FACULTY OF SCIENCE
HANDBOOK 1975

THE UNIVERSITY OF NEWCASTLE
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One Dollar
FOREWORD

In bidding you “welcome” to the Faculty of Science, I also wish you a mentally stimulating and socially enjoyable sojourn at the University.

The time spent as an undergraduate should be a period in which preparation for a future career is intertwined with the development of a sense of responsibility and concern for the world around us.

By wisely balancing study and social activities it is possible to achieve both academic success and the social characteristics required for your roles in the future.

The role of the academic staff is to stimulate your sense of critical evaluation, guide your reading, advance your knowledge, excite your interest and act as general mentors. Their aim is to help you to help yourself.

The purpose of this handbook is to provide you with information about the Faculty of Science in a convenient form. If you have questions not clearly answered by other contents of this book don’t hesitate to ask. Any member of the academic staff of the Faculty would be happy to advise you including, of course, the sub-dean and myself.

Your general development will be aided by adopting the University motto “LOOK AHEAD”. During your undergraduate period think beyond the narrow confines of individual subjects and courses; try to relate the knowledge you are accumulating with the problems that surround us.

Broaden your outlook by joining one or more of the social clubs or societies that exist on the campus, and if possible have a circle of friends drawn from other Faculties and other walks of life.

With a balanced programme of work and play, coupled with sustained effort, your period at the University should prove to be both rewarding and enjoyable.

J. A. KEATS
Dean
Faculty of Science
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Faculty of Science
The colour band on the spine of this Handbook is the lining colour of the hood worn by Bachelors of Science of this University

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FACULTY OF SCIENCE

The Faculty of Science comprises the Departments of Biological Sciences, Chemistry, Geology, Physics and Psychology. The Departments of Geography and Mathematics also offer major sequences of qualifying subjects for the degree of Bachelor of Science in the Faculty of Science.

The Faculty Board, Faculty of Science, consists of the Professors, Associate Professors, Readers, Senior Lecturers, Lecturers, Senior Tutors/Demonstrators and Tutor/Demonstrators of the Departments composing the Faculty together with the following representatives of the Departments offering services to or receiving services from the Faculty, as determined by Senate:

- six representatives of the Department of Geography;
- six representatives of the Department of Mathematics;
- two representatives of the Department of Metallurgy;
- two representatives of the Faculty of Engineering;
- two representatives of the Faculty of Arts, and
- four student members elected from the Faculty of Science.

The Role of the Faculty Board is defined by By-law 2.4.8

"Each Faculty Board shall:—

(a) supervise the teaching and research activities of the Faculty and determine such examinations as may be held within the Faculty;

(b) make recommendations to the Admissions Committee on applications for admission to the Faculty under By-law 5.3.3;

(c) authorise students' changes of courses and withdrawal from courses within the Faculty;

(d) deal with any matter referred to it by the Senate;

(e) make recommendations to the Senate on any matters affecting the Faculty; and

(f) exercise such other duties and powers as may from time to time be delegated to it by the Council".

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Faculty Secretary
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REQUIREMENTS FOR THE DEGREE OF BACHELOR OF SCIENCE IN THE FACULTY OF SCIENCE

GENERAL PROVISIONS

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

2. Grading of Degree
The Degree of Bachelor of Science may be conferred either as an ordinary degree or as an honours degree and may be undertaken by either full-time or part-time study.

3. Approval of Enrolment
(a) A candidate shall obtain the approval of the Dean or the Dean's nominee for his enrolment in any year and for any subsequent alteration in that enrolment.

(b) A candidate enrolling in the Faculty for the first time or a candidate wishing to enrol in more subjects than the number recommended for the normal programme, as set out in Clause 18, shall, when seeking the approval required in sub-clause (a) of this Clause, report in person to the Dean or the Sub-Dean.

4. Timetable Requirements
A candidate may not enrol in any year in any combination of subjects which is incompatible with the requirements of the timetable for that year.

5. Annual Examinations
The Annual Examinations shall be conducted by means of written examinations supplemented by such oral and practical tests 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. Examinations Grades
The results of successful candidates at Annual Examinations and Special Examinations, except for those enrolled in the final honours subjects, shall be classified:
Pass, Credit, Distinction, High Distinction
8. **Withdrawal**

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

(b) A candidate who withdraws from any subject after the sixth Monday in second term shall be deemed to have failed in that subject unless granted permission by the Dean to withdraw without penalty.

9. **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.

10. **Expected Work Load**

In the Faculty of Science students are expected to spend at least one hour in private study for every contact hour. For example, if a full-time student in the Faculty has 24 contact hours per week, he would be expected to spend a minimum of another 24 hours in private study.

**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 sub-clause (a) of this Clause and pass such examinations as the Faculty Board shall require.

12. **Subjects Offered**

(a) Qualifying subjects are listed in the Schedule of Subjects appended to these Requirements.

(b) A candidate may, with the permission of the Dean, count up to three subjects offered in other degree courses in the University as qualifying subjects, the status of any such subject in relation to the Parts set out in the Schedule of Subjects to be as determined by the Dean at the time when approval is granted.

13. **Degree Patterns**

To qualify for admission to the ordinary degree a candidate shall pass nine subjects, chosen in terms of Clause 12, provided that:

(i) (a) four subjects shall be chosen from Part I, three subjects from Part II, and two subjects from Part III.

(b) Notwithstanding the provision of sub-clause (i) (a) of this Clause, one subject from Part I may be substituted for a subject from Part II and one subject from Part II may be substituted for a subject from Part III;

(ii) the subjects passed shall include at least three of the following:

- Biology I, Chemistry I, Geography I, Geology I, Mathematics I, Physics IA or Physics IB, and Psychology I.

