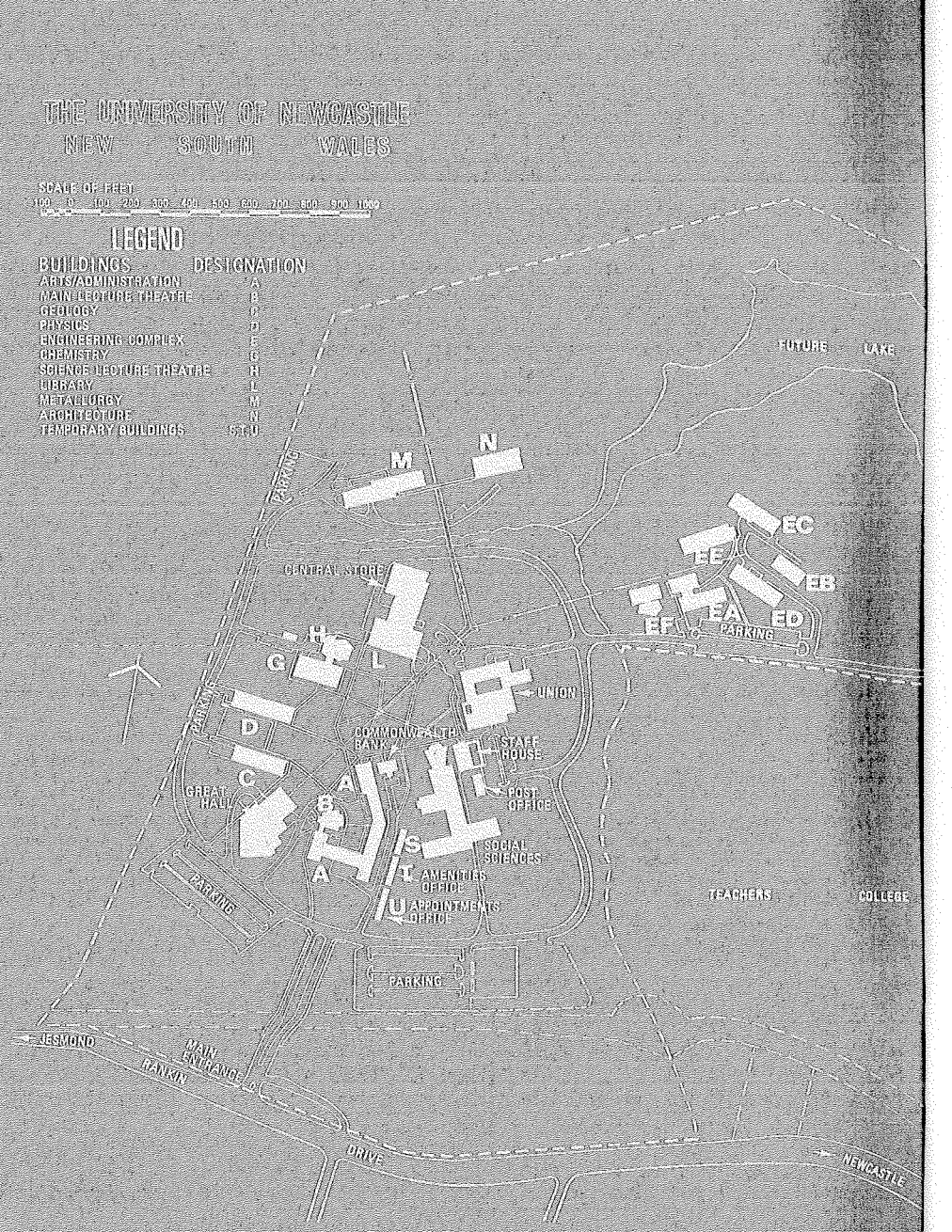
ULTY OF MATHEMATICS
HANDBOOK 1972

THE UNIVERSITY OF NEWCASTLE
NEW SOUTH WALES 2308



FACULTY OF MATHEMATICS

HANDBOOK 1972

THE UNIVERSITY OF NEWCASTLE
NEW SOUTH WALES 2308

Telephone — Newcastle 68 0401

Fifty Cents

THE UNIVERSITY OF NEWCASTLE

Fees — Effective 1st January, 1972

1. GENERAL SERVICES FEE:

(a) Students Proceeding to a Degree or Diploma

All registered students must pay a General Services fee of $42.00 per annum which includes a Library Fee. In addition, students joining the University of Newcastle Union for the first time, are required to pay an entrance fee of $12.00. This fee must be paid by the prescribed time in First Term.

(b) Non-Degree Student

Payment of the General Services Fee by a non-degree student is optional.
A student cannot elect to pay portion of this fee.

2. UNDERGRADUATE COURSE FEE:

	$
Full-time	
Faculties of Arts, Economics/Commerce, Mathematics	384 p.a.
All other Faculties	462 p.a.
Part-time Course	
All Faculties	231 p.a.
Non-Degree Subject	126 p.a.

3. POSTGRADUATE DIPLOMA COURSE FEES:

Full-time	384 p.a.
Part-time	231 p.a.

4. FEES FOR DEGREE OF MASTER:

(a) Research and Thesis

Registration Fee	6
Course & Supervision Fee (full-time)	162 p.a.
Course & Supervision Fee (part-time)	108 p.a.
Final Examinations & Graduation Fee	42

(b) Course Work and Dissertation or Formal Study Courses.

Registration Fee	6
Course & Supervision Fee (full-time)	384 p.a.
Course & Supervision Fee (part-time)	231 p.a.
Final Examination & Graduation Fee	42

5. FEES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY:

Qualifying Examination Fee (if applicable) *	18
Registration Fee	6
Course & Supervision Fee (full-time)	162 p.a.
Course & Supervision Fee (part-time)	99 p.a.
Final Examination & Graduation Fee	59

* Payable when examination is prescribed for the assessment of a student prior to his registration as a higher degree candidate.

6. RESUBMISSION OF THESIS:

A candidate required to re-submit a thesis will not be required to pay further fees unless laboratory work is involved, in which case the new appropriate course and supervision fee will be payable on a term basis. These fees are appropriate to the degree course in which the students are enrolled at the commencement of each year.

Where subjects are common to different degrees, e.g. Arts and Science, full-time fees will be assessed on the degree sought. Should a student subsequently transfer from one degree course to another which would result in a different full-time fee level being applicable, fees will be re-assessed retrospective to the commencement of the academic year (i.e. first term).

A student enrolled in a combined course leading to the award of two degrees shall, where there is a difference in the fees for the ordinary courses leading to the award of those degrees, pay the higher fee.

7. LATE FEES:

(1) Late payment fee.	
Payable if fees due are not paid within stipulated times approved by the Vice-Chancellor.	7
Plus a further penalty if the fees are not paid within an extended time approved by the Vice-Chancellor	5
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(3) Where a student who has been granted an extension of time in which to pay fees does not do so by the prescribed time, late fees in accordance with 7(1) and 7(2) shall be payable.	
(4) When an application to sit for examination is accepted after closing date	5

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(1) Deferred examinations, per subject	5
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(3) Review of examination results, per subject	7
(4) Statement of matriculation status	7
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November, 1971.

G. W. WALKER.
Accountant.

* N&B PRINT

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 to be 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 1972 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

CONTENTS

PRINCIPAL DATES
1972

JANUARY

1 Saturday	New Year's Day
3 Monday	New Year's Day Holiday
7 Friday	Last day for lodgement of Re-Enrolment Forms —Continuing Students
17 Monday	Deferred Examinations begin
21 Friday	Last day for lodgement of Applications for Admission from persons resident in Australia who were enrolled in another Australian University in 1971 or who are seeking admission on the basis of examination results which were not available by 1st November, 1971.
29 Saturday	Last Day of Deferred Examinations
31 Monday	Public Holiday — Australia Day

FEBRUARY

16 Wednesday to 18 Friday	New students required to attend the University in person to have their enrolment approved and to pay fees.
22 Tuesday	Last day for payment of First Term Course Fees and Annual General Services Fee (i.e. the lodgement of enrolment approvals with the Cashier together with fees, scholarship voucher, fees warrant or extension notice)
28 Monday	FIRST TERM begins

MARCH

17 Friday	Graduation Day
31 Friday	Public Holiday — Good Friday

APRIL

1 Saturday to 4 Tuesday	Easter Recess
25 Tuesday	Public Holiday — Anzac Day

MAY

13 Saturday	FIRST TERM ends

JUNE

5 Monday	SECOND TERM begins
12 Monday	Public Holiday — Queen's Birthday
16 Friday	Last day for payment of Second Term Fees. Last day for acceptance of applications for examinations. Last day for withdrawal without academic penalty from courses in the faculties of Arts and Economics and Commerce. For information regarding fees payable on withdrawal refer to page 31.

JULY

10 Monday	Last day for withdrawal without academic penalty from courses in all faculties other than Arts and Economics and Commerce. For information regarding fees payable on withdrawal refer to page 31.

AUGUST

12 Saturday	SECOND TERM ends

PRINCIPAL DATES

SEPTEMBER

4 Monday	THIRD TERM begins
15 Friday	Last day for payment of Third Term Fees

OCTOBER

2 Monday	Public Holiday — Eight Hour Day
27 Friday	Third Term Lectures and other Classes cease

NOVEMBER

4 Saturday	THIRD TERM ends
	Annual Examinations begin
25 Saturday	Annual Examinations end

1973

FEBRUARY

26 Monday	FIRST TERM begins

FACULTY OF MATHEMATICS

Dean

Professor R. G. Keats

Sub-Dean

Associate Professor I. L. Rose

MATHEMATICS

Professors

R. G. Keats, B.Sc., Ph.D.(Adel.), F.A.S.A.
H. M. Lieberstein, B.A., B.S.(Arkansas), M.A.(Kansas), Ph.D.(Maryland)

Associate Professor

I. L. Rose, B.E.(Syd.), Ph.D.(N.S.W.)

Senior Lecturers

W. Brisley, B.Sc.(Syd.), M.Sc.(N.S.W.), Ph.D.; Dip.Ed.(N.E.)
W. Ficker, Prom.Mat., C.Sc., RNDr.(Comenius)
J. R. Giles, B.A.(Syd.), Ph.D.; Dip.Ed.(Syd.)
J. A. Lambert, B.Sc.(Syd.), M.Sc.(N.S.W.)
W. T. F. Lau, M.E.(N.S.W.), Ph.D.(Syd.), M.A.I.A.A.
W. D. Wallis, B.Sc., Ph.D.(Syd.)

Lecturers

R. F. Berghout, M.Sc.(Syd.)
J. G. Couper, B.Sc., Ph.D.(N.E.)
A. J. Guttmann, M.Sc.(Melb.), Ph.D.(N.S.W.)
M. J. Hayes, B.A.(Cantab.)
T. K. Sheng, B.A.(Marian Coll.), B.Sc.(Malaya & Lond.), Ph.D.(Malaya)
P. K. Smrz, Prom.Phys., C.Sc., RNDr.(Charles)
Jennifer Wallis, B.Sc.(N.S.W.), M.Sc., Ph.D.(La Trobe)
W. P. Wood, B.Sc., Ph.D.(N.S.W.)

Senior Tutors

C. J. Ashman, B.A., Litt.B.(N.E.)
G. W. Southern, B.A.(N.S.W.)

Tutors

Winifred Frost, B.A.
G. S. Martin, B.A.(N.S.W.)
E. V. Petersons, B.Sc.(Syd.)
B. J. Stokes, B.Sc.

Secretary

Mrs. P. H. Abraham

Stenographer

Mrs. R. A. Mills

Assistant

Mrs. W. K. Jarvie, B.A.

ADMINISTRATIVE STAFF

Vice-Chancellor and Principal

Professor J. J. Auchmuty, C.B.E., M.A., Ph.D.(Dub.), M.R.I.A., F.R.Hist.S., F.A.H.A.

Vice-Principal and Deputy Vice-Chancellor

Professor B. Newton-John, M.A.(Cantab.)

Deputy Vice-Chancellor

Professor E. O. Hall, M.Sc.(N.Z.), Ph.D.(Cantab.), F.Inst.P., M.Aust.I.M.M., F.I.M.(Lond.), F.A.I.P., F.R.S.A.

Personal Assistant to Vice-Chancellor

A. Nell Emanuel, B.A.(N.S.W.)

BURSAR'S DIVISION

Bursar

L. W. Harris, A.A.S.A., A.C.A.A., A.B.I.A.

Deputy Bursar

L. F. Norberry, A.A.S.A., A.C.I.S.

Accountant

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

Assistant Bursar — Staff

R. J. Goodbody

SECRETARY'S DIVISION

Secretary

P. D. Alexander, B.A., Dip.Ed.(Syd.)

Student Administration

J. D. Todd, B.Com., A.A.S.A.
P. H. Beckett, B.A.(Syd.)

Examinations

Glennie Jones, B.A.(N.S.W.)

Faculty Secretariat

J. S. Boydell, M.A.(Cantab.)
T. G. Chapman, B. A.(Syd.)
D. L. Farmer, B.Sc., Dip.Ed.(Syd.)

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J. W. Armstrong, B.A.
E. Joan Bale, B.A.(N.S.W.)

Statistics and Systems

T. R. Rodgers, B.A.

PLANNER'S DIVISION

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

Assistant Planner

D. D. Morris, B. Arch., Dip.L.D.(N.S.W.), A.S.T.C., F.R.A.I.A. A.A.I.L.A.

Assistant Staff Architects

W. J. Crook, B.Arch.(N.S.W.), A.R.A.I.A.
A. Lee, A.S.T.C.

Staff Engineer

M. E. Edmonds, Dip.M.E.E.(Qld.), M.I.E.Aust.

STUDENT COUNSELLING UNIT

Senior Counsellor

A. P. T. Loftus, B.A.(Melb.), M.A.Ps.S.

Student Counsellor

B. E. Hazell, M.A.(Syd.), M.A.Ps.S.

Assistant Student Counsellor

Anne H. Furner, B.A., Dip.App.Psych.

APPOINTMENTS OFFICE

Appointments Officer

H. Floyer, B.Ec.(Syd.)

COMPUTER CENTRE

Director

J. A. Prichard, B.Sc.(Birm.), F.R.A.S., A.I.P., A.A.I.P.

Programmer

I. R. Beaman, B.Sc.(N.S.W.), Dip.Ind.Eng.

THE LIBRARY STAFF

University Librarian

E. Flowers, M.A.(Syd.), A.L.A.A.

Assistant University Librarian (Technical Services)

M. Elizabeth Guilford, B.A.(N.E.), A.L.A.A.

Assistant University Librarian (Reader Services)

Joan E. Murray, B.A.(N.E.), A.L.A.A.

Acquisitions Librarian

Barbara R. Cook, B.A.; Dip.Lib.(N.S.W.), A.L.A.A.

Serials Librarian

B. Mitcheson, B.A., A.L.A.A.

Assistant Librarians

Jane E. Scott, B.A.(N.E.), Dip.Ed.(Syd.), A.L.A.A.
C. I. Walsh, B.A.(W.Ont.), Dip.Lib.(N.S.W.)

Graduate Library Staff

Janet M. Brice, B.A.(N.S.W.)
L. Faidiga, B.A.
Carolyn R. Fredman, B.A.(N.S.W.)
Anna M. Lee, B.Sc.
E. Ann Morris, B.A., Dip.Ed.
Winifred Murdoch, B.Sc.(N.E.)
Mary E. Rabbitt, B.A.(N.S.W.)
Barbara E. Samojluk, B.A.
Jennifer M. Scobie, B.A., Dip.Ed.(Syd.)

