR THE DIPLOMA IN COMPUTER SCIENCE**

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>UNITS</th>
<th>PREREQUISITE</th>
<th>COREQUISITE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group I — Core Subjects</strong></td>
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<td></td>
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<tr>
<td>Programming and Algorithms</td>
<td>1</td>
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</tr>
<tr>
<td>Data Structures and Programming</td>
<td>1</td>
<td>Programming &amp; Algorithms</td>
<td>---</td>
</tr>
<tr>
<td>EE361 — Computer Structure: Machine and Assembly Language</td>
<td>1</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>EE362 — Logical Design &amp; Switching Theory</td>
<td>1</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Numerical Analysis</td>
<td>1.5</td>
<td>Mathematics II Topic F *</td>
<td>Programming &amp; Algorithms</td>
</tr>
<tr>
<td>Commercial Programming</td>
<td>1.5</td>
<td>---</td>
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</tr>
</tbody>
</table>

| **Group II — Electives ** | | | |
| Subjects or part of subjects offered in other courses and deemed by the Board to be of interest to computer scientists. | --- | As specified in other courses. |

| **Group III — Other Subjects** | | | |
| Subjects approved by the Board for an individual course but not included in Group I or Group II. | | As specified in other courses. |

* This prerequisite may be relaxed with consent of the Dean.
** It is intended that eventually subjects will be listed under Group II.
SUMMARIES OF SUBJECTS, TEXT BOOKS AND REFERENCE BOOKS

GROUP I — CORE SUBJECTS

PROGRAMMING AND ALGORITHMS — A. J. Guttmann

Boolean algebra, propositional logic, binary and other number systems, Representation of numbers and instructions. Flow charts. Description of machine code, assemblers, etc. Introduction to FORTRAN, ALGOL and the conversational language BASIC. Use of higher level languages to solve problems of a non-numerical nature. Programming techniques, efficient programming, evaluation of expressions, sources of error. Program development, diagnostics, testing, etc. Nature of algorithms and heuristics. Analysis of algorithms. Program structure, procedures, subroutines, scope of variables. Recursion. Graphs, trees, and the Travelling Salesman Problem.

References
The Art of Computer Programming
Vol. I — Fundamental Algorithms
Vol. II — Semi-numerical Algorithms
Vol. III — Sorting and Searching
Donald E. Knuth
(Addison-Wesley 1968, 1969, 1973)

Data Structures: Theory and Practice
A. T. Bertziss
(Academic Press 1971)

Computer Organization and Programming
C. William Gear
(McGraw-Hill 1969)

Programming Languages: History and Fundamentals
Jean E. Sammet
(Prentice-Hall 1969)

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

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

COMPUTER STRUCTURE: MACHINE AND ASSEMBLY LANGUAGES (First half year) (EE361)

Basic computer elements and peripherals, representation and organization of information, number systems and arithmetic, logical operations. Hardware components, processor structure, addressing modes and instruction set, machine-language programming, subroutines, traps and interrupts, use of the stack. Assembly: pseudo-ops, macros, recursion and re-entrancy, relocation, linking and loading. System software: assemblers, linkers, loaders, dumpers, interpreters, simulators, compilers.

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

Prerequisite
Mathematics I or consent of lecturer.

Text
To be decided.

References
Introduction to Computer Organization and Data Structures
H. S. Stone
(McGraw-Hill 1972)

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

Systems Programming
J. J. Donovan
(McGraw-Hill 1972)

PDP-11 Handbook

DATA STRUCTURES AND PROGRAMMING — D. L. S. McElwain

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

Higher level programming languages: Syntax and semantics. Backus normal form. Polish notation. Declarations, storage allocation, subroutines and linkage. Compilation, interpretation and translation. Study and comparison of data structures in several languages, e.g. ALGOL 60, ALGOL 68, COBOL, FORTRAN, LISP, etc.
GROUP 1 -- CORE SUBJECTS

LOGICAL DESIGN AND SWITCHING THEORY (EE362)
(Second half year)
A course of lectures, tutorial, and practical work.
Boolean algebra, combinational logic, logical circuits, minimization tech­
niques, 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.

Prerequisite
Mathematics I.