(iii) (a) only one of Physics IA and Physics IB may be counted.

(b) not more than four Mathematics subjects may be counted.*

14. **Prerequisites**

Before enrolling in a subject a candidate shall:

(i) if the subject concerned is either a Part II or a Part III subject have passed in the corresponding subject in either Part I or Part II respectively; and

(ii) have passed at the standard specified for any prerequisite subject prescribed in the Schedule of Subjects.

15. **Corequisites**

A candidate shall not be permitted to enrol in a subject for which a corequisite subject is prescribed in the Schedule of Subjects, unless he concurrently enrols in or has previously passed that subject.

16. **Preparatory Subjects**

Preparatory subjects are those which students are strongly advised to have completed before enrolling in the subject for which the preparatory subject is recommended.

A candidate enrolling in a subject for which a preparatory subject is prescribed in the Schedule of Subjects shall, before enrolling, consult with the Head of the Department offering the subject if he has not passed the Preparatory Subject.

17. In order to provide for exceptional circumstances arising in particular cases, the Dean, after consultation with the Heads of Departments concerned, may relax any requirement of Clauses 14, 15, 16.

18. **Progression**

(a) Progression in the course shall be by subject.

(b) A candidate shall be liable to exclusion from the course if he has not passed four subjects at the completion of two years full-time enrolment or four years part-time enrolment.

* Undergraduates who enrolled in the course prior to 1972 are exempt from this proviso.
Where a candidate has transferred from full-time to part-time enrolment, or vice-versa, two part-time years shall be taken as the equivalent of one full-time year for the purpose of this clause.

e) A candidate may not enrol in more than four subjects in any one academic year.

d) A candidate enrolling in four subjects in any one academic year shall not include a Part III subject nor more than two Part II subjects in the four in which he is enrolling.

e) A candidate enrolling in three subjects in any one academic year shall not include more than one Part III subject in the three in which he is enrolling.

(f) For the purpose of these Requirements the following shall be regarded as the normal programme:

**YEAR I**

Four Part I subjects

**YEAR II**

Three Part II subjects; or
Two Part II and one Part I subject

**YEAR III**

Two Part III subjects; or
One Part III and one Part II subject.

The Dean may, in individual cases relax restrictions (c), (d), (e) but only if he is satisfied that the academic merit of the candidate warrants such relaxation.

19. Standing

(a) A candidate may be given standing in qualifying subjects in recognition of work completed in another faculty or tertiary institution and be deemed to have passed in these subjects for the purpose of Clause 13. If the candidate is a graduate such standing shall be limited to a maximum of four subjects.

(b) Standing may be granted in subjects not offered in the University. Any such subject shall be regarded for the purpose of these Requirements as being a subject in the Part in the Schedule of Subjects as determined by the Dean at the time such standing is granted.

19. Standing

(a) A candidate may be given standing in qualifying subjects in recognition of work completed in another faculty or tertiary institution and be deemed to have passed in these subjects for the purpose of Clause 13. If the candidate is a graduate such standing shall be limited to a maximum of four subjects.

(b) Standing may be granted in subjects not offered in the University. Any such subject shall be regarded for the purpose of these Requirements as being a subject in the Part in the Schedule of Subjects as determined by the Dean at the time such standing is granted.

**HONOURS DEGREE**

20. A candidate seeking to complete an honours degree shall consult with the Head of the Department concerned before enrolling in Part II subjects. Such a candidate may be required to complete concurrently with the study prescribed for the ordinary degree such additional work as the Department may prescribe.

21. A candidate for the honours degree, before enrolling in the honours subject shall:

(i) have completed the requirements for admission to the ordinary degree;

(ii) have been granted approval to enrol in the honours subject from both the Head of the Department concerned and the Dean.

22. The honours subjects offered shall be:

- Biology IV
- Chemistry IV
- Geography IV
- Geology IV
- Mathematics IV *
- Physics IV
- Psychology IV

23. To qualify for admission to the honours degree a candidate, in addition to satisfying the other provisions of these Requirements, shall:

(i) complete the requirements of the honours subject in one year’s full-time study or two years’ part-time study; and

(ii) pass the honours subject.

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

25. In each department the candidate or candidates at the head of Honours Class I in any year may, if of sufficient distinction, be awarded a University Medal.

**COMBINED DEGREE COURSES**

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

(i) admission to a combined course shall normally be at the end of the first year and shall be subject to the approval of the Deans of the two Faculties concerned;

(ii) admission to combined courses will be restricted to students with an average of at least Credit level;

(iii) the Deans of both Faculties shall certify that the work in the combined degree course is no less in quantity and quality than if the two courses were taken separately;

* Please refer to the Notes to the Degree Requirements.
Science/Arts

A candidate who has enrolled in a combined course shall comply with all the provisions of the Requirements for the degree of Bachelor of Arts other than Clause 12 and with all the Requirements for the degree of Bachelor of Science other than Clauses 13(i) and 18, and shall qualify for admission to the ordinary degrees of Bachelor of Arts and Bachelor of Science by passing fourteen subjects chosen from the Schedules of Subjects approved for the two degrees, provided that:

(a) at least six subjects including at least one Part III subject, shall be chosen from Group I of the Schedule of Subjects approved for the degree of Bachelor of Arts;

(b) at least six subjects, including at least one Part III subject and one Part II subject in a different department, shall be chosen from the Schedule of Subjects approved for the degree of Bachelor of Science (the Part III subject elected must be from a department different from that providing the Part III subject mentioned in (a));

(c) the maximum total number of Arts Part I subjects and Science Part I subjects shall not exceed six.