THE UNIVERSITY OF NEWCASTLE

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 3571 in 1971.

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.

The present Chancellor of the University is the Honourable Sir Alister McMullin, K.C.M.G., D.Litt. Professor J. J. Auchmuty, C.B.E., M.A., Ph.D.(Dub.), M.R.I.A., F.R.Hist.S., F.A.H.A. is the Vice-Chancellor and Principal.

The principal academic body in the University is the Senate comprising the Vice-Chancellor, Professors, a representative of each of the Faculty Boards and certain other *ex officio* members. Teaching and research in each Faculty are supervised by a Faculty Board consisting principally of the permanent academic staff of the Departments in the Faculty. A number of Boards of Studies have also been established, each board having the task of integrating or supervising activities in a particular area of interest.

The University is financed by grants from the New South Wales and Commonwealth Governments and fees paid by students. The State and Commonwealth Governments contribute equally to the cost of buildings and major items of equipment whilst with respect to recurrent expenditure, the Commonwealth contributes $1 for every $1.85 received by way of State grant and student fees.

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	Greek	Chinese
Mathematics	Latin	Japanese
Science	French	Hebrew
Agriculture	German	Dutch
Modern History	Italian	Art
Ancient History	Bahasa Indonesia	Music
Geography	Spanish	Industrial
Economics	Russian	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 5.3 — *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.

PREREQUISITES

Althoug 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:—

FACULTY	ASSUMPTION
APPLIED SCIENCE	Second level Short Course Mathematics and Science including Physics and Chemistry options.
ARCHITECTURE	Second level Short Course Mathematics and Science.
ARTS	Economics I — Second level Short Course Mathematics. English 1 — Second level English. French 1 — Second level French.
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 AT THE UNIVERSITY OF NEWCASTLE FOR THE FIRST TIME

Students seeking admission in the 1972 academic year will be required to lodge an "Application for Admission — 1972" with the Student Administration Office not later than

(a) **5.00 p.m. on Monday, 1 November, 1971,** in the case of:
- persons resident in Australia who are seeking admission on the basis of qualifications which they already hold at 1 November, 1971;
- persons resident outside of Australia or persons applying for admission on the basis of qualifications gained outside Australia.

(b) **5.00 p.m. on Friday, 21 January, 1972,** 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, 1971;

(ii) in 1971 have been enrolled in another Australian University; or

(iii) have applied to attempt the University of Sydney Matriculation Examination in February, 1972.

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, 1972 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 in 1972 new students will be required to attend the University in person to have their enrolment approved and to pay fees. The days Wednesday, 16 February to Friday 18 February, 1972 have been set aside for this purpose.

PERSONS RE-ENROLLING IN UNDERGRADUATE COURSES

Undergraduates re-enrolling will be required to complete an enrolment form and lodge it with the Student Administration Office on or before Friday, 7 January, 1972. Students enrolled in 1971 will be sent a re-enrolment form with the advice of their examination results in December.

Students awaiting deferred or special examination results must also lodge a re-enrolment form on or before Friday, 7 January, 1972. The re-enrolment form should be completed on the basis that the student will be successful at the deferred or special examinations. Students unsuccessful at the deferred or special examinations will be notified in writing of the action they will be required to take to have their re-enrolment in 1972 approved.

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 his term address.

CANDIDATES FOR POSTGRADUATE DIPLOMA COURSES

DIPLOMA IN APPLIED PSYCHOLOGY

Applicants for admission to the Postgraduate Diploma in Applied Psychology are selected biennially. No new candidates will be accepted in 1972.

DIPLOMA IN BUSINESS STUDIES

Intending candidates will be required to complete an Application Form to register as a candidate for the Postgraduate Diploma course in Business Studies and lodge it with the Student Administration Office on or before Friday, 21 January 1972.

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.

Enquiries regarding this course and the conditions governing admission may be made to Mr. D. S. Karpin, Department of Commerce, extension 214 or dial 68 5214.

DIPLOMA IN COMPUTER SCIENCE

Intending candidates will be required to complete an Application Form to register as a candidate for the Postgraduate Diploma course in Computer Science and lodge it with the Student Administration Office on or before Friday, 21 January,1972.

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

DIPLOMA IN EDUCATION

Intending candidates will be required to complete an Application Form to register as a candidate for the Postgraduate Diploma course in Education and lodge it with the Student Administration Office as soon as possible but in any case not later than Friday, 21 January, 1972

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

Notices will be displayed on the University Notice Boards giving information as to where and when prospective candidates will be interviewed concerning their studies.

DIPLOMA IN INDUSTRIAL ENGINEERING

Intending candidates will be required to complete an Application Form to register as a candidate for the Postgraduate Diploma course in Industrial Engineering and lodge it with the Student Administration Office on or before Friday, 21 January, 1972.

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

CANDIDATES FOR THE DEGREE OF MASTER OR OF DOCTOR OF PHILOSOPHY

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, 7 January, 1972.

Candidates Registering for the First Time

These persons should complete an Application Form to register as a candidate for a Higher Degree and lodge it with the Student Administration Office on or before Friday, 21 January, 1972. A separate application form will be available for candidates wishing to register for a Course Work Masters degree.

NON-ACCEPTANCE

The student whose enrolment is not accepted will be notified in writing.

LATE ENROLMENTS

(i) Students who are unable to lodge their Application Form or 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, 21 January, 1972 in the case of new students, or Friday, 7 January, 1972 in the case of students re-enrolling, otherwise the University reserves the right not to accept the student's application or 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 or to re-enrol in a subject (or subjects) as the case may be, 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.

The student's "show cause" statement and completed re-enrolment form must be lodged with the Student Administration Office on or before Friday, 7 January, 1972.

STUDENTS WISHING TO RE-ENROL AFTER A PERIOD OF EXCLUSION

A student wishing to re-enrol after a period of exclusion should make an appointment for an interview with the Dean of the Faculty concerned before Friday, 7 January, 1972 to present his case for the acceptance of his re-enrolment.

UNIVERSITY SKILLS ASSESSMENT

In the first week of First Term as part of its service to students, the Student Counselling Unit 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 results are completely confidential. 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 THE COURSE REGARDED AS FAILURE

Approval to withdraw from a course is not automatic. It should be noted that a student is regarded as having failed in a course if he enrols 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 within seven (7) days of the date of withdrawal. 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.

(a) Faculties of Arts, and Economics and Commerce
Second Friday in Second Term

(b) Faculties of Applied Science, Architecture, Engineering, Mathematics, and Science
Sixth Monday in Second Term

AMENDMENTS

Any action taken by a student which involves an amendment to or a variation in his course programme or enrolment status is required to be documented.

A student must formally apply for permission to do any of the following:

(a) completely withdraw from course

(b) withdraw from a subject or subjects

(c) substitute one subject for another

(d) add a subject to existing programme

(e) transfer from F/T to P/T within degree course

(f) transfer from P/T to F/T within degree course

(g) transfer from one degree course to another

(h) transfer from a degree course in one Faculty to a degree course in another Faculty

If the variation sought is not listed above, a brief indication of the nature of the change sought is required.

NOTES

1. Exemptions in a subject unit or units, the substitution of a unit or units within a subject and exemption from practical work, is the responsibility of the Head of the Department concerned who will authorise such exemption or exemptions.
2. Students are reminded that compliance with the Degree or Diploma Requirements governing their courses is their responsibility. Approval of a Variation Application does not of itself entitle the applicant to any rights or privileges to which the completion of his previous programme might have entitled him.

HOW TO DOCUMENT WITHDRAWALS AND AMENDMENTS

All withdrawals and amendments should be recorded on a Variation Application Form.

It is essential that students notify the Student Administration of variations in their courses promptly. Automatic approval is not given; the student must have valid and sufficient reasons for making the change and these reasons should be stated on the Variation Form.

Variation Forms are available from the Student Administration Office.

CHANGE OF ADDRESS

Student are responsible for notifying the Student Administration Office in writing of any change in their address as soon as possible.

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.

A Variation Application Form should be used to notify a change of address.

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 the identity card which will be given to him.

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 fee receipt 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.

Non-Degree Students and Identity Card

Each non-degree student, who does not elect to pay the General Service Fee, will be issued with an identity card appropriately endorsed. It must be shown on request to prove status as a student of the University.

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, Building "A".

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 to holders of Commonwealth Scholarships, Teachers' College 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) at the rear of the Main Lecture Theatre B01 (Room 04).

FEES

GENERAL INFORMATION

COMPLETION OF ENROLMENT

Fees are determined by the University Council and are subject to alteration without notice.

Enrolment is not effective until fees for the course in which the student has enrolled, are paid. Fees should be paid on or before Tuesday, 22 February, 1972. After that, a late fee will apply. Enrolments will not be accepted after 31 March, 1972 without the Secretary's special written approval. This will be given only in exceptional circumstances.

Payment of fees by mail is encouraged. Money Orders should be made payable at the Newcastle University Post Office, 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.

PAYMENT OF FEES BY TERM

The Entrance Fee and General Services Fee must be paid in full at the time of enrolment. However, students may pay Course Fees by the term, in which case they are required to pay First Term Course Fees and the whole of the General Services Fee by the due date.

Students paying fees under this arrangement will receive accounts for Second and Third Term fees prior to the commencement of these terms.

EXTENSION OF TIME IN WHICH TO PAY FEES

Students who are unable to pay fees by the prescribed date may apply in writing to the Vice-Principal for an extension of time in which to pay fees. Special forms are available for this purpose. Completed forms must be forwarded to the Vice-Principal's Office before Wednesday, 16 February, 1972.

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 their fees will be paid by Sponsors. The University looks to Sponsors to provide a separate voucher, warrant or letter for each student sponsored. Where such documentary evidence is not available, students are expected to make payment by the due date to avoid late fees and apply for a refund of fees when the authority required is available.

DATES FOR PAYMENT OF FEES IN 1972

		* LATE PAYMENT FEE	
	Fees payable before or on	$6.00 payable on and after	$10.00 payable on and after
FIRST TERM	Tuesday February 22	Wednesday February 23	Thursday March 30
SECOND TERM	Friday June 16	Monday June 19	Monday July 3
THIRD TERM	Friday September 15	Monday September 18	Tuesday October 3

* Refer page 33 for other Late Fees

FAILURE TO PAY FEES

Students cease to be entitled to membership and privileges of the University where they are indebted to the University and fail to make settlement or satisfactory arrangements regarding their indebtedness. Such a student is not permitted to register for a further term, to attend classes or examinations, or to be granted any official credentials. The student is not eligible to attend the annual examinations in any subject where any portion of his Course Fees or amounts due for other purposes are outstanding. In very special cases, the Vice-Principal may grant exemption from this disqualification upon receipt of a written statement setting out all the relevant facts.

FEE ADJUSTMENTS

Should an application to withdraw from a course or a subject be approved, the University will consider an application for an adjustment of course fees based on the student's last date of attendance at lectures or tutorials. All correspondence dealing with adjustments to fees should be addressed to the Accountant.

Where notification of withdrawal from a course is received by the Secretary before the first day of First Term, a refund will be made of all Course Fees. Where a student for acceptable reasons notifies the termination of a course before the end of the fifth week of term, one-half of the Course Fees for the term may be refunded. If the student notifies termination of a course after the end of the fifth week of term, no refund will be made for that term.

THE UNIVERSITY RESERVES THE RIGHT TO DEFER PROCESSING APPLICATIONS FOR FEE REFUNDS RECEIVED IN THE EARLY PART OF FIRST TERM UNTIL AFTER THE SIXTH WEEK OF FIRST TERM.

The University Administration does not refund any portion of the General Services Fee. Students withdrawing from courses may enquire of the University Union, Sports' Union and Students' Association regarding refund possibilities.

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.

FEES

All fees are subject to variation without notice.

GENERAL SERVICES FEE

(a) *Students Proceeding to a Degree or Diploma*

All registered students must pay a General Services fee of $42.00 per annum which includes a Library Fee. In addition, students joining the Newcastle University Union for the first time, are required to pay an entrance fee of $12.00.

This fee must be paid by the prescribed date.

(b) *Non-Degree Student*

Payment of the General Services Fee by a non-degree student is optional. A non-degree student cannot elect to pay portion of this fee.

UNDERGRADUATE COURSE FEES

FULL-TIME

Faculties of Arts, Economics & Commerce, and Mathematics	$330 per annum
All other Faculties	$396 per annum

PART-TIME

All Faculties	$198 per annum
Non-Degree Subject	$108 per annum

POSTGRADUATE DIPLOMA COURSE FEES

Full-time	$330 per annum
Part-time	$198 per annum

LATE FEES

	Amount $
(a) Late payment fee if fees due are not paid within stipulated times approved by the Vice-Chancellor	6
(b) Additional amount payable if fees are not paid within an extended time approved by the Vice-Chancellor	4
(c) Late re-enrolment fee where a continuing student fails to lodge an enrolment form by the date approved by the Vice-Chancellor	10
(d) Late payment fee where an application to sit for examination is accepted after closing date	4

Late fees in accordance with (a) and (b) above are applicable where a student has been granted an extension of time in which to pay fees and fails to pay these fees by the prescribed time.

OTHER FEES

	Amount $
(1) Deferred examinations, per subject	4
(2) Examination under special supervision, per paper	8
(3) Review of examination results, per subject	6
(4) Statement of matriculation status	6
(5) Laboratory Kits, per kit	8

FEES FOR THE DEGREE OF MASTER

(a) *Research and Thesis*

Registration Fee	5
Course & Supervision Fee (full-time)	138 p.a.
Course & Supervision Fee (part-time)	93 p.a.
Final Examination & Graduation Fee	36

(b) *Course Work and Dissertation or Formal Study Courses (Master of Eng. Sc.)*

Registration Fee	5
Course & Supervision Fee (full-time)	330 p.a.
Course & Supervision Fee (part-time)	198 p.a.
Final Examination & Graduation Fee	36

FEES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Qualifying Examination Fee (if applicable)*	15
Registration Fee	5
Course & Supervision Fee (full-time)	138 p.a.
Course & Supervision Fee (part-time)	84 p.a.
Final Examination & Graduation Fee	51

*Payable when an examination is prescribed for the assessment of a student prior to registration as a higher degree candidate.

HIGHER DEGREE FEES

Course and Supervision Fee

This fee for Higher Degree candidates is assessed on a term basis, the period of registration being from the first day of the term to the Friday immediately preceding the first day of the following term. Candidates proceeding to a Higher Degree must enrol or re-enrol at the beginning of each academic year at the normal enrolment time. The usual late fees apply in respect of late enrolments.

All fees and monies owing to the University by a Higher Degree candidate must be paid before the student's thesis can be lodged for examination.

Where a Higher Degree candidate withdraws from a course during a term, no portion of the term fee will be refunded.

General Services Fee

Higher Degree candidates are required to pay the General Services Fee (see page 33). Where a Higher Degree candidate's enrolment 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.

Re-submission of Thesis

A candidate required to re-submit a thesis, will not be required to pay further fees, unless laboratory work is involved, in which case the appropriate course and supervision fee will be payable on a term basis. The General Services Fee will also apply.