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

References
Introduction to Switching Theory and
Logical Design
F. J. Hill & G. R. Peterson
(Wiley 1968)

Digital Electronics with Engineering
Applications
T. P. Sifferlen & V. Vartanian
(Prentice-Hall 1970)

Theory and Design of Digital Computers
Douglas Levin
(Nelson 1972)

NUMERICAL ANALYSIS — W. C. Summerfield
Solution of simultaneous linear and non-linear equations by direct and
iterative methods. Computation of eigenvalues and eigenvectors of matrices.
Ordinary differential equations — initial and boundary value problems.
Partial differential equations — parabolic, elliptic and hyperbolic. Optimisation.

Text
No prescribed text.

References
A first course in Numerical Analysis
A. Ralston
(McGraw-Hill 1965)

Elementary Numerical Analysis 2nd ed.
S. D. Conté & C. de Boor
(McGraw-Hill 1972)

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

GROUP 1 — CORE SUBJECTS

References (cont.)
The Numerical Solution of Initial Value Problems in
Ordinary Differential Equations
C. W. Gear
(Prentice-Hall 1971)

Numerical Solution of Partial Differential Equations
G. D. Smith
(Oxford U.P. 1969)

Methods for Unconstrained Optimisation
Problems
J. S. Kowalik & M. R. Osborne
(Elsevier 1968)

Algorithms for Minimization without Derivatives
R. P. Brent
(Prentice-Hall 1972)

Problems in Numerical Methods
M. P. Cherkesova
(Wolters-Noordhoff 1972)

COMMERCIAL PROGRAMMING
A course of two hours of lectures per week throughout the year.
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. Rerun tech­
niques; verifying program accuracy; table lookup; program documentation
and use of test data.

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

References
Systems Analysis for Business Data Processing
H. D. Clifton
(Business Books 1969)

Elementary Cobol Programming
G. B. Davis & C. R. Litecky
(McGraw-Hill 1971)

Cobol Simplified
M. V. Farina
(Prentice-Hall 1968)

1900 Series Cobol Manual
System Design for Computer
Applications
International Computers Ltd.

Programming Business
Computers
H. N. Laden & T. R. Gildersleeve
(Wiley 1964)

Computers in Business
D. D. McCracken, H. Weiss & T. Lee
(Wiley 1959)

Cobol Programming
D. H. Sanders
(McGraw-Hill 1972)

Cobol Programming
N. B. Stern & R. A. Stern
(Wiley 1970)

Cobol Programming
J. L. Watters
(Heinemann 1970)
GROUP II—ELECTIVES

OFFERED BY DEPARTMENT OF MATHEMATICS

Details of these subjects will be found where indicated below.

Mathematical Logic
Operations Research
Topic in Applied Probability e.g. Information Theory
Graph Theory

Mathematics III

Mathematics III Topic O,
see page 88.
Mathematics III Topic U,
see page 92.
Mathematics III Topic Y,
see page 95.
Mathematics IV,
see page 112.

OFFERED BY DEPARTMENT OF ELECTRICAL ENGINEERING

EE341—AUTOMATIC CONTROL (Also see ME361)
(First half year)
A course of lectures, tutorial, and laboratory work.
Mathematical models of systems and components: linear differential equations, block diagrams, Laplace transforms, state-space formulation.

Prerequisite
Mathematics IIB (Topics C, D, E) or consent of lecturer.

Text
To be decided.

References

Automatic Control Engineering
Raven (McGraw-Hill)
Linear Control Systems
Melsa & Schultz (McGraw-Hill)
Fundamentals of Automatic Control
Gupta & Hasdorff (Wiley)
Modern Control Engineering
Ogata (Prentice-Hall)
Notes for a Second Course in Linear Systems
Desoer (Van Nostrand Reinhold)

EE425—DIGITAL ELECTRONICS
(Second half year)
A course of lectures, tutorial, and laboratory work. Pulse and digital circuits, design of computer hardware.

Prerequisites
EE421-EE423L (or Physics III and consent of lecturer); EE362

Text
To be decided.

References

Digital Electronics for Scientists
Malmstadt & Enke (Benjamin Inc.)
Digital Electronics with Engineering Applications
Sifferlen & Vartanian (Prentice-Hall)

EE441—MODERN CONTROL
A course of lectures, tutorial and laboratory work on sampled-data control systems, z-transforms, state-variable techniques, sampling and reconstruction.

Prerequisite
EE342.