Science/Mathematics

A candidate who has enrolled in such a combined course shall qualify for admission to the ordinary degrees of Bachelor of Science and Bachelor of Mathematics by passing fourteen subjects, five of which shall be Mathematics I, Mathematics IIA, Mathematics IIC, Mathematics IIIA and either Mathematics IIIB or a Part III subject chosen from Schedule B of the Schedule of Subjects approved for the degree of Bachelor of Mathematics, and the remainder of which shall be chosen from the other subjects listed in the Schedule of Subjects approved for the degree of Bachelor of Science provided that:

(a) the maximum total number of Mathematics Part I subjects and Science Part I subjects shall be six;

(b) the minimum total number of Mathematics Part III subjects and Science Part III subjects shall be three;

(c) a candidate counting Psychology IIIC may not count either Psychology IIIA or Psychology IIIB;

(d) a candidate counting Economics IIIC may not count either Economics IIIA or Economics IIIB.

Science/Engineering

A candidate who has enrolled in such a combined course shall complete all requirements for the Bachelor of Engineering in any specialisation and comply with the Requirements for the degree of Bachelor of Science, with the provision that Engineering I is recognised as a Science Part I subject and that a subject taken for the Science degree course may be accepted as Elective III for the Engineering degree course. Normally the requirements for the degree of Bachelor of Science shall be completed before the candidate enrols for the final year of the Engineering degree course.

EQUIVALENT HONOURS

27. (a) On the recommendation of a Head of Department in the Faculty and with the permission of the Dean, a graduate who, in the discipline concerned, has not completed the 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 the fourth year honours subject either as a full-time or a part-time student.

(b) Such a graduate who has completed all of the requirements of the fourth year honours subject shall be issued with a statement to this effect by the Secretary; the statement shall indicate the honours level equivalent to the standard achieved by the student in completing the fourth year honours subject.

SCHEDULE OF SUBJECTS

<table>
<thead>
<tr>
<th>Subject</th>
<th>Remarks, Prerequisites, Corequisites, Preparatory Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology I</td>
<td>Only one of these subjects may be taken.</td>
</tr>
<tr>
<td>Chemistry I</td>
<td></td>
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<tr>
<td>Geography I</td>
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<td>Geology I</td>
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<tr>
<td>Mathematics I</td>
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<tr>
<td>Physics IA</td>
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<td>Physics IB</td>
<td></td>
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<tr>
<td>Psychology I</td>
<td></td>
</tr>
<tr>
<td>Biology IIA</td>
<td>Preparatory subjects</td>
</tr>
<tr>
<td>Biology IIB</td>
<td>Mathematics I and either Physics IA or Physics IB.</td>
</tr>
<tr>
<td>Chemistry IIA</td>
<td>Prerequisite Physics IA or IB</td>
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<tr>
<td>Chemistry IIB</td>
<td></td>
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<tr>
<td>Electronics and Instrumentation II</td>
<td></td>
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<tr>
<td>Geography IIA</td>
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<td>Geography IIB</td>
<td></td>
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<tr>
<td>Geology IIA</td>
<td></td>
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<tr>
<td>Geology IIB</td>
<td></td>
</tr>
</tbody>
</table>
Subject

Mathematics IIA
Mathematics IIB
Mathematics IIC
Physics II

Psychology IIA
Psychology IIB

PART III

Biology IIIA
Biology IIB
Chemistry IIIA
Chemistry IIIB

Geography IIIA
Geography IIB
Geology IIIA

Geology IIIB

Mathematics IIIA
Mathematics IIIB*
Physics IIIA

Physics IIIB
Psychology IIIA
Psychology IIIB

* Note Clause 13 (iii) (b)

Remarks, Prerequisites, Corequisites, Preparatory Subjects

Corequisite Mathematics IIA
Prerequisite
Mathematics I, Physics I or normally a credit pass or better in Physics IIB.

Prerequisite Mathematics I
Corequisite Chemistry IIIA
Remarks
Before enrolling in Chemistry IIIB, the student must obtain the approval of the Head of the Department of Chemistry or his representative.

Preparatory Subjects

Chemistry I and either Physics I or Physics II
Corequisite Geology IIIA

Preparatory Subject Mathematics I
Corequisite Chemistry IIIA

Prerequisites
Mathematics IIA and Mathematics IIC
Corequisite Mathematics IIIA

Prerequisites
Mathematics IIA or Mathematics IIB or Mathematics IIC — the topics C, E, G and H are desirable. It is possible to achieve this combination with either Mathematics IIB alone, or Mathematics IIA with Mathematics IIC.

Corequisite Physics IIIA

Corequisite Psychology IIIA

2. In the first two years of enrolment as a full-time student or the first four years of enrolment as a part-time student — to pass at least four subjects.

Where there is a change in classification of a student from full-time to part-time or vice versa, his part-time years will be taken as the equivalent of one full-time year.

COMBINED DEGREE COURSES

Sample programmes for students wishing to enrol for a combined degree course under Section 26 of the Requirements for the degree of Bachelor Science are:

B.Sc./B.A.

Normally the joint degree programme would be pursued as in either (a) or (b):

(a)

Year I Four Science Part I subjects passed with an average performance of credit level or higher.

Year II Three Science Part II subjects and an additional subject which will be an Arts Group I Part I subject if no Arts Group I subject has been passed.

Year III At least one Science Part III subject and two other subjects including an Arts Group I Part II subject if no Arts Group I Part II subject has so far been passed. At the end of Year III students must have passed at least three Arts Group I subjects.

Year IV One subject which is an Arts Group I Part III subject if this requirement has not already been met (and is from a department different from that of the Science Part III subject) and two other subjects to complete the Requirements for the degree of Bachelor of Arts.