GENERAL REQUIREMENTS

The University tries to function with a minimum of formal regulations; it has, for instance, drawn up no code of conduct for students, beyond forbidding gambling in the precincts and smoking in lectures, examinations and the Library.

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.

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 (B.01) for the specific purpose of displaying examination timetables and notices concerning all 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".

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 STUDENT'S 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.

STUDENT IDENTIFICATION

Students are expected to carry their Identity Card as evidence that they are entitled to the rights and privileges afforded by the University.

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 available for collection at the Student Administration Office soon after the commencement of First Term. The Student must produce his fee receipt before an identity card will be issued.

Loss of Identity Card

If a student loses his identity card, he should pay to the University Cashier, the sum of 50c., 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.

CHANGE OF ADDRESS

Students are responsible for notifying the Student Administration Office in writing of any change in their address as soon as possible. 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. The Transport Authorities may challenge a student whose address on his identity card is incorrect. A change of address should be notified on a Variation Application Form.

GENERAL CONDUCT

Acceptance as a member of the University implies an undertaking on the part of the student to observe the by-laws and other requirements of the University.

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

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

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, member of the academic staff or other person employed by the University who wishes to bring a motor vehicle on to the Shortland site shall obtain a University parking permit which shall be clearly displayed on the vehicle.
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. No person shall drive any vehicle on to the University site:
   (a) in a dangerous or careless manner
   (b) at a speed exceeding 20 miles per hour
   (c) so as to cause undue noise
   (d) other than on formed roads currently open for traffic
5. The driver of any vehicle within the Shortland site shall comply with the directions shown on all traffic signs, road markings and directory notices. Government traffic regulations shall apply to marked pedestrian crossings.
6. 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.
7. Any person who contravenes or fails to observe any of these regulations shall, if a student, be deemed guilty of a breach of discipline (By-Law 4) or if in the employ of the University, be deemed guilty of a breach of regulations and may be dealt with accordingly.
8. The maximum penalty for the time being which may be applied under these regulations shall be the banning for a period of three months of any vehicle driven by the person concerned.

NOTE:

Permits may be obtained from the Senior Attendant (Patrol) in Room 04 at the rear of the main lecture theatre (B.01) between 9 a.m. and 5 p.m. on Mondays to Fridays inclusive.

EXAMINATIONS

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

A student desiring to sit for an annual examination must lodge an application with the Secretary on the appropriate form by the prescribed date, 16 June, 1972.

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 fee of $4.00. 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

The official examination results will be posted on the notice board at the top of the main staircase. 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 fee of $6.00 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 fee 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

To assist those students who may be unsuited to university study or whose circumstances jeopardise success at study and to deal with those students whose lack of success has a detrimental effect on the work of the course, 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.

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 190,000 volumes and made up of monographs, pamphlets, serials and microform sets, 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 procedure for borrowing.

The Library, fittingly, occupies a 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., March 31 — April 4 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 liason 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.

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 is responsible for the operation of the Personal Accident Insurance Scheme.

APPOINTMENTS OFFICE

The Appointments Office was established in 1971 primarily to help students obtain information about careers and to assist graduating students find employment.

All new students are invited to consult the Appointments Office sometime 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 Appointments 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.

Careers Library

1. A section of the Careers Library will contain books, periodicals, articles, etc. giving general information on various professional occupations.
2. Information is 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.

During 1972 it is hoped that the Appointments Office will move into Building "A", when a Library and Reading Room will become available in which students may consult relevant material.

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 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 Appointments Office at the commencement of each year and complete a card indicating their needs. As opportunities are notified to the Appointments Office, appropriate students are informed.

The Appointments 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 organizations in the ensuing year. The Appointments Office arranges distribution of this Directory; a few spare copies are available upon request for undergraduates.

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

The Appointments Office is located in Room U.10 in the Temporary Buildings.

CHAPLAINCY SERVICE

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 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 A. J. A. Scott, B.A.(Melb.), Th.L.,
83 Queen's Road,
NEW LAMBTON. Tel. 57 1875

Baptist — The Reverend T. H. Binks,
133 Kemp Street,
HAMILTON. Tel. 61 4048

Methodist — The Reverend W. D. Adams, B.A.(Syd.), B.D.(Melb.)
23 William Street,
HAMILTON. Tel. 61 4040

Presbyterian — The Reverend H. V. Barratt, B.A.(Syd.)
St. Phillip's Manse,
NEWCASTLE. Tel. 2 2379

Roman Catholic — The Reverend Father L. A. Larkin, B.A.(Syd.), B.Ed.(Melb.), S.T.B.(Baltimore), M.A.C.E.
Catholic Presbytery,
HAMILTON. Tel. 61 1107

HALL OF RESIDENCE

Stage One of the First Hall will provide accommodation for 173 students and about 12 tutors. The Hall is governed by a Board of Trustees consisting of the Warden and six members, three of whom are nominated by the Council, two elected by the students of the Hall and one by the resident tutors. The Hall is situated near the South Eastern boundary of the Sports Oval, close to the tennis and squash courts.

At the time of writing, fees have not been determined.

Applications for residence should be sent to the Warden, First Hall of Residence, University of Newcastle, N.S.W. 2308.

Warden

Dr. M. W. Blackmore, B.Sc., Ph.D.(Belf.)

STUDENT COUNSELLING UNIT

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 S.C.U. 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.

Student 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 S.C.U. 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 S.C.U. 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 Secretary. Counsellors are available for evening appointments.

S.C.U. STAFF

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

Student Counsellor — B. E. Hazell, M.A.(Syd.), M.A.Ps.S.

Assistant Student Counsellor — Mrs. Anne H. Furner, B.A., Dip.App.Psych.

Secretary — Mrs. Joy Hoesli

Stenographer — Mrs. Vicki Lloyd

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).

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 $200 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.

OVERSEAS STUDENTS

Overseas students who wish to obtain any information or help are invited to see the Overseas Students' Adviser in the Student Counselling Unit.

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. G. J. Cousins attends each Wednesday, 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 ORGANISATIONS

CONVOCATION

Convocation consists of members or former members of the University Council; graduates of the University or graduates of the University of New England or the University of New South Wales who spent at least three years as students at the Newcastle University College; full-time members of the academic staff and graduate permanent members of the administrative, library and technical staff; and graduates of other Universities, either resident in the Hunter Valley or North Coast areas or approved by Council, who have been admitted as members of Convocation by Council after payment of the fee prescribed by Council.

At least two meetings are held each year, an Annual Meeting during First Term and an ordinary meeting in Third Term.

Convocation elects a Chairman who is called the Warden of Convocation and whose term of office is two years, and a Standing Committee of Convocation consisting of the Warden and twelve other members.

This body, which has the right to discuss and to pronounce an opinion on any matter relating to the University and to communicate directly with either the Council or the Senate, provides a means whereby graduates can remain active in university affairs. Five of the members of the Council are elected by the members of Convocation.

OFFICE BEARERS

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

Secretary — Miss F. M. Burns, B.A.

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 co-operation of University men and women in furthering the interests of the University.

The Union maintains a fine building at Shortland which provides recreational and common room facilities for its members; a complete range of catering services; rooms for meetings and functions of all kinds including a film viewing room (16mm); billiards, table tennis, chess and music rooms; a reading room; a stationery shop catering for all members' academic needs; and the University Co-operative Bookshop. The offices of the Students' Representative Council and the Students' Counsellor together with the A.U.S. Travel Service, N.S.W. Banking Facilities and the Student Health Centre are also situated within the building.

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.

and the Secretary Manager of the Union.

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

President — Mr. G. S. Martin, B.A.(N.S.W.)

Secretary Manager — Mr. W. V. Bridgwater

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 N.S.W. 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 the 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.
An alternative to 2 years full-time National Service.
Opportunities for attendance at Regular Army Courses and short time attachments to Army units in Malaysia, New Guinea or Vietnam.
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. 61 2121.

OFFICERS AND STAFF

Officer Commanding — Maj. F. O'Toole

Full-time Staff — WO2 K. Stoker
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, Judo, Mountaineering, Men's and Women's Rowing, Rugby Union and Rugby League, Sailing, Ski-ing, Soccer, Softball, Squash, Surfriding, Swimming, Scuba, Table Tennis, 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 performance 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.(Melb. and Cantab.)

Secretary — Miss C. F. Clarke, B.A.

Amenities Officer — Mr. H. Bradford

THE UNIVERSITY OF NEWCASTLE STUDENTS' ASSOCIATION

Included in the General Services fee of the University, which all of you pay or have paid for you, is $8.00 subscription to the Students' Association. You are all financial members of this Association, and you have every right — and a duty to yourselves — to take part in the running of the Association and the administration of your collective assets. At present, the governing administrative body of the Association is the Students' Representative Council (SRC), with its standing committees, such as the finance committee, the disciplinary committee etc. The ultimate policy-making power rests with general meetings of the Association; these can be called at seven days notice by any twenty members of the Association presenting their signatures to the SRC Office, which is in the Union Basement, near the Music Room and Games area. The functions of the Association are many and varied.

Officers of the Association act as a method of liaison between the student body and the University authorities. Complaints and requests from students may be handled by the Education and Welfare Committee, or by the SRC as a whole when brought to its attention by one of the Faculty or General Representatives. At present, the Association has helped to finance and set up a Student Health Centre, in conjunction with the Union, Sports Union and the University and also helps provide automatic accident insurance cover for Association members.

One of the ways in which the income of the Association is spent is in grants to affiliated clubs and societies (which include cultural, social, political and religious societies). To this end the Vice-President is the Clubs' and Societies' Liaison Officer, and, with his assistant and the Clubs' and Societies' Committee, gives such help to these societies as they may seek from time to time.

The Association is also responsible for publishing the student newspaper "Opus", the literary magazine "Nimrod" and the Orientation Handbook, which may be seen around the campus at the time of their publication. A weekly "Bulletin" is issued to publicise activities of the SRC, and affiliated clubs and societies.

Each year the Association organises, with assistance from the University and the Union, Orientation Week and other activities designed to help new students adjust to university life. Early in July Autonomy Day is also organised by the SRC — of this nothing need be said other than that it 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. We can only do this if you make these decisions, by offering candidates for elections, voting at these elections, coming to general meetings and letting us know your requests and complaints. Like God, we can only help those who help themselves.

PRESIDENT — Mr. A. Svirskis

SECRETARY — Miss Lesley E. Stead, (B.A.)

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.

THE ORDINARY DEGREE

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. *Pre-requisites and Co-requisites*

No candidate may enrol in a subject unless he has satisfied the pre-requisites and co-requisites 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.

THE HONOURS 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.

SCHEDULE A — MATHEMATICS SUBJECTS

SUBJECT	REMARKS INCLUDING PRE-REQUISITES AND CO-REQUISITES
PART I	
Mathematics I	It is assumed that students have studied Higher School Certificate Mathematics at second level short course or higher.
PART II	
Mathematics IIA	Pre-requisite: Mathematics I.
Mathematics IIB	Pre-requisite: Mathematics I. This subject is offered to part-time students in 2 parts each of three terms duration.
Mathematics IIC	Pre-requisite: Mathematics I; Pre- or co-requisite: Mathematics IIA.
PART III	
Mathematics IIIA	Pre-requisite: Mathematics IIA and Mathematics IIC.
Mathematics IIIB	Pre- or co-requisite: Mathematics IIIA.
PART IV	
Mathematics IV	Pre-requisites: Mathematics IIIA and Mathematics IIIB.

SCHEDULE B — SUBJECTS WITH A SUBSTANTIAL MATHEMATICAL CONTENT

SUBJECT	REMARKS INCLUDING PRE-REQUISITES AND CO-REQUISITES
PART I	
Civil Engineering IM	It is assumed that students have studied Higher School Certificate Mathematics and Science, including Physics and Chemistry, at second level short course or higher.
PART II	
Civil Engineering IIM	Pre-requisite: Civil Engineering IM and Mathematics I.
PART III	
Economics IIIC	Pre-requisite: Economics IIA
Chemical Engineering IIIC	Pre-requisite: Chemical Engineering I,* Mathematics IIA and Mathematics IIC, (including Topics E and F).
Civil Engineering IIIM	Pre-requisite: Civil Engineering IIM, Mathematics IIA and Mathematics IIC, (including Topic E).
Communications and Automatic Control	Pre-requisite: Physics I, Mathematics IIA and Mathematics IIC.
Mechanical Engineering IIIC	Pre-requisite: Mathematics IIA and Mathematics IIC, (including Topics E, F and H).
Physics IIIA	Pre-requisite: Physics II
Psychology IIIC	Pre-requisite: Psychology IIA

* 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 IIIC without Chemical Engineering I, and may, after interview, be granted exemption by the Head of the Department of Chemical Engineering.

SCHEDULE C — COMBINED HONOURS SUBJECTS

SUBJECT	REMARKS INCLUDING PRE-REQUISITES AND CO-REQUISITES
Mathematics/Psychology IV	Pre-requisite: Mathematics IIIA and Psychology IIIC

DESCRIPTION OF SUBJECTS

SCHEDULE A

MATHEMATICS I

A subject of four lectures and two tutorial hours per week for three terms comprising the following topics. Summaries of these topics, text books and reference books appear on page 76 of this handbook.

	Topic
AN	Real Analysis
AL	Algebra
CA	Calculus
NM	Numerical Mathematics

PART II SUBJECTS

The following topics are offered by the Mathematics Department. Certain combinations of these topics specified below will comprise the Part II subjects offered by the Department; each topic consists of about 27 lectures and 13 tutorials. A pass in Mathematics I is a pre-requisite for entry to each Part II subject given by the Department; in addition some topics will require other topics as a co-requisite or pre-requisite as shown. Summaries of these topics, text books and reference books appear on page 78 of this handbook.

	Topic	Co-requisite or Pre-requisite Topic
A	Analysis of metric spaces	C
B	Complex analysis	C
C	Calculus and vector calculus	—
D	Linear algebra	—
E	Differential equations and integral transforms	C
F	Numerical analysis and computing	—
G	Fourier series, partial differential equations and special functions	C E
H	Probability and statistics	C
I	Topic in statistics, e.g. non-parametric methods	H
J	Topic in applied mathematics, e.g. finite mathematics	—
K	Topic in pure mathematics, e.g. group theory	—
L	Topic in pure mathematics, e.g. differential geometry	C

MATHEMATICS IIA

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

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.

MATHEMATICS IIC

A subject of four lectures and two tutorial hours per week comprising either topics E, 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 H may be substituted for topics K or L.

NOTES

1. Part-time students may take Mathematics IIB in two parts each of two lectures per week for three terms.
2. In order to pass both Mathematics IIA and Mathematics IIB a student must study all the topics A to H above and offer them for examination.
3. Mathematics IIA is a co-requisite or pre-requisite for Mathematics IIC.
4. In order to pass in all three Part II subjects a student must study all twelve topics and offer them for examination.
5. Students whose course includes Physics IIIA are advised to include topics C, E, G and H in their Part II mathematics subjects.
6. Students whose course includes a Schedule B subject may have their choice of topics further restricted.

TRANSITION ARRANGEMENTS

A student who has passed some Part II subjects prior to 1969 and wishes to continue with Mathematics may proceed according to the pattern detailed on p.155 of the 1970 handbook for the Faculty of Arts, a copy of which is available in the Library.