Text

Discrete-Time and Computer Control Systems

Reference

Discrete-Data Control Systems
B. C. Kuo (Prentice-Hall Inc. 1970)
GROUP II ELECTIVES

EE442 — MODERN CONTROL
(Nonlinear Optimal Control Theory)
(Second half year)
A course of lectures, tutorial and laboratory work, including computer
analysis covering the general area of Optimal Control Theory and in
particular Dynamic Programming, the Calculus of Variations and Pon-
tryagin’s Minimum Principle and various iterative numerical techniques
for finding optimal controls and trajectories.

Prerequisites
EE341 and EE342.

Text
Optimal Control Theory
D. R. Kirk
(Prentice-Hall 1971)

References
Optimal Systems Control
A. P. Sage
(Prentice-Hall 1968)

EE443 — OPTIMIZATION TECHNIQUES (Not offered in 1974)
A course including lectures, tutorial and computer analysis, Mathematical
background to optimization. Comparison of optimization methods; engineering
applications — such as to problems of identification, control, pattern
recognition and resource allocation.

References
Introduction to Optimization Techniques (Fundamentals and
Applications of Nonlinear Programming)
M. Aoki
(N.Y., Macmillan 1971)
Optimization Theory with Applications
D. Pierre
(Wiley 1969)

EE463 — COMPUTER OPERATING SYSTEMS
(First half year)
Functions of an Operating System. Multiprogramming and multi-access
systems. Input-output control, file management. Multiprocessor systems. The
user interface.

Prerequisite
EE361.

Text
Computer Operating Systems
D. W. Barron
(Chapman & Hall 1971)

GROUP II — ELECTIVES

Reference
Systems Programming
J. J. Donovan
(McGraw-Hill 1972)

EE464 — COMPILERS, ASSEMBLERS AND INTERPRETERS
(Second half year)
The design of assemblers. Theory of grammars, parsing techniques. Con-
struction of compilers, including an introduction to optimisation methods.
Construction of interpreters. Translator-writing systems and string manip-
ulation languages.

Prerequisite
EE361.

Text
Compiler Construction for Digital Computers
D. Gries
(Wiley 1971)

References
Computer Organisation and Programming
C. W. Gear
(McGraw-Hill 1969)

Systems Programming
J. J. Donovan
(McGraw-Hill 1972)

Introduction to Computer Organisation and
Data Structures
H. S. Stone
(McGraw-Hill 1972)

EE516 — COMPUTER-AIDED ANALYSIS OF POWER SYSTEMS
(Not offered in 1974)
Application of digital computers to the analysis of power systems, with
emphasis on load and fault calculations and optimization.

Text
Computer Methods in Power System
Analysis
G. W. Stagg & A. H. El-Abiad
(McGraw-Hill 1968)

EE565 — PATTERN RECOGNITION (Not offered in 1974)
A course of lectures and tutorial work, with some laboratory use of the
computer in pattern recognising systems. Theory of trainable pattern-
classifying systems; Fourier-optical methods. Machines that learn with and
without a teacher. Current research results obtained in the department
will be included.

Prerequisite
Mathematics IIB
GROUP II — ELECTIVES

References

Sequential Methods in Pattern Recognition and Machine Learning
K. S. Fu
(Academic Press 1968)

Learning Machines
J. Nilsson
(McGraw-Hill 1965)

Pattern Recognition
L. Uhr
(Wiley 1966)

Decision-making Processes in Pattern Recognition
G. Sebestyen
(Macmillan 1962)

EE566 — AUTOMATA AND COMPUTING MACHINES
(Second half year) (Not offered in 1974)

This is a course of lectures and tutorial work giving an introduction to the theory of finite and infinite computation, and to logic machines.

Prerequisite
Mathematics I

References

Finite State Models for Logical Machines
F. Hennie
(John Wiley 1968)

Brains, Machines and Mathematics
Michael Arbib
(McGraw-Hill 1964)

Computation (Finite and Infinite Machines)
M. Minsky
(Prentice-Hall 1967)

EE567 — COMPUTER PROCESS CONTROL (Not offered in 1974)

Modelling the automated process — physical and economic models. Optimization of both well defined and poorly defined processes. Computer simulation languages. Analog computation.

References

Computer Process Control
(Wiley 1968)

Computer Simulation for Engineers
R. E. Stephenson
(Harcourt, Brace & Jovanovich 1971)

EE568 — ADVANCED COMPUTER ARCHITECTURE
(Second half year)

Lectures, seminars and tutorials.