(b)

Year I Four Arts Part I subjects passed with an average performance of credit level or higher.

Year II Three Arts Part II subjects and an additional subject which will be a Part I subject chosen from the B.Sc. Schedule if no subject included in that Schedule has been passed.

Year III At least one Arts Part III subject and two other subjects including a Science Part II subject if no Science Part II subject has so far been passed. By the end of this year at least three subjects from the B.Sc. Schedule of Subjects must be passed.

Year IV One subject, which is a Science Part III subject if this requirement has not already been met (and is from a department different from that providing the Arts Part III subject), and two other subjects to complete the Requirements for the degree of Bachelor of Science.

PROGRESS REQUIREMENTS FOR STUDENTS IN THE FACULTY OF SCIENCE

Students enrolled in the Faculty of Science are required to meet the following standards to maintain satisfactory progress.

1. In the first year of enrolment as a full-time student or in the first two years of enrolment as a part-time student — to pass at least one subject.
B.Sc./B.Math

Normally the joint degree programme would be pursued as follows:

Year I Mathematics I and three Part I subjects passed with an average performance of credit level or higher.

Year II three Group II subjects including Mathematics IIA and Mathematics IIC, and another Part I subject.

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

Year IV either Mathematics IIIB or a schedule B subject from the requirements for B.Math, plus two other subjects which will complete the requirements for the Science degree.

B.Sc./B.E.

For sample programmes see relevant sections of the Handbook for the Faculty of Engineering.

REQUIREMENTS FOR THE DIPLOMA IN PSYCHOLOGY

1. There shall be a Diploma in Psychology.

2. The courses of the Diploma shall be supervised by a Board of Studies consisting of the Dean of the Faculty of Science (ex officio) (Chairman), the Head of the Department of Psychology (Deputy Chairman), Professors, Associate Professors, Readers, Senior Lecturers and Lecturers of the Department of Psychology and any other persons appointed by Senate on the recommendation of the Faculty Board, Faculty of Science, which shall seek the advice of the Board of Studies. Any person so appointed shall hold office for a period of two years and shall be eligible for reappointment.

3. To be eligible for registration as a candidate for the Diploma an applicant shall
   (i) have satisfied all of the requirements for a degree with honours in Psychology of the University of Newcastle or another university approved for this purpose by the Faculty Board, Faculty of Science; or
   (ii) hold such other qualifications as may be approved for this purpose by the Faculty Board on the recommendation of the Board of Studies. Approved qualifications must include satisfaction of requirements for a degree with a major in Psychology.

An applicant wishing to register under paragraph (ii) shall be required to carry out such work and pass such examinations at fourth year level as the Faculty Board may determine before registration as a candidate is confirmed.

The Board of Studies shall be responsible for the selection of candidates and shall take into account academic qualifications, experience, and the report of interviews conducted by a selection committee appointed by the Board.

4. (a) Candidates for the Diploma in Psychology, over a period of two or more years of part-time attendance, shall attend lectures and complete such practical work as is required by the Board of Studies.

   (b) Candidates must elect to specialise in one of the following areas:
      (i) Clinical Psychology
      (ii) Educational Psychology
      (iii) Industrial Psychology, or
      (iv) Any other area of Psychology approved from time to time by the Faculty of Science on the recommendation of the Board of Studies.

REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE

1. An application to register as a candidate for the degree of Master of Science 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 Science 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 Science 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 examinations and to perform such other work as may be prescribed by the Faculty Board. The candidate may submit also for examination any work he has published, whether or not such work is related to the thesis.

(ii) The 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.

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.

* 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.

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GUIDE TO SUBJECT ENTRIES

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

1. (a) Prerequisites are subjects which must be passed before a candidate enrols in a particular subject.

   (b) Where a subject is marked Advisory it refers to a pass in the Higher School Certificate. In such cases lectures will be given on the assumption that a pass has been achieved at the level indicated.

   (c) Preparatory subjects are those which candidates are strongly advised to have completed before enrolling in the subject for which the preparatory subject is recommended.

2. Corequisites refer to subjects or topics which the candidate must either pass before enrolling in the particular subject or be taking concurrently.

3. Texts are books recommended for purchase.

4. References are books relevant to the subject or topic which need not be purchased.

DEPARTMENT OF BIOLOGICAL SCIENCES

711100 Biology I

Prerequisites Nil, but a series of 10 lectures in background chemistry will be offered in the last two weeks of February for those students enrolling in Biology I who have done little chemistry. Attendance at the lectures is optional.

Hours Three lecture hours and three hours of tutorial and laboratory classes per week. A two-day excursion.

Examination One three-hour paper

Content

Cells and Cell Constituents Proteins, carbohydrates, lipids, mitosis. Organisation of cells as tissues.

Fundamental Chemical Reactions Photosynthesis. Respiration (aerobic and anaerobic). Chemosynthesis. Production of ATP.

Continuity of Life

Immunology
Antigens and antibodies. Blood groups.

Chemical Basis of Heredity
Evolution and Ecology
Diversity of Organisms

Human Biology
Population control.
The practical classes will present exercises relevant to these topics.

Preliminary Reading
White, E. H. *Chemical Background for the Biological Sciences* (2nd ed. New York, Prentice-Hall)

Texts
Keeton, W. J. *Biological Science* (2nd ed. New York, Norton & Co.)