PART III SUBJECTS

The Mathematics Department offers two Part III subjects, each comprising four topics. Students wishing to proceed to Honours in Mathematics only are required to take both these subjects. Students wishing to proceed to Combined Honours are required to take Mathematics IIIA together with the appropriate subject from Schedule B. Students proceeding to Honours will also be required to study additional topics as prescribed by the Heads of the Departments concerned. Subject to the transition arrangements below a pass in Mathematics IIA and Mathematics IIC is a pre-requisite for entry to Mathematics IIIA. Students taking Mathematics IIIB are required to study Mathematics IIIA as a pre-requisite or co-requisite. Certain combinations of the topics specified below, will comprise the Part III subjects offered by the Department; each topic consists of about 27 lectures and 13 tutorials. It is assumed that every student enrolling for a Part III Mathematics subject has studied the Part II topics B, C, D and K. Some Part III topics require additional Part II topics as pre-requisites as shown. Summaries of these topics, text books and reference books appear on page 84 of this handbook.

	Topic	Pre-requisite	Co-requisite
M	General tensors	—	—
N	Variational methods	—	—
O	Mathematical logic	—	—
P	Differential and integral equations	E	—
Q	Fluid dynamics	—	—
R	Probability and statistics	H	—
S	Geometry	—	—
T	Group theory	—	—
U	Topic in operations research	—	—
V	Measure theory and integration	A	—
W	Analysis of normed linear spaces	A	—
X	Rings and fields	—	—
Y	Topic in applied probability, e.g. information theory	H	—
Z	Numerical analysis	F	—

MATHEMATICS IIIA

A subject of four lectures and two tutorial hours per week for three terms. This subject comprises four topics which must include O, and either P, Q, R or U.

MATHEMATICS IIIB

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

NOTES

1. In order to pass both Mathematics IIIA and Mathematics IIIB, a student must study eight topics from M to Z above. Topic O, and either 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.

TRANSITION ARRANGEMENTS

A student who has passed Pure Mathematics IIA, Pure Mathematics IIB, Applied Mathematics IIA or Applied Mathematics IIB may with the permission of the Head of Department be admitted to Mathematics IIIA.

A student who has passed Pure Mathematics IIA or Pure Mathematics IIB and one other Part II mathematics subject may with the permission of the Head of Department be admitted to both Mathematics IIIA and Mathematics IIIB.

A student who has passed exactly one Part III subject prior to 1970 and wishes to obtain one more mathematics major must satisfy the following conditions.

1. He must have passed two Part II Mathematics subjects.
2. If he has passed Pure Mathematics IIIA or Pure Mathematics IIIB, he must study topic O, one of M, N, Q or R, and two other topics which must not include P or T.
3. If he has passed Applied Mathematics IIIA or Applied Mathematics IIIB, he must study topic O and three other topics which must not include topics M, N, Q, R, Y or Z.

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 chosen from any branch of Mathematics including Pure Mathematics, Applied Mathematics, Statistics and Computing Science as exemplified in the publication *Mathematical Reviews*. In any one year it is hoped that up to 20 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 1972 appear on page 92 of this handbook.

DESCRIPTION OF SUBJECTS

SCHEDULE B

PART I SUBJECT

CIVIL ENGINEERING IM

This subject consists of the following four topics.

CE111	Statics
ME131	Dynamics
CE231	Fluid Mechanics I or ME251 Fluid Mechanics
CE212	Mechanics of Solids I

PART II SUBJECT

CIVIL ENGINEERING IIM

This subject consists of the following three topics.

CE313A	Structural Analysis I
CE332	Fluid Mechanics II
ME301	Engineering Computations

PART III SUBJECTS

ECONOMICS IIIC

In order to pass Economics IIIC a student must study the topics Fluctuations and Growth, Econometrics I and one of the topics Public Economics or International Economics and offer them for examination.

CHEMICAL ENGINEERING IIIC

This subject consists of the following topics.

Stage Transfer Processes
Continuous Contacting Processes
Particulate Systems — Granular Materials
Particulate Systems — Fluid-solid Separations
Transport Theory II
Reaction Engineering I
Chemical Process Control

NOTE

Heat Transfer III may be studied as an alternative to Transport Theory II or to two other topics.

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
CE435A	Fluid Mechanics — Theoretical Hydrodynamics
CE435B	Fluid Mechanics — Open Channel Flow

COMMUNICATIONS AND AUTOMATIC CONTROL

This subject consists of the following four topics

EE341	Automatic Control
EE342	Automatic Control and Linear Systems Theory
EE443	Optimization Techniques
EE444	Communication Systems

In some circumstances and with the consent of the instructor concerned topic EE442 — Modern Control may be substituted for one of the topics listed above.

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

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.

SCHEDULE C

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 IIIC 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 — R. F. Berghout

Properties of the real numbers, sequences, series. Functions of a real variable, limits, continuity, differentiability, integrability. Taylor's series.

Text:

Calculus Vol. I 2nd Edition ..... T. Apostol
(Ginn Blaisdell, 1967)

Reference:

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

TOPIC. AL — ALGEBRA — W. Brisley

Introduction to algebraic concepts. Vector spaces: definitions and properties; matrices; linear equations. Complex numbers.

Text:

Calculus Vol. I 2nd Edition ..... T. Apostol
(Ginn Blaisdell, 1967)

References:

Linear Algebra ..... S. Lipschutz
(Schaum, 1968)

Linear Algebra ..... D. Zelinsky
(Academic Press, 1968)

Introduction to Algebra ..... S. Perlis
(Blaisdell, 1966)

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

Calculus and Linear Algebra ..... H. S. Wilf
(Harcourt Brace & World Inc., 1966)

TOPIC. CA — CALCULUS — M. J. Hayes

Vector geometry in three dimensions. Revision of differentiation and integration of polynomials and trigonometric functions. Differentiation of rational functions and of implicit and parametrically defined functions. Definition and properties of logarithmic, exponential and hyperbolic functions. Integration by parts and by substitution techniques. Integration of rational functions. First order separable, linear and homogeneous differential equations. Second order linear differential equations with constant coefficients. Conic sections and simple three-dimensional geometry of curves and surfaces. Partial differentiation. Tangency.

Text:

Calculus Vol. I 2nd Edition ..... T. Apostol
(Ginn Blaisdell, 1967)

References:

Calculus and Analytic Geometry ..... J. R. Britton, R. B. Kriegh & 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 — J. A. Lambert

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

Text:

No prescribed text.

References:

1900 Series Fortran (Technical Publication 4088) ..... International Computers Ltd.

Statistical Computations on a Digital Computer W. J. Hemmerle
(Blaisdell, 1967)

PART II TOPICS

TOPIC. A — ANALYSIS OF METRIC SPACES — M. J. Hayes

Real numbers as a complete ordered field, density of rationals. Metric spaces, continuity, uniform continuity. Compactness, connectedness, completeness. Applications to the differential and integral calculus of functions of one real variable. Uniform convergence, and application to differentiation, integration of sequences and series.

Text:

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

Reference:

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

TOPIC. B — COMPLEX ANALYSIS — T. K. Sheng

Complex numbers — polar, exponential forms. Sequences and series of complex numbers — convergence. Functions of a complex variable — limits, continuity. Derivatives, differentials and integrals. Analytic functions — Cauchy-Riemann equations. Cauchy integral theorem. Elementary analytic functions — polynomials — exponential, trigonometric and hyperbolic. Inverse functions — logarithmic function, inverse trigonometric, etc. Power series in positive powers. Multiply connected domains — Cauchy's theorem. Power series in positive and negative powers. Laurent's expansion. Singularities — isolated, essential. Zeros and Poles. Complex number ∞ & Residues — residue at ∞ — real integrals. Conformal mapping — one-to-one transformations.

Texts:

Complex variables ..... N. Levinson & R. M. Redheffer (Holden Day, 1970)

OR

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

TOPIC. C — CALCULUS AND VECTOR CALCULUS — R. F. Berghout

Surfaces. Functions of several variables. Partial derivatives. Tangent planes and normals. Extremum problems. Double integrals. Iterated integrals. Multiple integrals and transformations of them. Line and surface integrals. Green's theorem, Gauss' theorem and Stokes' theorem.

Text:

Calculus Vol. II 2nd Edition ..... T. Apostol (Ginn Blaisdell, 1969)

References:

Calculus and Linear Algebra Vol. II ... W. Kaplan & D. J. Lewis (Wiley, 1971)

Linear Algebra and Multivariate Calculus ..... G. F. Feeman & N. R. Grabois (McGraw-Hill, 1970)

Advanced Calculus ..... H. K. Nickerson, D. C. Spencer & N. E. Steenrod (Van Nostrand, 1959)

TOPIC. D — LINEAR ALGEBRA — T. K. Sheng

Linear spaces, subspaces, span sum of subspaces, linear dependence, basis, dimension. Inner product spaces, Cauchy-Schwarz inequality, orthogonality, orthonormal sets, Gram-Schmidt orthogonalisation, orthogonal complements. Linear mappings, kernel and image, invertible mappings, the linear space of linear mappings, the algebra of linear operators. Matrix representation of linear mappings, change of basis, equivalence, similarity, Hermite normal form. Unitary operators, change of orthonormal basis. Eigenvalues and eigenspaces, characteristic polynomial, algebraic and geometric multiplicity. Hermitian operators, diagonalisation of Hermitian matrices, quadratic forms, identification of quadric surfaces.

Text:

Linear Algebra ..... S. Lipschutz (Schaum, 1968)

References:

Linear Equations and Matrices ..... J. B. Johnstone, G. B. Price & F. S. Van Vleck (Addison-Wesley, 1966)

A Survey of Matrix Theory and Matrix Inequalities ..... M. Marcus & H. Minc (Allyn & Bacon, Boston, 1964)

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

Origin of differential equations. Solutions of differential equations (complete, particular, singular). Number of arbitrary constants. Special methods for first order equations. Linear homogeneous equations with constant coefficients. Systems of **n** homogeneous and non-homogeneous differential equations. Power series solutions of linear equations about ordinary points and about regular singular points (Frobenius' method). Bessel's equation. Legendre's equation. Euler's equations. Laplace transform and its application to the solution of ordinary differential equations. Boundary value problems.

Text:

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

TOPIC. F — NUMERICAL ANALYSIS AND COMPUTING — A. J. Guttmann

Sources of errors in computation and methods for estimation. Interpolation problems and the Lagrange interpolating polynomial. The finite difference calculus and applications to interpolation. Numerical differentiation and integration. Numerical solution of differential equations — Runge-Kutta and predictor-corrector methods. Introduction to Algol coding.

Texts:

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

International Computers Limited Algol Programming Manual.

Reference:

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

TOPIC. G — FOURIER SERIES, PARTIAL DIFFERENTIAL EQUATIONS AND SPECIAL FUNCTIONS — P. K. Smrz

Inner product spaces, Fourier series of a function relative to an orthonormal system, computation of cosine and sine series. Bessel's inequality and Parseval's relation. The convergence problems for Fourier series: the Riemann-Lebesgue lemma: Riemann's localisation theorem: solutions of pointwise and mean square convergence problems. Differentiation and integration of Fourier series, Gibb's phenomenon. Special functions: Gamma and Beta functions. The Bessel equation and Bessel functions. The Legendre equation and Legendre polynomials. Partial differential equations, classification, linear equations with constant coefficients, solution by separation of variables, discussion of solutions of equations appropriate to different circumstances.

Texts:

A First Course in Partial Differential Equations H. F. Weinberger
AND (Blaisdell, 1965)

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

Reference:

Advanced Calculus ..... W. Kaplan (Addison-Wesley, 1965)

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, independence, frequency function, distribution function, joint frequency function, moments and binomial variates. Tchebichev inequality and the weak law of large numbers. Elementary random variables, Poisson's theorem and the strong law of large numbers will be mentioned. Conditional probability; Bayes' theorem, tree diagrams. Continuous random variables, frequency function, expectation, joint frequency function, moments. Normal variates. Classification of experimental data, histograms, empirical moments, measures of location and scatter. Statistical inference, hypothesis testing, types of error, power function, sampling theory, maximum likelihood estimation; frequency functions of the mean ($\bar{X}$), difference of two means ($\bar{X}$-$\bar{Y}$), and the statistics χ^2, S^2, T and F with applications.

Text:

Introduction to Mathematical Statistics 3rd Ed. ..... 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 Chapter 12 ..... C. B. Allendoerfer & C. O. Oakley (McGraw-Hill, 1955)

An Introduction to Probability Theory and Its Applications Vol. I 3rd Ed. ..... 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. Loève (Van Nostrand, 1960)

TOPIC. I — TOPIC IN STATISTICS, 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:

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

References:

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.g. FINITE MATHEMATICS — W. D. Wallis

Introduction to enumeration: generating functions; linear difference equations. Graph theory: definitions; Euler paths; trees; planarity; colourability. Networks and flows. Linear programming: the simplex method. Block designs and configurations.

Text:

Introduction to Combinatorial Mathematics ..... C. L. Liu (McGraw-Hill, 1968)

References:

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

Finite Mathematics ..... G. Owen (Saunders, 1970)

An Introduction to Combinatorial Analysis ..... J. Riordan (Wiley, 1958)

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

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

Groups, definition and examples, permutations. Isomorphism, cyclic groups, Cayley's theorem, automorphism groups. Subgroups, cosets, Lagrange's theorem. Normal subgroups, quotient groups, isomorphism theorems, centre of a group and commutator subgroup. Direct products.

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: an Introduction ..... J. J. Rotman (Allyn & Bacon, 1966)

TOPIC. L — TOPIC IN PURE MATHEMATICS, e.g. DIFFERENTIAL GEOMETRY — I. L. Rose

Space curves — tangent, normal, binormal — curvature, torsion — Serret-Frenet formulae — involutes, evolutes — intrinsic equation. Surfaces — curves on a surface — metric — first fundamental form — geodesics — second fundamental form — principal curvatures — lines of curvature — developables — ruled surfaces — fundamental equations of surface theory — parallel surfaces — mappings.

Text:

Introduction to Differential Geometry ..... T. J. Willmore (Oxford Univ. Press, 1959)

Reference:

Differential Geometry ..... D. J. Struik (Addison-Wesley, 1961)

PART III TOPICS

TOPIC. M — GENERAL TENSORS — I. L. Rose

Reference systems — dual basis systems. Fundamental tensors and derivatives. Two-dimensional curved surface — Christoffel symbols, covariant differentiation — intrinsic differentiation. Special results — orthogonal curvilinear co-ordinates. Riemannian geometry — Riemann-Christoffel tensor. Curvature tensor — geodesics. Differential geometry — helix — surfaces — First Fundamental Form — Second Fundamental Form —curves on surface — principal directions. Codazzi and Gauss equations — total curvature.

Text:

Tensor Calculus ..... J. Abram
(Butterworths, 1965)

References:

Elements of Tensor Calculus ..... A. Lichnerowitz
(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

Introduction — statement and formulation of relevant problems. Euler-Lagrange equation special and degenerate case — geodesics — Brachistochrone — several dependent variables — parametric representation — undetermined end points — Isoperimetric problems — extensions — Fermat's principle. Dynamics of particles — generalised co-ordinates — Hamilton's principle — Lagrange equations of motion. Principle of least action. Several independent variables — vibrating string, Sturm-Liouville eigenvalue-eigenfunction problem — vibrating membrane.