EE569 — FORMAL LANGUAGES AND AUTOMATA
(First half year)

Languages and Grammars. Properties of regular, context-free and context-sensitive grammars. Relationship between automata and formal languages.

Prerequisite
Mathematics I.

Corequisite
EE464 complements this course but is not mandatory.

Text
Formal Languages and their Relation to Automata
Hopcroft & Ullman
(Addison-Wesley)

OFFERED BY DEPARTMENT OF MECHANICAL ENGINEERING

Details of these subjects will be found where indicated below.

ME 402 — Systems Planning, Organization and Control — see page 135.
ME 404 — Mathematical Programming — see page 136.
ME 488 — Operations Research — Probabilistic Models — see page 139.
ME 489 — Operations Research — Applications in Industry — see page 139.
ME 502G — Operations Research and Decision Theory — see page 156.
ME 581G — Mathematical Programming — see page 156.
ME502G OPERATIONS RESEARCH AND DECISION THEORY
— G. D. Butler
Queueing theory and applications.

Reference
Principles of Operations Research H. M. Wagner
(Prentice-Hall)

Reading
Mathematical Programming S. Vadja
(Pitman)

ME581G MATHEMATICAL PROGRAMMING — K. L. Hitz
(Second half year)
A survey of methods for the solution of static, deterministic optimisation problems.
Linear programming the simplex algorithm and its revised form duality theory sensitivity analysis decomposition algorithms transportation and assignment problems.
Linear programming in integers cutting plane algorithms branch-and-bound methods implicit enumeration algorithms for binary integer programmes.
Network, scheduling and other combinatorial problems.
Introduction to the theory of convex nonlinear programmes the Kuhn-Tucker theorem applications to quadratic programming and geometric programming.
Dynamic programming methods.

Texts
Introduction to Dynamic Programming G. L. Nemhauser
(Wiley 1966)
Linear Programming S. I. Gass
(3rd ed. McGraw-Hill
International Students’ edition)
Perspectives on Optimisation A. M. Geoffrion (ed.)
(Addison-Wesley 1972)

GROUP II — ELECTIVES

GROUP II — ELECTIVES

References
Applied Dynamic Programming R. E. Bellman & S. E. Dreyfus
(Princeton 1962)
Linear Programming G. Hadley
(Addison-Wesley, World Student Series 1969)
Nonlinear Programming H. P. Künzi, W. Krelle & W. Oettli
(Blaisdell 1966)
Operations Research H. A. Taha
(Macmillan 1971)
Foundations of Optimisation D. J. Wilde & C. S. Beightler
(Prentice-Hall 1967)
Geometric Programming R. J. Duffin, E. L. Peterson & C. Zener
(Wiley 1967)
Introduction to Linear and Nonlinear Programming D. G. Luenberger
(Addison-Wesley 1973)

OFFERED BY THE DEPARTMENT OF COMMERCE

SYSTEMS ANALYSIS AND DESIGN
A course of two hours of lectures per week throughout the year.
Basic approach to planning for a computer; systems concepts and theory. Pre-installation planning; documenting current applications; design of new applications; conversion problems and implementation; programme development; testing of programmes; programme documentation.
Case studies will be used extensively throughout the course.

References
Practical Systems Analysis A. Chandor, J. Graham & R. Williams
(Rupert, Hart & Davis 1969)
Systems Analysis for Business Data Processing H. D. Clifton
(Wiley 1969)
Basic Training in Systems Analysis A. Daniels & D. Yeates
(Pitman 1969)
(Holt, Rinehart & Winston 1968)
Systems Analysis: A Diagnostic Approach Van Court Hare
(Harcourt, Brace & World 1967)
Systems Analysis for Business Management 2nd ed. S. L. Opner
(Prentice-Hall 1968)
Business Data Processing Systems L. Orilia, N. B. Stern & R. A. Stern
(Wiley 1972)
Computer Usage/ Applications E. A. Weiss
(McGraw-Hill 1970)
GROUP III SUBJECTS

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

OFFERED BY DEPARTMENT OF MATHEMATICS

Details of these subjects will be found where indicated below.

- Probability and Statistics — Mathematics III Topic R, see page 90.
- Asymptotic Methods in Analysis — Mathematics IV, see page 113.
- Random and Restricted Walks — Mathematics IV, see page 114.
- Signal Detection — Mathematics IV, see page 104.
- Stochastic Processes — Mathematics IV, see page 103.
- Combinatorial Designs — Mathematics IV, see page 111.