References
Holloway, B. W. *Genes and Chromosomes in Action* (Thomas Nelson 1969)
Moroney, M. J. *Facts from Figures* (Middlesex Penguin)
Srb, A. M., Owen, R. D. & Edgar, R. S. *General Genetics* (2nd ed Freeman)

712100 Biology IIA
Prerequisites Biology I
Hours Three lecture hours and six hours tutorial and laboratory classes per week
Examination 2 three-hour papers

Content
Biochemistry

Cell Biology
Cellular organization and inter-relationships. Organelles, their structure and function. Cellular processes.
### 712200  Biology IIB

**Prerequisites**  
Biology I

**Hours**  
Three lecture hours and six hours tutorial and laboratory classes per week

**Examination**  
2 three-hour papers

**Content**

- **Comparative Morphology of Animals and Plants**  
Structural comparisons of organisms from the major phyla. Phylogenetic development of particular structures in terms of their functional capacities to solve environmental problems.

- **Ecology**  
Physical and biological factors influencing the abundance and distribution of organisms. Determination and measurement of these factors.

- **Statistics**  

The practical classes will present exercises relevant to these fields. Tutorials will deal with biological topics of interest, and provide practice in statistical evaluation of biological data.

**Texts**

- Bailey, N. T. J.  
*Statistical Methods in Biology* (English Universities Press)

- Bell, P. & Woodcock, C.  
*The Diversity of Green Plants* (2nd ed. Edward Arnold 1971)

- Buchsbaum, R.  
*Animals Without Backbones* (2nd ed. The University of Chicago Press)

- Krebs, C. J.  
*Ecology* (Harper & Row 1973)

- Russell-Hunter, W. D.  
*Biology of Lower Invertebrates Vols. 1 & 2* (Collier Macmillan)

- Sutcliffe, J.  
*Plants and Water* (Edward Arnold 1968)

- Torrey, T. W.  

**References**

- Andrewartha, H. G.  
*Introduction to the Study of Animal Populations* (2nd ed Chapman & Hall)

- Barnes, R. D.  
*Invertebrate Zoology* (2nd ed. Saunders)

- Chapman, W. B. J.  
*Natural Ecosystems* (Macmillan)

- Darnell, R. M.  
*Organism and Environment* (Freeman)

- Doyle, W. T.  
*The Biology of Higher Cryptogams* (Macmillan 1970)

- Kershaw, K. A.  
*Quantitative and Dynamic Plant Ecology* (2nd ed. Edward Arnold)

- Weechert, C.  

### 713100  Biology IIIA

**Prerequisites**  
Biology IIA

**Hours**  
Four lecture hours and eight hours tutorial and laboratory classes per week

**Examination**  
2 three-hour papers

**Content**

- **Developmental Biology**  
Embryology, genetic control.

- **Animal and Plant Physiology**  
General principles of physiology with comparisons between different organisms. Emphasis laid on molecular and cellular physiology.

- **Immunology**  
Molecular and cellular aspects.

- **Microbiology**  
Additional texts and references may be recommended at the beginning of the course.

**Texts**

- Ebert, J. D.  
*Interacting Systems in Development* (New York, Prentice-Hall 1965)

- Gordon, B. L.  
*Essentials of Immunology* (2nd ed. Philadelphia, Davis 1974)

- Hamburgh, M.  
*Theories of Differentiation* (London, Arnold 1971)

- Hill, T. A.  
*Endogenous Plant Growth Substances* (London, Arnold 1973)

- Torrey, J. G.  
*Development in Flowering Plants* (New York, Macmillan 1967)

**References**

- Balinsky, B. I.  

- Bellanti, J. A.  
*Immunology* (Philadelphia, Saunders 1971)

- Harper, H. A.  

- Stanier, R. Y., Doudoroff, M. & Adelberg, E. A.  

- Tyndale-Biscoe, H.  
*Life of Marsupials* (London, Arnold 1973)

- Wareing, P. F. & Phillips, I. D. J.  
*The Control of Growth and Differentiation in Plants* (Oxford, Pergamon 1970)

- Wilkins, M. B.  
713200  Biology III B  

**Prerequisites**  
Biology II

**Hours**  
Four lecture hours and eight hours tutorial and laboratory classes per week

**Examination**  
2 three-hour papers

**Content**  

**Population Genetics**  

**Animal and Plant Breeding**  
Genetics of quantitative characters, Heritability. Breeding systems.

**Evolution**  

**Community Analysis**  
Structure and dynamics of biological communities.

**Environmental Physiology**  
Functional adaptations (homeostatic and developmental) of organisms to their environments.

**Texts**  
Falconer, D. S.  
*Introduction to Quantitative Genetics*  
( Oliver & Boyd)

Kershaw, K. A.  
*Quantitative and Dynamic Plant Ecology*  
( 2nd ed. Edward Arnold)

Mettler, L. E., Gregg, T. G.  
Population Genetics and Evolution  
(Prentice-Hall 1969)

Milthorpe, F. L. & Moorby, J.  
*An Introduction to Crop Physiology*  
(Cambridge University Press 1974)

**References**  
Briggs, D. & Walters, S. M.  
*Plant Variation and Evolution*  
(University Library 1969)

Ford, E. B.  
*Ecological Genetics*  
(Methuen)

Phillipson, J.  
*Ecological Energetics*  
(Edward Arnold 1966)

Additional texts and references may be recommended at the beginning of the course.

714100  Biology IV  

**Prerequisite**  
Nil

**Hours**  
As required by the Head of the Department

**Examination**  
As required by the Head of the Department

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721100  Chemistry I  

**Prerequisites**  
Nil

**Hours**  
About three lecture hours and three hours of tutorial and laboratory classes per week.

**Examination**  
Three three-hour papers, one held in mid-year

**Content**  

**Inorganic Chemistry**  
(30 lectures)  
The periodic properties of the elements and their compounds; chemistry of selected elements from some Groups of the Periodic Table.