Text:

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

References:

Methods of Applied Mathematics ..... F. B. Hildebrand
(Prentice-Hall, 1952)

Methods of Mathematical Physics Vol. I ..... R. Courant & D. Hilbert
(Interscience, 1953)

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

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. Certain of the following topics will be discussed briefly: axiomatic arithmetic and Gödel's theorem; geometry; set theory; modal calculi.

Text:

First Order Mathematical Logic ..... A. Margaris
(Blaisdell, Mass, 1967)

References:

An Introduction to Mathematical Logic ..... Gerson B. Robison
(Prentice-Hall, 1969)

Elements of Mathematical Logic ..... P. S. Novikov
(Addison-Wesley, 1963)

Mathematical Logic ..... S. C. Kleene
(Wiley, 1967)

Symbolic Logic ..... I. Copi
(Macmillan, 1967)

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 integral equations of the second kind by successive substitutions; 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, San. Fran., 1968)

AND

Linear Integral Equations ..... W. V. Lovitt
(N.Y., Dover, 1950)

TOPIC. Q — FLUID DYNAMICS — W. P. Wood

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. Axisymmetrical 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 convolutions of random variables, sampling distributions associated with the normal (Gaussian) distribution, point and interval estimation. A study will also be made of some aspects of statistical inference employing the Neyman-Pearson lemma, likelihood ratio tests, Bayesian prior distributions, and the likelihood function. Further items to be examined include regression and analysis of variance.

Text:

Probability Distributions and Statistics ..... Peter W. Zehna
(Allyn & Bacon, 1970)

OR

Introduction to Mathematical Statistics 3rd Ed. ..... R. V. Hogg & A. T. Craig
(Collier-Macmillan, 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 — I. L. Rose

Projective space — duality — projective line. Perspective pencils in a plane — projectivities. Cross ratios — invariance — projective property. Plane and space configurations — Desargue's two-triangle theorem — successive perspectivities. Harmonic sets — complete quadrangle and quadrilateral. Projectivities between superposed pencils — involutions. Point and Line Conics. Poles and polar lines. Theorems of Pascal and Brianchon. Pencils of points and lines on a conic — Harmonic sets. Axiomatic approach to projective geometry. Analytic projective geometry — homogeneous co-ordinates — conics and pencils of conics. If time permits: Affine geometry — parallel lines — length — midpoint — types of conics — Euclidean geometry — perpendicular lines — circles — bisectors of angles — foci and directrices of conics.

Text:

Projective Geometry ..... F. Ayres Jnr.
(Schaum, 1967)

References:

Projective and Euclidean Geometry ..... W. T. Fishback
(Wiley, 1962)

Plane Projective Geometry ..... E. A. Maxwell
(Cambridge Uni. Press, 1952)

TOPIC. T — GROUP THEORY — M. J. Hayes

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 Uni. Press, 1968)

OR

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

Reference:

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

TOPIC. U — TOPIC IN OPERATIONS RESEARCH — J. A. Lambert

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:

Operations Research — An Introduction ..... H. A. Taha
OR (Macmillan, 1971)
Introduction to Operations Research ..... F. S. Hillier & G. J. Lieberman (Holden-Day, 1967)

References:

Flows in Networks ..... L. Ford & D. Fulkerson (Princeton Uni. Press, 1962)
Combinatorial Theory ..... M. Hall Jr. (Blaisdell, 1967)
Methods and Models of Operations Research ..... A. Kaufmann (Prentice-Hall, 1963)
Introduction to Operations Research ..... C. W. Churchman, R. L. Ackoff & E. L. Arnoff (Wiley, 1957)
Mathematical Programming ..... S. Vajda (Addison-Wesley, 1961)
Applied Dynamic Programming ..... R. E. Bellman & S. E. Dreyfus (Princeton, 1962)
Games and Decisions ..... R. D. Luce & H. Raiffa (Wiley, 1957)
Integer Programming and Network Flows ..... T. C. Hu (Addison-Wesley, 1969)

TOPIC. V — MEASURE THEORY AND INTEGRATION — W. Ficker

Sets and classes of sets: rings, algebras, σ-rings, σ-algebras, monotone classes, generated rings and σ-rings. Measures and outer measures: measures on rings, outer measures, measurable sets, extension of measures, Lebesgue measure, Lebesgue-Stieltjes measure. Measurable functions, combinations of measurable functions, sequences of measurable functions, convergence of measurable functions. Integration, integrable simple functions, sequences of integrable simple functions, integrable functions, Lebesgue and Lebesgue-Stieltjes integral. If time permits, general set functions, Hahn and Jordan decompositions, absolute continuity and the Radon-Nikodym theorem.

Text:

The Elements of Integration ..... R. G. Bartle (N.Y., Wiley, 1966)

References:

Measure Theory ..... P. R. Halmos (Van Nostrand, 1950)
Measure Theory and Integration ..... S. K. Berberian (Macmillan, 1965)
A First Course in Integration ..... E. Asplund & L. Bungart (Holt, Rinehart & Winston, 1966)

TOPIC. W — ANALYSIS OF NORMED LINEAR SPACES — M. J. Hayes

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)
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 (Frederick Unger, N.Y., 1961)
Elements of the Theory of Functions and Functional Analysis Vol. I A. N. Kolmogorov & S. V. Fomin (Grayloch Press, Rochester, N.Y., 1957)

TOPIC. X — RINGS AND FIELDS — R. F. Berghout

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, separability of polynomials, finite fields, normality and splitting 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.

Note: This course will quote, without proof, several results proved in Topic T, Group Theory.

Text:

Topics in Algebra ..... I. N. Herstein (Blaisdell, N.Y., 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 (P. Noordhoff, Netherlands, 1962)

Oeuvres Mathématiques ..... E. Galois (Gauthiers-Villars, 1951)

TOPIC. Y — TOPIC IN APPLIED PROBABILITY; e.g., INFORMATION THEORY — W. P. Wood

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 (John Wiley, N.Y., 1965)

OR

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

References:

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

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

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

Science & Information Theory ..... L. Brillouin (Academic Press, 1962)

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

TOPIC. Z — NUMERICAL ANALYSIS AND COMPUTING — Jennifer Wallis

Finite-difference approximations to derivatives; Gauss' elimination method; iterative point methods — Jacobi and Gauss-Seidel; convergence, stability and systematic iterative methods. Method of characteristics; matrix inversion methods and linear algebra. Miscellaneous methods—numerical solution of polynomial equations. Fourier analysis. Random number generation.

Text:

International Computers Limited Algol Programming Manual.

References:

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

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

PART IV TOPICS

RING THEORY — R. F. Berghout

This course deals with rings which in some respect resemble fields, or are related to fields. Such rings include division rings, simple rings, matrices over division rings and primitive rings. The study of such rings involves the Jacobson-Wedderburn-Artin structure theory. Rings may also be related to fields via their rings of fractions, as the integers are related to the rationals. Such rings include, successively, integral domains, prime rings and semi-prime rings. These are studied under the Goldie theory. Considerable use will be made of modules and module-theoretic versions of the main structure theorems will be presented.

Pre-requisite:

Topic X.

Text:

Vorlesungen über artinsche Ringe ..... A. Kertész
OR (Akadémiai Kiadó, 1968)
Noncommutative Rings ..... I. N. Herstein (Wiley, 1968)

OR both the following
Fields and Rings ..... I. Kaplansky (Univ. of Chicago, 1969)
Topics in Ring Theory ..... I. N. Herstein (Univ. of Chicago, 1969)

References:

Rings, Modules and Algebras ..... I. T. Adamson (Oliver & Boyd, 1970)
The Theory of Rings ..... N. McCoy (Macmillan, 1965)
Rings & Radicals ..... N. Divinsky (Allen-Unwin, 1964)
Elementary Rings and Modules ..... I. T. Adamson (Oliver & Boyd, 1970)

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.

References:

Asymptotic Methods in Analysis 3rd Ed. ..... N. G. De Bruijn (North Holland, 1970)
Asymptotic Expansions ..... E. T. Copson (Cambridge Univ. Press, 1965)
Asymptotic Solutions of Differential Equations and Their Applications ..... C. Wilcox Ed. (Wiley N.Y., 1964)
Asymptotic Estimates and Entire Functions ..... M. A. Evgrafov (Gordon & Breach N.Y., 1961)
Asymptotic Methods in the Theory of Linear Differential Equations S. F. Feshchenko, N. I. Shkil', & L. D. Nikolenko (Elsevier N.Y., 1967)
Asymptotic Approximations ..... H. Jeffreys (Oxford Univ. Press, 1962)
Asymptotic Expansions ..... A. Erdélyi (Dover N.Y., 1956)
Asymptotic Expansions ..... H. A. Lauwerier (Mathematisch Centrum, Amsterdam, 1966)

DIFFERENCE SETS — W. D. Wallis or Jennifer 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 (Wiley, New York)
(Math. Association of America, 1963)
Cyclic Difference Sets ..... L. D. Baumert (Springer, 1971)

TOPOLOGICAL GROUPS — P. K. Smrz

Topological or continuous groups play a special role in the 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 Univ. Press, 1946)

Theory of Lie Groups Vol. I ..... C. Chevalley
(Princeton Univ. Press, 1946)

Lectures on Lie Groups ..... J. F. Adams
(W. A. Benjamin, 1969)

TOPICS IN FINITE MATHEMATICS — W. D. Wallis

A selection from the following topics: tournaments, zero-one matrices, difference sets, integer programming, factorization of graphs, finite geometries, group decision processes, binary codes, groups and graphs.

Text:

No prescribed text.

References:

Topics on Tournaments ..... J. W. Moon
(Holt-Rinehart-Winston, 1968)

An Introduction to Finite Projective Planes ..... A. A. Albert & R. Sandler
(Holt-Rinehart-Winston, 1968)

Combinatorial Mathematics ..... H. J. Ryser
(M.A.A., 1963)

Combinatorial Theory ..... M. Hall
(Blaisdell, 1967)

Theory of Finite and Infinite Graphs ..... D. König
(Chelsea, 1971)

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

Games and Decisions ..... R. D. Luce & H. Raiffa
(Wiley, 1957)

Integer Programming and Network Flows ..... T. C. Hu
(Addison-Wesley, 1969)

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

CATEGORICAL ALGEBRA — R. F. Berghout or W. Brisley

A course of some twenty-seven lectures introducting the notions of category, functor, limits, natural transformation. Examples will be drawn from Analysis and Algebra so it is advisable that students be familiar with the rudiments of Ring Theory and Group Theory. The course will study categories of modules and more generally, abelian categories, in some depth and also problems associated with adjunction. Depending on the background of the class, there may also be applications to Universal Algebra.

Texts:

Categories and Functors ..... B. Pareigis
(Academic Press, 1969)

An Introduction to Categorical Algebra ..... S. Dickson
(available from Maths. Dept.)

References:

Theory of Categories ..... B. Mitchell
(Academic Press, 1965)

Abelian Categories ..... P. Freyd
(Harper & Row, 1964)

Categories and Functors ..... I. Bucur & A. Deleanu
(Wiley, 1968)

Algebra ..... S. MacLane & G. Birkhoff
(Collier-Macmillan, 1967)

Homology ..... S. MacLane
(Springer, 1963)

Categorial Algebra ..... S. MacLane
(Bulletin of the American Math. Soc. 71(1965) pp.40-106)

Kategorien Vols. I and II ..... H. Schubert
(Springer, 1969)

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.)
(Dover, N.Y., 1954)

Introduction to Probability Theory and Its Applications (2 Vols.) ..... W. Feller
(Wiley N.Y., 1968, 1971)

References (Cont.):

Principles of Random Walk ..... F. Spitzer
(Van Nostrand N.Y., 1964)

PERTURBATION THEORY — I. L. Rose

Classical perturbation techniques — the fundamental technique — Lagrange expansion — linear differential equations — inhomogeneous linear equations — linear perturbation series — perturbation techniques — multi-dimensional considerations — Pioncaré-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.

Text:

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

References:

Journal sources listed throughout the textbook.

DISTRIBUTION THEORY — J. R. Giles

Schwartz distribution theory puts the generalised functions used in Engineering, Physics, etc., such as the Dirac δ— function, on a firm mathematical foundation. The course will cover the following subject matter: Motivation, locally integrable mappings; the test space, Schwartz distributions, distributions of slow growth; derivatives and primitives of distributions; support and order of distributions; convergence of distributions, the completeness theorem, application to Fourier series; convolution of distributions, properties; Fourier transforms of distributions of slow growth; Fourier series of periodic distributions.

Texts:

Schwartz Distributions ..... Hanna Neumann
(A.N.U., 1969)

Distribution Theory and Transform Analysis ..... A. H. Zemanian
(McGraw-Hill, 1965)

References:

Generalised Functions Vol. I ..... I. M. Gelfand & G. E. Shilov
(Academic Press, 1968)

Generalised Functions ..... D. S. Jones
(McGraw-Hill, 1966)

Distributions, Complex Variables and Fourier Transforms ..... H. Bremermann
(Addison-Wesley, 1965)

Operational Calculus and Generalised Functions ..... A. Erdélyi
(Holt, Rinehart & Winston, 1962)

Introduction to the Theory of Distributions ..... I. Halperin
(Uni. Toronto Press, 1952)

Théorie des Distributions ..... L. Schwartz
(Hermann et Cie, 1966)

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 coloured 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
(Pergamon Press, N.Y., 1960)

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

Signal Theory ..... L. E. Franks
(Prentice-Hall, N.J., 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, N.Y., 1965)

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

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

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

Signal Detection Theory ..... J. C. Hancock & P. A. Wintz
(McGraw-Hill, N.Y., 1966)

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

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

Selected Papers on Noise and Stochastic Processes N. Wax (Ed.)
(Dover, N.Y., 1954)

PROBABILITY THEORY — J. A. Lambert

This offers a treatment of probability theory based on measure theory. (Topic V). There is thus some repetition of subject headings with material in topics H and R.

Distribution functions, Lebesgue-Stieltjes measure, random variates, expectation, convergence, integral transforms, central limit theorem.

Pre-requisites:

Topics H, R and V.

Text:

A Course in Probability Theory ..... K. L. Chung
(Harcourt, Brace and World, 1968)

References:

An Introduction to Probability Theory and Its Applications (2 Vols.) ..... W. Feller
(Wiley N.Y., 1968, 1971)

Introduction to Measure and Probability ..... J. F. C. Kingman & S. J. Taylor
(Cambridge Univ. Press, 1966)

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 and filtering will also be studied.

Text:

No prescribed text.

References:

Stochastic Processes ..... J. L. Doob
(Wiley, N.Y., 1953)

Probability 3rd Ed. ..... M. Loeve
(Van Nostrand, Princeton, N.J., 1963)

Stochastic Processes ..... E. Parzen
(Holden-Day, San. Fran., 1962)

Theory of Stationary Random Functions ..... A. M. Yaglom
(Prentice Hall, Englewood Cliffs N.J., 1965)

Random Processes in Automatic Control ..... J. H. Laning & R. H. Battin
(McGraw-Hill, 1956)

Stochastic Processes ..... M. S. Bartlett
(Cambridge University Press, 1955)

References (Cont.):

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
(London Methuen, 1960)

An Introduction to Probability Theory and Its Applications Vols. I & II ..... W. Feller
(Wiley & Sons, 1957 & 1966)

Introduction to the Theory of Random Processes ..... I. I. Gikhman & A. V. Skorokhod
(W. B. Saunders Co., 1969)
(translated by Scripta-technica)

APPLIED PROBABILITY — J. A. Lambert

A study of some applications of probability theory: recurrent events and renewal theory; birth and death processes, branching processes, epidemics; random splittings.