OFFERED BY DEPARTMENT OF COMMERCE

Details of the following will be found in the Economics and Commerce Faculty Handbook.

- Principles of Management
- Accounting and Financial Studies

OFFERED BY DEPARTMENT OF ELECTRICAL ENGINEERING

Details of the following will be found in the Engineering Faculty Handbook.

- EE321-322-323L — Electronics
- EE421-423L — Electronics
- EE444-445 — Communication Systems

OFFERED BY DEPARTMENT OF MECHANICAL ENGINEERING

Details of the following will be found in the Engineering Faculty Handbook.

- ME449 — Reliability Analysis for Mechanical Systems
- ME503G — Design of Experiments for Engineering Research

OFFERED BY DEPARTMENT OF PHYSICS

PHYSICS III (ELECTRONICS)

A course comprising 20 lectures and 20 hours of laboratory work covering the principles and operation of semiconductor devices, including linear and digital integrated circuits.

Prerequisite

Physics I

REQUIREMENTS FOR THE DEGREE OF MASTER OF MATHEMATICS

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

2. A person may register for the degree of Master of Mathematics if —

(a) he is a graduate or graduand of the University of Newcastle or other approved University with Honours in the subject to be studied for that degree; or

(b) he is a graduate or graduand of the University of Newcastle or other approved University; or

(c) in exceptional cases he produces evidence of such academic and professional attainments as may be approved by the Senate, on the recommendation of the Faculty Board.

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

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

5. An applicant approved by the Faculty Board shall register in one of the following categories:

(i) Student in full-time attendance at the University.

(ii) Student in part-time attendance at the University.

6. (i) Every candidate for the degree shall be required to submit a thesis embodying the results of research carried out by him during his candidature, to take such examination and to perform such other work as may be prescribed by the Faculty Board. The candidate may submit also for examination any work he has published, whether or not such work is related to the thesis.

(ii) The research and other work as provided in paragraph 6 (i) shall be conducted under the direction of a supervisor appointed by the Faculty Board or under such conditions as the Faculty Board may determine.

(iii) A part-time candidate shall, except in special circumstances —

i. conduct the major proportion of his research in the University; and

ii. take part in research seminars within the Department in which he is working.
(iv) Every candidate shall submit annually a report on his work to his supervisor for transmission to the Higher Degree Committee.

(v) Every candidate shall submit three copies of the thesis as provided under paragraph 6(i). All copies of the thesis shall be in double-spaced typescript, shall include a summary of approximately 200 words, and a certificate signed by the candidate to the effect that the work has not been submitted for a higher degree to any other University or institution. The ORIGINAL copy of the thesis for deposit in the Library shall be prepared and bound in a form approved by the University. The other two copies of the thesis shall be bound in such manner as allows their transmission to the examiners without possibility of their disarrangement.

(vi) It shall be understood that the University retains the three copies of the thesis and is free to allow the thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act (1968) the University may issue the thesis in whole or in part in photostat or microfilm or other copying medium.

7. No candidate shall be considered for the award of the degree until the lapse of six complete terms from the date from which the registration becomes effective, save that in the case of a candidate who has obtained the degree of Bachelor with Honours or a qualification deemed by the Faculty Board to be equivalent or who has had previous research experience, this period may, with the approval of the Faculty Board, be reduced by up to three terms.

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

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

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

REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

1. The degree of Doctor of Philosophy may be awarded by the Council on the recommendation of the Senate to a candidate who has satisfied the following requirements.

2. A candidate for registration for the degree of Doctor of Philosophy shall:

(i) have satisfied all of the requirements for admission to the degree of master or the degree of bachelor with first or second class honours in the University of Newcastle or a degree from another University recognised by the Senate as having equivalent standing;

or

(ii) have satisfied all of the requirements for admission to the degree of bachelor with third class honours or without honours in the University of Newcastle or a degree from another University recognised by the Senate as having equivalent standing, and have achieved by subsequent work and study a standard recognised by the Senate as equivalent to at least second class honours;

or

(iii) in exceptional cases submit such other evidence of general and professional qualifications as may be approved by the Senate.

3. The Senate may require a candidate, before he is permitted to register, to undergo such examination or carry out such work as it may prescribe.