**Organic Chemistry**  
(30 lectures)  
The chemistry of carbon and its compounds; hydrocarbons; chemistry of compounds containing oxygen, nitrogen and halogens as functional groups; reaction mechanisms; molecules containing two or more functional groups; separation and purification of compounds.

**Physical Chemistry**  
(30 lectures)  
The mole concept; atomic and molecular structure; binding and energy; chemical equilibria and energetics; chemical kinetics.

**Texts**  
Aylward, G. H. & Findlay, T. J. V.  
*S.I. Chemical Data*  
(2nd ed. Sydney, Wiley & Sons Australasia 1974)

Benfey, O. T.  
*The Names and Structures of Organic Compounds*  
(New York, Wiley & Sons 1966)

Hart, H. & Scheutz, R. D.  
*Organic Chemistry*  

Kneen, W. R.,  
*Chemistry — Facts, Patterns and Principles*  
(London, Addison-Wesley 1971)

Rogers, M. J. W. & Simpson, P.  
*Chemistry- Facts, Patterns and Principles*  
(London, Addison-Wesley 1971)

1 An alternative text for the organic section of the course.
722200 Chemistry IIA
Prerequisite Chemistry I
Preparatory Subjects Mathematics I and either Physics IA or IB
Hours About three lecture hours and six hours of tutorial and laboratory classes per week
Examination Two three-hour papers
Content
Analytical Chemistry
Basic principles; spectroscopic procedures; separation methods.
Co-ordination Chemistry
Types of complexes; structure elucidation; transition metal chemistry.
Dynamics
Kinetics; chemical affinity; electrochemical cells.
Organic Chemistry
Aliphatic and aromatic compounds; condensation reactions; reaction mechanisms.
Quantum Chemistry
Schrödinger's equation; methods of approximation; applications to spectroscopy and bonding theories.
Thermodynamics
Basic laws.

Texts
Barrett, J.
Geissman, T. A.
Moore, W. J.
Pecsok, R. L. & Shields, L. D.
OR
Pickering, W. F.
Shoemaker, D. P. & Garland, C. W.

722300 Chemistry IIB
Prerequisites Chemistry I
Corequisites Chemistry IIA (advisory)
Hours Three lecture-hours and six laboratory-hours per week comprising eight units of which the student must attempt six. Each unit is of equal length — approximately ten lectures, four tutorials and twenty-eight hours of laboratory or other support activities.
Examination Each unit will be examined separately (by one hour examination) and the annual examination grading will be obtained by combination of the individual unit marks.
Content Each student programme must be approved by the Head of the Department.
The units offered may vary from year to year and the topics available include: electronic instrumentation for chemists; problem solving; evaluation of chemical pollution; analysis in organic systems; radiochemistry; chemistry in industrial processes; science, conflict and society; chemistry of colloids; polymers; ionic transport in solution; non-aqueous chemistry; chemistry of S, P and B compounds; symmetry and chemistry.

Texts
Range of texts required will vary with the options selected. Consult lecturers concerned and Departmental lists.

723100 Chemistry IIIA
Prerequisites Chemistry IIA & Mathematics I
Hours About four lecture hours and eight hours of tutorial and laboratory classes per week
Examination Not less than two three-hour papers

Students intending to proceed to Chemistry IIIA are advised to purchase a copy of either:
OR
Content
The units offered may vary from year to year, but will be drawn from the following topics:—

Analytical Chemistry
Selected modern techniques.

Heterogeneous Equilibria
Phase rule, sedimentation processes, ion exchange.

Ionics and Electrodes
General principles.

Inorganic Chemistry
Recent chemistry of metals and non-metals.

Molecular Spectroscopy
Transitions, vibrational spectra, potential functions, etc.

Organic Chemistry
1. Heterocyclic compounds.
2. Amino acids, proteins, carbohydrates and nucleic acids.
3. Reaction mechanisms.

Organometallic Chemistry
Transition metal complexes incorporating a metal-carbon bond.

Structure Elucidation
Interpretation of IR, NMR and Mass Spectra; X-ray studies; ESR, ORD, etc.

Solid State Chemistry
Crystal structures, non-stoichiometric and cluster compounds, etc.

Surface Chemistry
Sorption, statistical thermodynamics.

Texts


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Physical Chemistry (4th ed. Prentice-Hall 1972)
Modern Methods of Chemical Analysis (New York, Wiley & Sons 1968)
Modern Analytical Chemistry (New York, Dekker 1971)

723200 Chemistry IIIB

Prerequisite Chemistry IIA
Corequisite Chemistry IIIA
Hours Three lecture hours and nine laboratory hours per week
Examination Each unit will be examined separately (by one hour examination or by assignment) and the annual examination result will be obtained by combination of the individual unit marks.

Content
Each student programme must be approved by the Head of the Department.
The units offered will vary from year to year and the topics available include:

Applied Spectroscopy; Applied Thermodynamics; Aromaticity; Advanced Co-ordination Chemistry; Bio-Inorganic Chemistry; Organic Compounds of Biological Interest; Biogenesis; Homogeneous Catalysis by Transition Metal Compounds; Heterogeneous Equilibria; Introductory Electrodes, Lasers and Laser Raman Spectroscopy; Modern Analytical Chemistry; Polymer Chemistry; Radio Chemistry; Reaction Mechanisms; Surface Chemistry; Theoretical Chemistry; Crystal Chemistry.

Texts
Range of texts required will vary with the options selected. Consult lecturers concerned and Departmental lists.
724100 Chemistry IV

Prerequisites Completion of ordinary degree requirements and permission of Head of Department.