Pre-requisites:

Topics H and R.

Text:

Introduction to Probability Theory and Its Applications (2 Vols.) ..... W. Feller
(Wiley N.Y., 1968, 1971)

References:

A Course in Probability Theory ..... K. L. Chung
(Harcourt, Brace & World, 1968)

The Theory of Branching Processes ..... T. E. Harris
(Springer-Verlag, 1963)

COMBINATORIAL CONFIGURATIONS — Jennifer Wallis

Block designs; elementary theorems, the Bruck-Ryser-Chowla theorem; applications. Difference sets; finite fields; Singer's theorem; the multiplier theorem; difference sets in general groups; some families of difference sets. Orthogonal latin squares and orthogonal arrays; constructions for these and the disproof of the Euler conjecture. Hadamard matrices; Paley's constructions and some more recent methods; applications. General constructions of block designs; Hanani's theorems, triple systems; block designs with $K > 3$. Theorems on completion and embedding; Connor's methods; rational completions; integral solutions.

Text:

No prescribed text.

References:

Addition Theorems. The Addition Theorems of Group Theory & Number Theory ..... H. B. Mann (Interscience, N.Y., 1965)

Combinatorial Identities ..... John Riordan (Wiley, 1968)

Patterns & Configurations in Finite Spaces ..... S. Vajda (Charles Griffin & Co., 1967)

The Mathematics of Experimental Design. Incomplete Block Designs & Latin Squares ..... S. Vajda (Charles Griffin & Co., 1967)

An Introduction to Combinatorial Analysis ..... John Riordan (Wiley, 1958)

Combinatorial Theory ..... M. Hall, Jnr. (Ginn Blaisdell, 1967)

Combinatorial Mathematics ..... H. J. Ryser (Wiley, N.Y., 1963)

A Survey of Matrix Theory and Matrix Inequalities ..... M. Marcus & H. Minc (Allyn & Bacon, Boston, 1964)

List of Prime Numbers from 1 to 10,006,721 D. H. Lehmer (Hafner Pub. Co., N.Y., 1956)

FLUID DYNAMICS — W. T. F. Lau

Introduction: basic equations; specifying equations; thermodynamic relations; the tangent gas approximation of Karman, Tsien and Chaplygin; derived equations; vortex theory of Helmholtz and Kelvin; compressible potential motions; hodograph representation. Theory of characteristics: general theory; two-dimensional flow theory. One-dimensional flow; unsteady flow of an ideal fluid; simple waves. Plane steady potential flow: hodograph method; simple waves.

Pre-requisite:

Topic Q.

Text:

Mathematical Theory of Compressible Fluid Flow .. R. V. Mises (Academic Press, 1958)

References:

High-Speed Aerodynamics (Compressible Flow) ..... E. Carafoli (Pergamon Press, 1957)

Supersonic Flow and Shock Waves ..... R. Courant & K. O. Friedrichs (Interscience, 1948)

References (Cont.):

Modern Developments in Fluid Dynamics; High Speed Flow 2 Vols. ..... L. Howarth (Ed.) (Oxford University Press, 1953)

Elements of Gasdynamics ..... H. W. Liepmann & A. Roshko (John Wiley, 1957)

Gas Dynamics (English version by G. Kuerti) .... K. Oswatitsch (Academic Press, 1957)

The Dynamics and Thermodynamics of Compressible Fluid Flow 2 Vols. ..... A. H. Shapiro (Ronald Press, 1953)

(Other references can be found in the text book).

UNIVERSAL ALGEBRA — W. Brisley

A course of approximately twenty-seven lectures to afford students entry into the topic, formalising the concepts of Ω-algebra, congruence, homomorphism, etc., in the general case, and presenting the appropriate theorems. As necessary, lattice-theory and set-theory will be investigated and Ω-word algebras and attendant general theorems will be proved. Applications will be made to derive results in groups and rings, and also to link results from separate algebraic topics.

Text:

To be decided.

References:

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

Algebra ..... Serge Lang (Addison-Wesley, 1965)

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* algebras. Numerical range of an element in a normed algebra; relation of the numerical range to the spectrum; B* algebras and symmetric, discussion of the Gelfand-Naimark representation theorem for B* 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 ..... G. Bachman & L. Narici (Academic Press, 1966)

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

General Theory of Banach Algebras ..... C. E. Rickart (Van Nostrand, 1960)

Numerical Ranges of Operators on Normed Spaces and Elements of Normed Algebras ..... F. F. Bonsall & J. Duncan (Camb. U. Press, 1970)

Normed Rings ..... M. A. Naimark (Noordhoff, 1959)

Commutative Normed Rings ..... I. M. Gelfand, D. A. Raikov & G. E. Shilov (Chelsea, 1964)

THEORY OF GROUPS — W. Brisley

A course on the modern results in the theory of groups, comprising about twenty-seven lectures on the topics: Nilpotent and Soluble groups; Free groups; Group Extensions; Varieties of Groups (as equationally defined classes and as constructively defined classes); unsolved problems in Group Theory.

Text:

To be decided.

References:

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) (Translated and edited by K. A. Hirsch)

GRAPH THEORY — W. D. Wallis

Basic definitions such as graph, subgraph, multigraph, connectivity, colouring. Cutpoints, bridges and blocks. Connectivity. Traversability. Factorization. Planarity, Kuratowski's theorem. Colouring: the four-colour conjecture and related theorems. Groups and graphs.

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)

VECTOR MEASURES — W. Ficker

This topic is an extension of topic V — Measure Theory and Integration. The set functions studied here are measures with values in vector spaces. The lectures will include problems concerning measures, extension of measures, measurable functions and integration.

Pre-requisite:

Topic V.

Text:

Vector Measures ..... N. Dinculeanu (Pergamon Press, 1967)

Reference:

Linear Operators Part I ..... N. Dunford & J. T. Schwartz (Interscience, 1958)

STOCHASTIC MODELS IN OPERATIONS RESEARCH — J. A. Lambert or W. D. Wallis

This topic will examine a number of stochastic models which are of relevance to operations research. Topic H will be a pre-requisite and previous study of topics R and U an advantage. The syllabus will be selected from the following areas; queucing theory, dams and storage, renewal theory, inventory, simulation, quality control.

Text:

No prescribed text.

References:

Renewal Theory ..... D. R. Cox (Methuen, 1962)

Some Aspects of Queueing and Storage Systems ..... A. Ghosal (Springer, 1970)

References (Cont.):

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

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

Operations Research: An Introduction ..... H. A. Taha (Collier-Macmillan, 1971)

MATHEMATICAL MODELS OF PHASE TRANSITIONS — A. J. Guttmann

Review of thermodynamics and statistical mechanics. Some rigorous results in statistical mechanics. Survey of critical phenomena and analogies. Classical theories of phase transitions. Exact solution of two-dimensional Ising model. Approximate results in three dimensions. Generation and analysis of exact series expansions. Anisotropic Heisenberg model and symmetry of ground state. Critical exponent inequalities and scaling laws. Asymptotic degeneracy as a mechanism of phase transitions. Kac models in one and two dimensions and connection with Onsager.

Text:

No prescribed text.

References:

Phase Transitions ..... R. H. Brout (Academic Press, 1965)

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

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

Phase Transitions and Critical Phenomena ..... C. Domb & M. S. Green (eds.) (Academic Press, 1971)

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)

NUMBER THEORY — T. K. Sheng

Congruences and residues, quadratic residues, integral polynomials, continued fractions, approximation by rationals, p-adic numbers, algebraic numbers, transcendental numbers, Liouville numbers, Roth theorem, arithmetical functions, order of magnitude of arithmetical functions, prime number theorem, distribution of rationals, Diophantine equations, Minkowski's theorem and simple applications.

Text:

An Introduction to the Theory of Numbers ..... G. H. Hardy & E. M. Wright (Oxford, 1965)

References:

Elementary Number Theory ..... Underwood Dudley (Freeman, 1969)

Introduction to Number Theory ..... T. Nagell (Uppsala, 1951)

An Introduction to the Theory of Numbers ..... Ivan Niven & H. S. Zuckermann (John Wiley, 1968)

Elements of Number Theory ..... I. M. Vinogradov (Dover Publications, 1954)

History of Theory of Numbers ..... L. E. Dickson (Carnegie Institution, Vol. I, 1919; Vol. II, 1920; Vol. III, 1923)

ANALYSIS OF TOPOLOGICAL SPACES — J. R. Giles

A topological space is the most general mathematical structure for study by the analyst. The course will cover the following subject matter.

Topological spaces, weaker and stronger topologies, bases and subbases, subspaces and relative topologies. Cluster points, closure. Continuous mappings, homeomorphisms. Countability. Convergence, nets. Product spaces and Quotient spaces. Separation axioms, Urysohn's lemma, the metrisation theorem. Compactness, sequential and countable compactness, local compactness; one-point-compactification; Tychonoff's theorem. Connectedness, local connectedness and arcwise connectedness. Homotopy, the fundamental group.

Text:

Introduction to General Topology ..... Helen F. Cullen (D. C. Heath & Co., 1968)

References:

General Topology ..... J. L. Kelley
(Van Nostrand, 1955)

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

General Topology ..... S. Lipschutz
(Schaum, 1965)

Introduction to General Topology ..... Sze-Tsen Hu
(Holden-Day, 1966)

COMMUTATIVE ALGEBRA — R. F. Berghout

The main subject of this course is the notion of a prime ideal in a commutative ring and generalizations thereof. The treatment will involve localization, chain conditions, modules, exact sequences, tensor products, platitude, and the like as well as some more classical material such as primary decomposition.

Pre-requisite:

Topic X.

Text:

Introduction to Commutative Algebra ..... M. F. Atiyah & I. G. MacDonald
(Addison-Wesley, 1969)

References:

Commutative Algebra Vols. I & II ..... O. Zariski & P. Samual
(Van Nostrand, 1960)

Commutative Rings ..... I. Kaplansky
(Allyn & Bacon, 1970)

A First Course in Rings and Ideals ..... D. M. Burton
(Addison-Wesley, 1970)

Commutative Algebra ..... J. T. Knight
(Cambridge Univ. Press, 1971)

SUMMARIES OF TOPICS, TEXT BOOKS AND REFERENCE BOOKS

SCHEDULE B

PART I TOPICS

CIVIL ENGINEERING IM

TOPIC, CE111 — STATICS — P. W. Kleeman

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

Text:

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

References:

Statics ..... J. L. Meriam
(Wiley, 1966)

Mechanics for Engineers:
Statics 2nd Ed. ..... F. P. Beer & E. R. Johnston
(McGraw-Hill, 1962)

TOPIC, ME131 — DYNAMICS — K. L. Hitz

A Study of Force and Motion.

The forces involved in motion; gravity, dry friction, viscous friction, rolling friction. The "free body" and control volume techniques. Internal and external forces and equilibrium.

Newton's laws of motion applied to point masses, rigid bodies and connected bodies moving in straight line or curved paths, or in simple rotation. Reference frames and relative motion; inertial frames, accelerating frames and rotating frames, Coriolis acceleration with illustrations.

Momentum and impulse, both linear and angular, related to point masses and rigid bodies.

Energy and the conservation principle applied to mechanical work, strain energy, kinetic energy, potential energy and friction "losses", in the context of point masses and rigid bodies.

Text:

Mechanics — Part II Dynamics ..... J. L. Meriam
(International Student Edn. John Wiley, 1959)

Reference:

Mechanics for Engineers:
Mechanics 2nd Ed. ..... F. P. Beer & E. R. Johnston
(McGraw-Hill, 1962)

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

TOPIC. ME251 — FLUID MECHANICS — A. K. Johnston

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

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

Text:

Fluid Mechanics 5th Ed. ..... V. L. Streeter (McGraw-Hill, 1971)

Reference:

Fluid Mechanics with Engineering Applications 6th Ed. ..... R. L. Daugherty & J. B. Franzini (McGraw-Hill, 1965)

TOPIC. CE212 — MECHANICS OF SOLIDS I — W. G. Field

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

Text:

Mechanics of Materials ..... F. R. Shanley (McGraw-Hill, 1967)

CIVIL ENGINEERING IIM

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

Analysis component of CE313, viz.

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

Text:

Elementary Structural Analysis ..... C. H. Norris & J. B. Wilbur (McGraw Hill, 1960)

References:

Hyperstatic Structures Vols. I & II ..... J. A. L. Matheson (Butterworths, 1912)

Structural Analysis ..... H. I. Laursen (McGraw-Hill, 1969)

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:

Fluid Mechanics 5th Ed. ..... V. L. Streeter (McGraw-Hill, 1971)

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

References:

Engineering Hydraulics ..... H. Rouse (Wiley, 1958)

Handbook of Fluid Dynamics ..... V. L. Streeter (McGraw-Hill, 1961)

Handbook of Applied Hydraulics 3rd Ed. ..... C. V. Davis & K. E. Sorenson (McGraw-Hill, 1969)

Applied Hydraulics in Engineering ..... H. M. Morris (Ronald Press, 1963)

Applied Hydrodynamics ..... H. R. Vallentine (Butterworths, 1959)

TOPIC. ME301 — ENGINEERING COMPUTATIONS — K. L. Hitz

Solutions of equations: sets of linear algebraic equations by elimination and iteration methods. Numerical integration and differentiation. Numerical solution of ordinary differential equations, initial value, boundary value and characteristic value problems. Solution of partial differential equations by finite difference methods. Introduction to linear programming, with engineering applications.

Text:

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

Reference:

Introduction to Numerical Analysis ..... F. B. Hildebrand (McGraw-Hill, 1956)

ECONOMICS IIIC

TOPIC. FLUCTUATIONS AND GROWTH — I. Fairbairn/I. Holmes

This topic analyses the problem of economic fluctuations and growth. The various tools and concepts employed in such analysis are first treated; and this is followed by an examination of the theories of Harrod, Hicks, Duesenberry, amongst others. Particular emphasis is given to the application of these theories to the problems of a growing economy. The topic ends with an examination of economic development in selected countries in the Pacific area, the Middle East and Europe.

References:

The Trade Cycle ..... R. C. O. Matthews (Nisbet, 1959)

A Contribution to the Theory of the Trade Cycle ..... J. R. Hicks (Clarendon Press, Oxford, 1950)

Business Cycles and Economic Growth ..... J. Duesenberry (McGraw-Hill, 1958)

A Neo-Classical Theory of Economic Growth ..... J. E. Meade (Allen and Unwin, 1961)

Economic Development ..... C. P. Kindleberger (McGraw-Hill, 1965)

Economics for Development ..... S. Enke (Prentice-Hall, 1963)

On the Theory and Measurement of Technological Change ..... M. Brown (Cambridge Univ. Press, 1966)

TOPIC. ECONOMETRICS I — R. McShane

A knowledge of matrix algebra, and of the mathematical statistics dealt with in Statistical Analysis I is recommended for students attempting this topic. This topic 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.