4. A candidate for registration for a course of study leading to the degree of Ph.D. shall:

(i) apply on the prescribed form at least one calendar month before the commencement of the term in which he desires to register; and

(ii) submit with his application a certificate from the Head of the Department in which he proposes to study stating that the candidate is a fit person to undertake a course of study or research leading to the Ph.D. degree and that the Department is willing to undertake the responsibility of supervising the work of the candidate.

5. Before being admitted to candidature, an applicant shall satisfy the Senate that he can devote sufficient time to his advanced study and research.

6. Subsequent to registration, the candidate shall pursue a course of advanced study and research for at least nine academic terms, save that any candidate who before registration was engaged upon research to the satisfaction of the Senate, may be exempted from three academic terms.
7. A candidate shall present himself for examination not later than fifteen academic terms from the date of his registration, unless special permission for an extension of time be granted by the Senate.

8. The course, other than field work, must be carried out in a Department of the University, under the direction of a supervisor appointed by the Senate, or under such conditions as the Senate may determine, save that a candidate may be granted special permission by the Senate to spend a period of not more than three academic terms in research at another institution approved by the Senate.

9. Not later than three academic terms after registration the candidate shall submit the subject of his thesis for approval by the Senate. After the subject has been approved it may not be changed except with the permission of the Senate.

10. A candidate may be required to attend a formal course of study appropriate to his work.

11. On completing his course of study every candidate shall submit a thesis which complies with the following requirements:

(i) The greater proportion of the work described must have been completed subsequent to registration for the Ph.D. degree.

(ii) It must be a distinct contribution to the knowledge of the subject.

(iii) It must be written in English or in a language approved by the Senate and reach a satisfactory standard of literary presentation.

12. The thesis shall consist of the candidate's own account of his research. In special cases work done conjointly with other persons may be accepted provided the Senate is satisfied on the candidate's part in the joint research.

13. Every candidate shall be required to submit with his thesis a short abstract of the thesis comprising not more than 300 words.

14. A candidate may not submit as the main content of his thesis any work or material which he has previously submitted for a University degree or other similar award.

15. The candidate shall give in writing three months' notice of his intention to submit his thesis and such notice shall be accompanied by the appropriate fee.

16. Four copies of the thesis shall be submitted together with a certificate from the supervisor that the candidate has completed the course of study prescribed in his case and that the thesis is fit for examination.

17. The thesis shall be in double-spaced typescript. The original copy for deposit in the Library shall be prepared and bound in a form approved by the University. The other three copies shall be bound in such manner as allows their transmission to the examiners without possibility of disarrangement.

18. It shall be understood that the University retains four copies of the thesis and is free to allow the thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act (1968) the University may issue the thesis in whole or in part in photostat or microfilm or other copying medium.

19. The candidate may also submit as separate supporting documents any work he has published, whether or not it bears on the subject of the thesis.

20. The Senate shall appoint three examiners of whom at least two shall not be members of the teaching staff of the University.

21. The examiners may require the candidate to answer, viva voce or in writing, any questions concerning the subject of his thesis or work.

22. The result of the examination shall be in accordance with the decision of a majority of the examiners.

23. A candidate permitted to re-submit his thesis for examination shall do so within a period of twelve months from the date on which he is advised of the result of the first examination.
REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF SCIENCE

1. The degree of Doctor of Science may be awarded by the Council, on the recommendation of the Senate, for an original contribution or contributions of distinguished merit adding to the knowledge or understanding of any branch of learning with which the Faculty is concerned.

2. An applicant for registration for the degree of Doctor of Science shall hold a degree of the University of Newcastle or a degree from another University recognised by the Senate as being equivalent or shall have been admitted to the status of such a degree.

3. The degree shall be awarded on published work although additional unpublished work may also be considered.

4. Every candidate in submitting his published work and such unpublished work as he deems appropriate shall submit a short discourse describing the research embodied in his submission. The discourse shall make clear the extent of originality and the candidate's part in any collaborative work.

5. An applicant for registration for the degree shall submit in writing to the Secretary a statement of his academic qualifications together with:
   (a) four copies of the work, published or unpublished, which he desires to submit; and
   (b) a Statutory Declaration indicating those sections of the work, if any, which have been previously submitted for a degree or diploma in any other University.

6. The Senate shall appoint three examiners of whom at least two shall not be members of the teaching staff of the University.