Hours As required by the Head of the Department

Examination To be arranged

Content
A subject extending over one full-time academic year or its equivalent comprising three parts:
(i) A minimum of 40 hours of lectures and tutorials, and a course of directed reading;
(ii) A supervised research project, the results of which are to be embodied in a thesis;
(iii) Two seminars, one on the subject of the research project and the other on a literature survey.

The lecture and tutorial course will be assessed progressively, whereas the directed reading course will be examined early in third term with two papers each of three hours duration. An oral examination on the thesis will be given in November.

The assessment of the class of Honours will be based upon the formal work in Chemistry IV; the research project and thesis; and the previous undergraduate record. These three areas of assessment shall be equally weighted.

Texts
Consult lecturers concerned and Departmental lists.

DEPARTMENT OF GEOLOGY

731100 Geology I

Prerequisite Nil

Hours Three lecture-hours and 2½ laboratory hours per week. Two days field work.

Examination Two three-hour papers, class assignments and practical examinations.

Content
Material Geology
Introductory crystallography; mineralogy and petrology; classification of rocks; economic mineral deposits.

Physical Geology
Erosion cycle; agents of erosion; diastrophism; structural geology; geomorphology.

732200 Geology IIA

Prerequisite Geology I

Hours Three lecture-hours and four laboratory hours per week. Eight days field work.

Examination Two three-hour papers, class assignments and practical examinations.

Content
Mineralogy
Crystallography; chemistry and physics of minerals; genesis of minerals.

Petrology
Rock forming minerals; nature of and crystallization from a magma; chemical equilibrium studies; petrology of igneous rock associations; petrography and classification of igneous rocks.

Stratigraphy and Palaeontology
Stratigraphy of Australia; invertebrate palaeontology.

Structural Geology and Geotectonics
Nomenclature and origin of diastrophic and non-diastrophic structures.

Texts
Bishop
Brown, Campbell & Crook
EITHER
Black
OR
Moore, Lalicker & Fischer
Deer, Howle & Zussman

Historical Geology
Introductory palaeontology and stratigraphy; brief geological history of New South Wales.

Texts
EITHER
Rutley's Mineralogy
OR
Mason & Berry
Mineralogy
(for students intending to proceed beyond Geology I)
Geology Today (CRM Book)
The Elements of Palaeontology

Black

An Outline of Crystal Morphology
The Geological Evolution of Australia and New Zealand
The Elements of Palaeontology
Invertebrate Fossils
An Introduction to the Rock Forming Minerals
Hatch, Wells & Wells  *Petrology of the Igneous Rocks* (12th ed.)

Kottlowski  *Measuring Stratigraphic Sections*

**732300 Geology IIIB**

**Prerequisite** Geology I

**Hours** Four lecture-hours and three laboratory hours per week. Eight days field work.

**Examination** Two three hour papers, class assignments and tests.

**Content**
The subject comprises six units of which the students must select four. Students must note that it may not be possible to offer all six units each year. The selection of units by students must be approved by the Head of Department. No unit is offered for an enrolment of less than 3 in that unit. Each unit is of equal length — approximately 28 lectures and 21 laboratory hours. The units comprise the following topics:

(i) **Regional Geology**
The tectonic framework and geological history of continents, extra-terrestrial geology.

(ii) **Marine Geology**
Tectonic framework of ocean basins; sea floor topographic features and zones; sedimentary environments in relation to sediment types; techniques of marine investigation; economic application and implications.

(iii) **Environmental Geology**
Positive and negative geological factors in pollution; degassing of Earth; toxicity of geological materials; importance of trace metals; metal scavengers of sedimentation; bacterial oxygen demand; supply and demand of geological materials in rural and urban expansion; litho-hydro and atmospheric balances; disposal of atomic wastes.

(iv) **Palaecobotany and Palaeoecology**
Brief survey of fossil plants; introduction to palynology; ancient plant and animal communities.

(v) **Quaternary Geology** (including Man and other Vertebrates)
Geological events related to man's appearance and distribution on Earth and his relation to other vertebrates.

(vi) **Physico-chemical Principles Applied to Geology**
Problems of degrees of freedom in geological environments; equilibrium constants in geological systems; the laws of thermodynamics applied to geology.

Units ii and iv will be given during the first half of 1975. Students will do both. Units i, iii and vi will be given during the second half, hence students will be expected to select *two* from these.

**Texts**
Text books required will vary with the options selected. Consult lecturers concerned.

**733100 Geology IIIA**

**Prerequisites** Geology I & Geology II A

**Preparatory Subjects** Chemistry I and either Physics IA or IB

**Hours** Five lecture hours and six laboratory hours per week. Four days field work.

**Examination** Two three hour papers, class assignments and practical examinations.

**Content**
- **Petrology** (21 lectures, 42 laboratory hours)
  Petrology of igneous rock associations; petrogenesis of metamorphic rocks, metamorphic belts and plate tectonics.

- **Sedimentology** (21 lectures, 42 laboratory hours)
  Petrogenesis of sedimentary rocks.

- **Economic Geology** (21 lectures, 21 laboratory hours)
  Principles of formation of economic mineral deposits; textures of ore minerals; major Australian ore deposits; ore mineralogy.

- **Structural Geology and Geotectonics** (21 lectures, 42 laboratory hours)
  Advanced structural geology and detailed geotectonics; structural aspects of geosynclinal concept; orogenies; continental drift; global tectonics.

- **Photogrammetry and Photogeology** (21 laboratory hours)
  Basic principles of photogrammetry and photogeological interpretation; aerial photographs and their use in cartography and in stratigraphic and structural studies.

- **Theoretical and Evolutionary Palaeontology** (21 lectures)
  Principles of taxonomy, quantitative methods; palaeoecology; species concepts, genetics, evolution; selected evolutionary patterns from the palaeontological record.