Texts:

Econometric Methods ..... J. Johnston (McGraw-Hill, 1953)

AND

Intermediate Economic Statistics ..... K. A. Fox (Wiley, 1968)

OR

Econometrics ..... R. J. Wonnacott & T. H. Wonnacott (Wiley, 1970)

References:

Econometric Theory ..... A. S. Goldberger (Wiley, 1966)

Regression and Econometric Methods ..... D. S. Huang (Wiley, 1970)

Statistical Methods of Econometrics ..... E. Malinvaud (North-Holland, 1966)

Linear Algebra ..... G. Hadley (Addison-Wesley, 1961)

Introduction to the Theory of Statistics 2nd Ed. ..... A. M. Mood & F. A. Graybill (McGraw-Hill, 1963)

AND ONE OF EITHER

TOPIC. PUBLIC ECONOMICS — W. Sheehan/J. Stanford

Public Economics is a study of government intervention in the economy through the budget. It is, therefore, concerned with taxes and with government expenditures. There is an analysis of the effects of various existing personal and business taxes in Australia on incentives to work, to consume, to save and to invest. There is also a discussion of other possible taxes, such as expenditure tax, a capital gains tax and a tax on value added.

The macro-economic aspects of the budget are examined. Topics covered include the relation of fiscal policy to other economic and social policies for growth and stability and applications of basic multiplier theory to budgetary measures. There is also a discussion of the problems of the national debt, of inter-governmental financial relationships and of the place of fiscal policy in socialist economies and in developing economies.

References:

Public Finance 2nd Ed. ..... O. Eckstein (Prentice-Hall, 1967)

Fiscal Policy in Australia ..... J. W. Nevile (Cheshire, 1970)

Public Finance ..... R. W. Houghton (ed.) (Penguin, 1970)

Public Enterprise ..... R. Turvey (ed.) (Penguin, 1968)

The Economic Theory of Fiscal Policy A. Peacock & G. K. Shaw (Allen & Unwin, 1971)

Public Spending ..... R. N. McKean (McGraw-Hill, 1968)

The Theory of Public Finance ..... R. A. Musgrave (McGraw-Hill, 1959)

Public Finance ..... C. S. Shoup (Weidenfeld & Nicolson, 1969)

Modern Public Finance ..... B. P. Herber (Irwin, 1970)

Public Economics ..... L. Johansen (North-Holland, 1965)

OR

TOPIC. INTERNATIONAL ECONOMICS

This topic begins with 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. This is followed by analysis of balance of payments problems and of various policies of adjustment, such as internal deflation, devaluation and direct controls. The topic 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. The final section reviews Australia's changing pattern of foreign trade and payments and assesses relevant economic policies.

References:

International Economics 4th Ed. ..... C. P. Kindleberger (Irwin, 1968)

International Economics ..... S. J. Wells (Allen & Unwin, 1969)

International Trade and the Australian Economy ..... R. H. Snape (Longmans, 1969)

Theoretical Issues in International Economics ..... M. O. Clement, R. L. Pfister & K. T. Rothwell (London Constable, 1967)

International Monetary Relations ..... D. A. Snider (Random House, 1966)

International Trade; Theory and Empirical Evidence ..... H. R. Heller (Prentice-Hall, 1968)

The International Economics of Development Theory and Policy ..... G. M. Meier (Harper International Editions, 1968)

CHEMICAL ENGINEERING IIIC

TOPIC. STAGE TRANSFER PROCESSES — B. D. Henry

Equilibrium stage processes for leaching absorption, extraction and distillation; stage efficiencies. Graphical methods of analysis; algebraic formulation for linear systems.

Texts:

Separation Processes ..... C. Judsonking (McGraw-Hill, 1971)

Mass Transfer Operations 2nd Ed. ..... R. E. Treybal (McGraw-Hill, 1968)

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

TOPIC. CONTINUOUS CONTACTING PROCESSES — K. L. Smith

Continuous contacting processes for leaching, absorption, extraction and distillation; transfer units, equivalent stages, hydraulic behaviour of columns. Integration with constant coefficients; graphical methods of analysis.

Texts:

Separation Processes ..... C. Judsonking (McGraw-Hill, 1971)

Mass Transfer Operations 2nd Ed. ..... R. E. Treybal (McGraw-Hill, 1968)

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

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 — B. W. Lancaster

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 — 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.

References:

Boundary Layer Theory ..... H. Schlichting (McGraw-Hill, 1955)

Heat Transmission ..... W. H. McAdams (McGraw-Hill, 1959)

Conduction of Heat in Solids ..... H. S. Carslaw & J. C. Jaeger (Cambridge Univ. Press, 1959)

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)

References:

Mass Transfer with Chemical Reaction ..... G. Astarita (Elsevier, 1967)

Principles of Chemical Equilibrium ..... K. Denbigh (Cambridge Univ. Press, 1961)

TOPIC. CHEMICAL PROCESS CONTROL — W. G. Kirchner

Relationship between measurement and control information display; plant response; types of controliers; transfer functions; analogue computer.

Text:

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

TOPIC. HEAT TRANSFER III — I. McC. Stewart

Fundamentals of radiant heat transfer. Integral equations, matrix and network solutions for multizone systems. Determination of exchange areas for gas radiation. Analysis of transfer in packed bed systems.

Text:

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

References:

Heat Transmission ..... W. H. McAdams (McGraw-Hill, 1959)

Conduction of Heat in Solids ..... H. S. Carslaw & J. C. Jaeger (Cambridge Univ. Press, 1959)

CIVIL ENGINEERING IIIM

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

Analysis component of CE414, viz.

Elastic analysis, instability of frames. Introduction to matrix analysis; plastic analysis.

Texts:

The Plastic Methods of Structural Analysis 2nd Ed. B. G. Neal (London, Science, 1965)

Introduction to Matrix Methods of Structural Analysis ..... H. C. Martin (McGraw-Hill, 1966)

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

References:

Plastic Analysis and Design Vol. I *Beams and Frames* ..... C. E. Massonet & M. A. Save

OR (Blaisdell, 1965)

Plastic Design of Steel Frames ..... L. A. Beedle (Wiley, 1958)

Matrix Methods of Structural Analysis ..... R. K. Livesley (Pergamon, 1964)

Plastic Design of Frames Vols. I & II ..... J. Heyman (Cambridge Univ. Press, 1971)

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, shear 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 non linear 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. CE435A — 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. CE435B — 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) — T. E. Fortmann and K. L. Hitz

A topic of lectures, tutorials and practical work.

Mathematical models of systems and components: linear differential equations, block diagrams, Laplace transforms, state-space formulation. Transient 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 AND LINEAR SYSTEMS THEORY (Second half year)—T. E. Fortmann and 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.

References:

As for EE341.

TOPIC. EE443 — OPTIMIZATION TECHNIQUES (First half year) — J. B. Moore

A topic 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). Masanao Aoki (Macmillan, N.Y., 1971)

Optimization Theory with Applications ..... D. Pierre (Wiley, 1969)

TOPIC. EE444 — COMMUNICATION SYSTEMS (Second half year) — B. D. O. Anderson

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. EE442 — MODERN CONTROL (Second half year) — J. B. Moore

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.

References:

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

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

MECHANICAL ENGINEERING IIIC

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

An introductory topic in linear control systems.

Mathematical models of systems and components; differential equations and transfer functions. Discussion of analog computers and their use in the solution of equations and simulations of systems. Simple systems of the first and second order. Analysis of steady state performance. System stability and transient response by algebraic, root-locus and frequency response methods. Introduction to compensation techniques.

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. Cupta & L. Hasdorff (Wiley, 1970)

TOPIC. ME401 — SYSTEMS ANALYSIS — A. J. Carmichael

An introduction to systems concepts. Mathematical modelling and some probability concepts. Deterministic and probabilistic models, stochastic models. Linear graph theory and networks. Problem formulation. An introduction to organization systems — production systems. Assemblies of quantifiable and non-quantifiable elements or branches. Sub-system analysis and optimization. Optimization of total system.

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. J. Carmichael or G. D. Butler

Goals and structure of systems. Concepts of optimization. Planning of systems — planning strategies. Mathematical modelling and system simulation. Organization of industrial and business systems. Control functions and control systems, feedback. Hierarchical control systems. Examples of inventory systems, production systems.

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 — A. J. Carmichael/A. K. Johnston/G. D. Butler

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 & Co., San. Fran., 1969)

TOPIC. ME404 — MATHEMATICAL PROGRAMMING — K. L. Hitz

Non-linear programming — calculus of variations, dynamic programming, principles of optimality, multidimensional processes, use of Lagrange multipliers, integer programming, successive approximation method, non-additive return functions, quadratic programming, geometric programming.

References:

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

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

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

Non-Linear and Dynamic Programming ..... G. Hadley (Addison-Wesley, 1964)

Foundations of Optimization ..... D. J. Wilde & C. S. Beighller (Prentice-Hall, 1967)

Mathematical Programming ..... C. McMillan (Wiley, 1970)

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

Plastic behaviour materials — idealizations.

Basic laws of plastic flow. Prandtl-Reuss stress versus strain relations for work-hardening materials. Hencky stress versus strain relations. Experimental confirmation of laws of plasticity.

Applications where there exists: (i) no elastic-plastic interface; (ii) an elastic-plastic interface.

Plane strain of perfectly plastic solids. Theory of slipline field. Rolling of strip metal. The wire drawing process. Interpretation of test data.

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 PHOTOMECHANICS — A. J. Carmichael or E. Betz

Concepts of bi-refringence. Polarized light-plane, circular and elliptical polarization. Fundamentals of photoelastic method — stress-optic law in two dimensions. Isochromatics, isoclinics, isopachics — fundamental equations for linear and non-linear model materials.

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. Dally & W. F. Riley (McGraw-Hill, 1965)

TOPIC. ME449 — RELIABILITY ANALYSIS FOR MECHANICAL SYSTEMS — A. J. Carmichael

Some important probability concepts. Fundamental concepts of the theory of reliability. Some quantitative aspects of reliability. Component reliability and reliability of assemblies of components, gradual and sudden failure. Matrix formulation of problems. Spectral method for calculation of reliability.

Basic concepts of systems. Reliability analysis of systems. Methods for improving the reliability of systems. Cost-Benefit analysis. Reliability Case Studies. Automobile suspension ignition system. Measuring system.

References:

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

Fundamentals for Reliability Theory ..... A. M. Polovko (Academic Press, 1968)

Engineering Reliability and Long Life Design ... R. P. Haviland (Van Nostrand, 1964)

TOPIC. ME487 — OPERATIONS RESEARCH — DETERMINISTIC MODELS — G. D. Butler

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:

Fundamentals of Operations Research ..... R. L. Ackoff & M. W. Sasieni (Wiley, 1968)

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

Principles of Operations Research ..... H. M. Wagner (Prentice-Hall, 1969)

Mathematical Programming ..... C. McMillan (Wiley, 1970)

Readings in Mathematical Programming ..... S. Vajda (Pitman, 1962)

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

Economic Decision Models ..... J. L. Riggs (McGraw-Hill, 1968)

Mathematical Techniques of Operational Research L. S. Goddard (McGraw-Hill, 1965)

Network Analysis for Planning & Scheduling ..... A. Battersby (Macmillan, 1964)

Mathematical Methods of Operations Research ..... T. L. Saaty (McGraw-Hill, 1959)

TOPIC. ME488 — OPERATIONS RESEARCH — PROBABILISTIC MODELS — G. D. Butler

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

References:

Elementary Decision Theory ..... H. Chernoff & L. E. Moses (Wiley, 1959)

Statistical Forecasting for Inventory Control ..... R. G. Brown (McGraw-Hill, 1959)

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

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

Production-Inventory Systems ..... E. S. Buffa (Wiley, 1968)

Queueing Theory ..... J. A. Panico (Prentice-Hall, 1969)

Elements of Queueing Theory ..... T. L. Saaty (McGraw-Hill, 1961)

Inventory Systems ..... E. Naddor (Wiley, 1966)

Queues, Inventories & Maintenance ..... P. M. Morse (Wiley, 1958)

The Art of Simulation ..... K. D. Tocher (English Universities Press, 1963)

Computer Simulation Techniques ..... T. H. Naylor, J. L. Balinty, D. J. Burdick & K. Chu (Wiley, 1966)

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:

Exercises in Industrial Management ..... S. Eilon, R. I. Hall, & J. R. King (Macmillan, 1966)

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

Casebooks in Production Management A. R. Dooley, W. K. Wolstein, J. L. McKenny, ... R. S. Rosenbloom, C. W. Skinner & P. H. Thurston (Wiley, 1968)

Case Analysis and Business Problem Solving ... K. E. Schnelle (McGraw-Hill, 1967)

Selected Case Problems in Industrial Management ..... P. E. Holden & F. K. Shallenberger (Prentice-Hall, 1962)

References (Cont.):

A Manager's Guide to Operational Research ..... B.H.P. Rivett & R. L. Ackoff (Wiley, 1963)

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

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 to atomic and nuclear systems.
5. **Statistical mechanics,** including principles and application.
6. **Electronics,** theory and applications.

References:

Electronic Devices and Circuits ..... J. Millman & C. Halkias (McGraw-Hill, 1967)

Pulse, Digital and Switching Waveforms ... J. Millman & H. Taub (McGraw-Hill, 1965)

Introduction to Solid State Physics 4th Ed. ..... C. Kittell (Wiley)

Fundamentals of Optics 3rd Ed. ... F. A. Jenkins & H. E. White (McGraw-Hill, 1957)

Classical Mechanics 2nd Ed. ..... J. W. Leech (Methuen, 1965)

Fundamentals of Modern Physics ..... R. M. Eisberg (Wiley, 1961)

Introduction to Modern Physics ..... F. K. Richtmeyer, E. H. Kennard & T. Lauritsen (McGraw-Hill, 1969)

Introductory Quantum Mechanics ..... V. B. Rojansky (Prentice-Hall, 1938)

Text book lists will be displayed on the Physics notice board towards the end of 1971 and lists will also be available from the Cashier. Students should retain all their Physics II texts.

PART III TOPICS

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
(Univ. 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/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 pages 92-106 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 Univ. Press, Cal., 1964)

Foundations of Science: The Philosophy of Theory and Experiment ..... N. R. Campbell
(Dover, N.Y., 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
(Aarhuus Stiftsbogtrykkerie A-S, Denmark, 1964)

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

A GUIDE TO STUDENTS ENROLLING IN THE FACULTY OF MATHEMATICS

1. Students received approval to enrol in the following non-mathematics subjects in 1971.

PART I	PART II
Accounting I	Chemistry II
Chemistry I	Economics IIA
Classical Civilisation I	Economics IIB
Economics I	English IIA
English I	Physics II
French I	Psychology IIA
Geography I	
Geology I	
Greek I	
History I	
Philosophy I	
Physics I	
Psychology I	
Sanskrit I	

2. Students transferring to the Faculty of Mathematics in 1971 were granted standing in the following non-mathematics subjects, completed while enrolled in other Faculties

PART I	PART II
Accounting I	Economics IIA
Chemistry I	Education IIA
Economics I	Geography IIA
Engineering I	History IIA
English I	Philosophy IIA
French I	Physics II
Geography I	Psychology IIA
Geology I	
German I	
History I	
Philosophy I	
Physics I	
Psychology I	

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 I — Students should study Microeconomics and Applied Economics.

   Economics IIA — Students should study Macroeconomics and Monetary Economics. 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 Engineering IM in his course.

4. Permission will normally be given for the inclusion in a student's course of subjects which are pre-requisites or co-requisites 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. (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.

5. (a) Before enrolling in a subject, a candidate shall have passed in any pre-requisite 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 co-requisite subject or subjects specified, in the Schedule of Subjects.