7. The examiners may require the candidate to answer, viva voce or in writing, any questions concerning his work.

8. The result of the examination shall be in accordance with the decision of a majority of the examiners.

* In these requirements, the term "published work" shall mean printed in a periodical or as a pamphlet or as a book readily available to the public. The examiners are given discretion to disregard any of the work submitted if, in their opinion, the work has not been so available for criticism.

RESEARCH IN THE
DEPARTMENT OF MATHEMATICS

ALGEBRA
Mr. R. F. Berghout is pursuing some topics in the theory of rings and ring-like categories.
Associate Professor W. Brisley is working on some problems occurring in the laws defining certain varieties of groups, the subsequent lattice of sub-varieties of given varieties, and the location of generating critical groups for varieties of groups.

BASIC BIOLOGICAL FORCES
Dr. E. R. Smith is studying the role of Van der Waals and related forces in the stabilisation of biological objects and colloids. He is also interested in the stability of the myosin lattice in striated muscle.

CHEMICAL KINETICS
Dr. D. L. S. McElwain is working on the mathematical modelling of nonequilibrium phenomena in gases, using the Master Equation approach. A stochastic theory of the dissociation of diatomic gases and exchange reactions is being investigated.

COMBINATORIAL THEORY AND OPERATIONS RESEARCH
Dr. W. D. Wallis is carrying out research on various parts of graph theory, including graph factorization. He is also working on rostering and scheduling problems.
Dr. R. J. Vaughan is interested in the application of optimisation methods to industrial production problems.

DIFFERENTIAL EQUATIONS
Dr. I. G. Couper has been working on the geometric theory of autonomous systems of ordinary differential equations.
Dr. L. Janos is working in transformation theory of second order differential equations of the form \( y'' + q(x)y = 0 \) and its connection with fixed point theory.

DYNAMIC OCEANOGRAPHY
Dr. W. C. Summerfield is working on the interactions of the various oceanic motions with continental boundaries. In particular, he is examining the resonance properties of the continental shelf region.

ENVIRONMENTAL STUDIES
Dr. R. J. Vaughan is investigating mathematical models in urban geography.
FLUID DYNAMICS
Dr. W. T. F. Lau is concerned with potential flow and viscous flow problems.

FUNCTIONAL ANALYSIS
Dr. J. R. Giles is involved in determining properties of Banach spaces which can be derived from relations between the points of the space and their support functionals. In particular, he is examining differentiability properties of the norm. He is also working on the development of the theory of algebra and numerical range of operators on locally convex spaces.
Dr. W. Ficker and Mr. C. J. Ashman are working in measure theory, particularly, in some problems on classes of null sets.

GENERAL TOPOLOGY
Dr. L. Janos is working in dimension theory on problems of metric characterisation of zero-dimensionality.

GEOMETRY
Dr. P. K. Smrz is working on application of the theory of continuous groups and fibre bundles to studies of the mathematical properties of space-time continuum, especially in relation to its spinor structure.

HISTORY OF MATHEMATICS
Mr. R. F. Berghout is pursuing research into the development of algebra, notably modern algebra, as well as the relations between this and classical occidental and oriental algebra.
Mr. Berghout, together with Mrs. W. Frost, is working on Greek algebra. Mrs. Frost is currently translating into English some of Euclid's as yet untranslated works.

INFORMATION THEORY
Professor R. G. Keats is continuing to work in cooperation with research scientists at the Weapons Research Establishment who are active in the study of signal processing. This work, which is supported by a grant from the Department of Supply, involves the study of non-linear systems with stochastic inputs.

NUMBER THEORY
Dr. T. K. Sheng studies the structure of humanly manageable numbers, application of dispersive and explosive linear operators, distribution of algebraic numbers in the complex plane, and functions defined on rational numbers.

NUMERICAL ANALYSIS AND COMPUTING
Dr. A. J. Guttmann is interested in methods of function approximation, particularly from the viewpoint of using a linear differential equation representation.

STATISTICAL MECHANICS
Dr. A. J. Guttmann is working on the theory of equilibrium critical phenomena. He is particularly interested in the analysis of power series expansions which are frequently used to study systems exhibiting phase transitions.
Dr. E. R. Smith is working on the theory of non-homogeneous systems and the theory of liquid crystals.
Dr. W. P. Wood is investigating the dynamical behaviour of long chain molecules in solution.

STATISTICS
Dr. W. D. Wallis is working on the theory and application of Room square designs.

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