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

7. (a) A candidate may withdraw from a subject 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.

8. In order to qualify for the diploma, a candidate shall, in not less than two years of part-time, or one year of full-time study, pass ten subjects 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.

9. In order to provide for exceptional circumstances arising in particular cases, the Senate, on the recommendation of the Faculty Board, may relax any requirements.

SCHEDULE OF SUBJECTS FOR THE DIPLOMA IN COMPUTER SCIENCE

SUBJECT	Pre-requisite	Co-requisite
Group I — Core Subjects		
Coding, Programming & Algorithms A		
Coding, Programming & Algorithms B		
Computer Organization		CPA A
Numerical Analysis	Maths II Topic F*	CPA A
Commercial Programming		CPA A
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 pre-requisite may be relaxed with the consent of the Dean.

** It is intended that eventually subjects will be listed under Group II.

DIPLOMA IN COMPUTER SCIENCE

SUMMARIES OF SUBJECTS, TEXT BOOKS AND REFERENCE BOOKS

GROUP I — CORE SUBJECTS

CODING, PROGRAMING AND ALGORITHMS A

Boolean algebra, propositional logic, binary arithmetic. Representation of numbers and instructions. Flow charts. Description of machine code, assemblers, etc. Introduction to FORTRAN, COBOL, ALGOL and a conversational language. Use of higher level languages to solve problems both of a numeric and non-numeric nature. Programming techniques. Efficient programming, evaluation of expressions, sources of error. Programme development, diagnostics, testing, etc. Nature of algorithms and programme structure, procedures, subroutines, parameters, scope of variables. A detailed study of the structure of the algorithmic language ALGOL.

Texts:

Algol Programming Manual ..... International Computers Ltd.
Cobol Programming ..... J. Watters (Heinemann, 1970)
Fortran Programming ..... J. Watters (Heinemann, 1969)

Other texts to be decided.

References:

The Art of Computer Programming
Vol. I — *Fundamental Algorithms*
Vol. II — *Semi-numerical Algorithms* ..... Donald E. Knuth (Addison-Wesley, 1968, 1969)

CODING, PROGRAMMING AND ALGORITHMS B

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 coroutines, linkage, iteration and recursion. Compilation, interpretation, translation and simulation. Study and comparison of several languages, e.g., ALGOL, COBOL, FORTRAN, JEAN, PL/I, APL, SIMULA, LISP, etc.

Texts:

The Art of Computer Programming
Vol. I — *Fundamental Algorithms*
Vol. II — *Semi-numeric Algorithms* ..... Donald E. Knuth
(Addison-Wesley, 1968, 1969)

References:

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)

COMPUTER ORGANIZATION (EE563-564)

Representation of information: number systems, conversion, complement arithmetic, non-numeric data, logical operations. Hardware components: gate logic, registers and accumulators, adders, counters. Central processor structure: addressing modes, instruction set, traps and interrupts, machine-language programming. Peripheral equipment: core memory, bulk storage, input-output devices.

Assembly: symbolic and mnemonic information, instruction and variable formats, pseudo-operations, loops, subroutines, macros, and recursion.

Information structures: lists, tables, stacks, searching and sorting.

Assembler operation: multiple passes, symbol table, evaluation of expressions, relocation.

Other system software: loaders, interpreters, dumps, compilers, simulators.

Advanced topics: compiler design, monitors, batch processing, multi programming and time-sharing.

Text:

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

References:

Programming: An Introduction to Computer Languages and Techniques ..... W. D. Maurer
(Holden-Day, 1968)
Programming Languages Information Structures, and Machine Organization ..... P. Wegner
(McGraw-Hill, 1968)

PDP-11 Manual.

PLAN Reference Manual International Computers Ltd.

NUMERICAL ANALYSIS (Mathematics III, Topic Z)

Finite difference approximations to derivatives; Gauss' elimination method; iterative point methods — Jacobi and Gauss-Seidel; convergence, stability and systematic iterative methods. Method of characteristics; matrix inversion methods and linear algebra.

Miscellaneous methods — numerical solution of polynomial equations. Fourier analysis. Random number generation. Introduction to simulation.

Text:

Algol Programming Manual ..... International Computers Ltd.

References:

A First Course in Numerical Analysis ..... A. Ralston
(McGraw-Hill, 1965)
Elementary Numerical Analysis ..... S. D. Conté
(McGraw-Hill, 1965)

COMMERCIAL PROGRAMMING

Review of Cobol.
Flowcharts. Systems and programs.
File structures; creation, up dating, and processing of files.
Searching and sorting.
Data acquisition and validation; editing and vetting.
Indexing techniques.
Report and file processing generators.
Exception reporting.
Economics of data processing.
1/0 devices for E.D.P.
Analyses of some commercial applications.
Multiprogramming.

Texts:

Cobol Programming ..... J. Watters (Heinemann, 1970)

Other texts to be decided.

OFFERED BY DEPARTMENT OF MATHEMATICS

Details of these subjects will be found where indicated below.

Mathematical Logic — Mathematics III Topic O, see p. 85

Operations Research (Deterministic Models) — Mathematics III Topic U, see p. 88

Information Theory — Mathematics III Topic Y, see p. 90

Graph Theory — Mathematics IV, see p. 102

Stochastic Models in Operations Research — Mathematics IV, see p. 103

OFFERED BY DEPARTMENT OF ELECTRICAL ENGINEERING

COMPUTER-AIDED ANALYSIS OF POWER SYSTEMS (EE516)

Application of digital computers to the analysis of power systems, with emphasis on loss and fault calculations, and optimization.

Text:

Computer Methods in Power System Analysis ..... G. W. Stagg & A. H. El-Abiad (McGraw-Hill, 1968)

LOGICAL DESIGN AND SWITCHING THEORY (EE561)

A course of lectures, tutorial, and laboratory work.

Pulse and digital circuits, Boolean algebra, switching theory, design of computer hardware.

Pre-requisite:

EE421-423L or Physics III and consent of the Head of Department.

Text:

Digital Electronics for Scientists ... H. V. Malmstadt & C. G. Enke (Benjamin, N.Y., 1969)

References:

Digital Computer Fundamentals ..... T. C. Bartee (McGraw-Hill, 1960)

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

AUTOMATA AND COMPUTING MACHINES

(Not offered in 1972) (EE562)

This is a course of lectures and tutorial work giving an introduction to the theory of finite and infinite computation, and to logic machines.

Pre-requisite:

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)

PATTERN RECOGNITION (EE565)

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.

Pre-requisite:

Mathematics IIB

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, N.Y., 1962)

OPTIMIZATION TECHNIQUES (EE566)

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 (Macmillan, N.Y., 1971)

Optimization Theory with Applications ..... D. Pierre (Wiley, N.Y., 1969)

COMPUTER PROCESS CONTROL

(Not offered in 1972) (EE567)

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 ..... T. H. Lee, G. E. Adams & W. M. Gains (Wiley, 1968)

Computer Simulation for Engineers ..... R. E. Stephenson (Harcourt, Brace & Jovanovich, 1971)

GROUP II — ELECTIVES

OFFERED BY DEPARTMENT OF MECHANICAL ENGINEERING

Details of these subjects will be found where indicated below.

Operations Research — Deterministic Models — (ME 487), see p. 123
Operations Research — Probabilistic Models — (ME 488), see p. 123
Operations Research — Applications in Industry — (ME 489), see p. 124
Mathematical Programming — (ME 404), see p. 121

GROUP II — ELECTIVES

OFFERED BY DEPARTMENT OF COMMERCE

SYSTEMS ANALYSIS AND DESIGN

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; program development; testing of programs; program documentation.

Case studies will be used extensively throughout the course.

Text:

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

References:

Computer Usage/Applications ..... E. A. Weiss (McGraw-Hill, 1970)

Practical Systems Analysis ..... A. Chandor, J. Graham & R. Williams (Rupert, Hart & Davis, 1969)

Systems Analysis. A Diagnostic Approach ..... Van Court Hare (Harcourt, Brace & World, 1967)

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 p. 86
Asymptotic Methods in Analysis — Mathematics IV, see p. 92
Topics in Finite Mathematics — Mathematics IV, see p. 94
Random and Restricted Walks — Mathematics IV, see p. 95
Signal Detection — Mathematics IV, see p. 97
Stochastic Processes — Mathematics IV, see p. 98
Combinatorial Configurations — Mathematics IV, see p. 99
Applied Probability — Mathematics IV, see p. 99

OFFERED BY DEPARTMENT OF ELECTRICAL ENGINEERING

Details of the following will be found in the Engineering Faculty Handbook.

EE321-322-323L — Electronics
EE341-342 — Automatic Control
EE421-423L — Electronics
EE541-542 — Modern Control (EE541 is not offered in 1972)
EE544-545 — 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.

OFFERED BY DEPARTMENT OF PHYSICS

PHYSICS IIIA (ELECTRONICS)

A course comprising 20 lectures and 20 hours of laboratory work covering the following topics: review of the physics of semiconductors; P N junction and junction transistor operation and characteristics; transistor small signal parameters; amplifier design; transistor switching characteristics; pulse and logic circuits; operation of special semiconductor devices.

Pre-requisite:

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 an investigation or design, to take such examination and to perform such other work as may be prescribed by the Faculty Board. The candidate may submit also for examation any work he has published, whether or not such work is related to the thesis.
   (ii) The investigation or design 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 the research or design work 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 — 1972

ALGEBRA — Mr. R. F. Berghout is pursuing some topics in ring theory, making use of the theory of radicals, and is also engaged in the extension of this theory to additive categories.

Dr. W. Brisley is working on some problems occuring 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.

COMBINATORIAL THEORY AND OPERATIONS RESEARCH — Dr. Jennifer Wallis has been working on Hadamard matrices and other specialised matrices used by experimental research workers, electrical engineers and by scientists using artificial satellites.

Dr. W. D. Wallis is carrying out research in the classification of graphs by their automorphism groups and on graph factorization.

DIFFERENTIAL EQUATIONS — Dr. J. G. Couper has been working on the geometric theory of autonomous systems of ordinary differential equations.

ENVIRONMENTAL STUDIES — Professor H. M. Lieberstein is studying problems on the nature of the "steady-state demand-output-waste economy".

FLUID DYNAMICS — Dr. W. T. F. Lau is concerned with flow problems involving free boundaries.

Mr. E. V. Petersons is working on the theory of a hydrofoil in a finite depth.

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.

Dr. W. Ficker and Mr. C. J. Ashman are working in measure theory, particularly, in some problems on classes of null sets.

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.

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.

Mr. J. A. Lambert is carrying out studies in pattern recognition, principally those dealing with "learning without a teacher".

MATHEMATICAL PHYSIOLOGY — Professor H. M. Lieberstein is working on a mathematical model of electrically active cells and is investigating the advantages of the coiled cochlea in therian animals.

NUMBER THEORY — Dr. T. K. Sheng is investigating the distribution of rational points on the real line and its relation to Diophantine equations and approximation theory.

Dr. Jennifer Wallis is studying difference sets and their application in combinatorial theory and operations research.

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.

Mr. J. A. Lambert is studying applications of spline functions in estimation of statistical density functions.

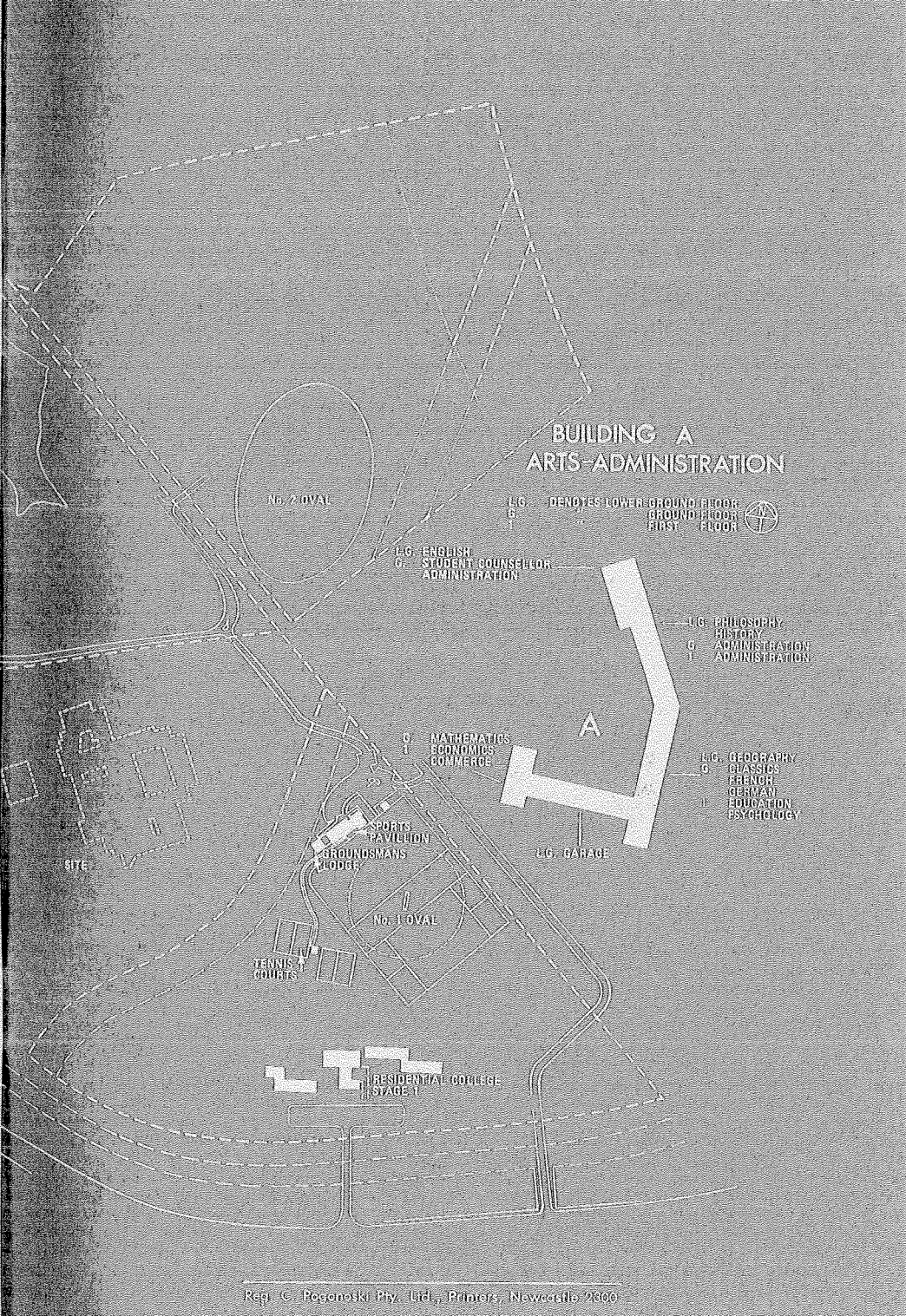
Professor H. M. Lieberstein is studying the use of sequences in the solution of stationary boundary-value problems to approximate the steady-state solution of time-dependent problems without specification of initial values.

Associate Professor I. L. Rose is investigating problems in numerical analysis and mathematical aspects of porous conduits.

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. W. P. Wood is investigating the dynamical behaviour of long chain modules in solution.

STATISTICS — Dr. W. D. Wallis is working on the theory and application of Room square designs.



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