- **Geochronology and World Stratigraphy** (14 lectures)
  Principles of age dating; regional geology of selected provinces of the world.

- **Exploration Geophysics** (28 lectures)
  Geophysical techniques — their interpretation and application in petroleum and mining exploration, and hydrogeological and engineering investigations.
Deer, Howie & Zussman  
Mason & Berry  
Miyashiro  
Park & McDiamid  
Ragan  
Raup & Stanley  
Spencer

**Texts**

*An Introduction to the Rock Forming Minerals*

*Mineralogy*

*Metamorphism and Metamorphic Belts*

*Ore Deposits* (2nd ed.)

*Structural Geology*

*Principles of Palaeontology*

*Introduction to the Structure of the Earth*

**Geology IIIIB**

**Prerequisites**

Geology I & IIA

**Corequisite**

Geology IIIA

**Hours**

Four lecture-hours and four laboratory hours per week. Twelve days field work.

**Examination**

Two three-hour papers, class assignments and practical examinations.

**Content**

This subject comprises eight units of which students must select four. Students must note that it may not be possible to offer all eight units each year. No unit is offered for an enrolment of less than 2 in that unit. The selection of units by students must be approved by the Head of Department. Each unit is of equal length—approximately 28 lectures and 28 laboratory hours. The units comprise the following topics:

(i) **Mineralogical and Geochemical Techniques**

X-ray diffraction and fluorescence, differential thermal and thermogravimetric analysis, atomic absorption, infra-red and optical spectroscopy, the electron microscope and microprobe, differential staining and advanced mineral separation methods and techniques; survey geochemistry and chromatography.

(ii) **Material Sources of Energy**

Origin, distribution, classification and economic potential of uranium, petroleum and gas, and coal.

(iii) **Structural Analysis and Rock Mechanics**

Petrofabric analysis, symmetry concepts; movement picture and movement plan; stress-strain relationship. Analysis of stress and strain; theory of elasticity; stress distribution; statistical analysis and experimental design; instrumentation; mechanical properties and behaviour of rocks; photoelasticity; rock model studies; design and stability of structures in rock.

(iv) **Sedimentology**

Lithologic associations in relation to the depositional facies of their environment of formation with emphasis on the genetic connection between the geological setting of a depositional area and its sedimentary fill (basin analysis).

(v) **Engineering and Mining Geology**

Geological problems in engineering design and construction; subsurface water; engineering control of sedimentation; fieldwork, drilling and analysis of exploration data; development of economic deposits; problems associated with mining in different geological environments.

(vi) **Economic and Exploration Geology**

Ore microscopy; paragenesis and stability of ore minerals; ore-forming fluids; sulphur, lead and oxygen isotopes in ore mineral genesis; geochemistry of ore deposits; dispersion of metals; geochemical prospecting.

(vii) **Petrographic Techniques and Advanced Igneous and Metamorphic Petrology**

Interpretation and representation of chemical analysis of minerals and rocks, micrometric analysis; petrology of selected igneous rock associations; interpretation of metamorphic textures; using metallurgical concepts; application of thermodynamic data to metamorphic minerals and reactions.

(viii) **Stratigraphic Palaeontology and Micropalaeontology**

An introduction to the main micro-fossil groups; a synthesis of the major zonal development of fossils in Australian stratigraphy and the correlation of these zones with overseas type sections.

Units i, iii and vii will be given during the first half of 1975 and units iv, v, vi and vii during the second half, hence students will be expected to select two from the units in each part of the year.

**Texts**

Text books required will vary with the options selected. Consult lecturers concerned.

**Geology IV**

**Prerequisites**

Geology IIIA, completion of ordinary degree requirements and permission of the Head of Department.

**Hours**

As required by the Head of the Department

**Examination**

(i) performance in one three-hour paper

(ii) a viva voce examination

(iii) research work carried out and its presentation in a thesis
such other work, e.g. seminars, assignments, earlier academic record, which may be considered relevant.

Content
Part A
Lecture-tutorial work with directed reading in two of the following fields of geology: mineralogy and crystallography; igneous petrology; metamorphic petrology; coal petrology; sedimentology; stratigraphy; palaeontology; structural geology; economic geology.

Part B
A research project, the results of which are to be embodied in a thesis.

DEPARTMENT OF PHYSICS

741200 Physics IA
Prerequisite Science 2F (Advisory)
Hours Three lecture-hours and three hours of laboratory and tutorial work per week.

Examination Three two-hour papers. Each paper will examine the work covered in one term and will be held shortly after the end of that term. There will also be a one-hour written examination on the year's practical work.

Content
A subject for students who may wish to proceed to Physics II, for students in the Faculty of Applied Science, and for all students in the Faculty of Engineering except Chemical Engineering. (Some students in Chemical Engineering may be advised to take Physics IB). The subject is presented as a rigorous, mathematically based discipline with emphasis on the unifying principles which link together different areas of the subject. Lectures will cover mechanics, wave motion, electromagnetism, thermal physics, geometrical optics, physical optics, and quantum physics. The treatment throughout will assume some knowledge of calculus.

Texts
Gray, Williams & Brownstein Student Study Guide
Resnick & Halliday Physics (Combined Edition)

741300 Physics IB
Prerequisite Science 2S (Advisory)

Hours Three lecture-hours and three hours laboratory or demonstrations and practice period per week.

Examination Three two-hour papers. Each paper will examine the work covered in one term and will be held shortly after the end of that term. Also one hour written examination on the year's practical work.

Content
A subject for students who in general do not intend to proceed with further studies in Physics. (A credit pass or better in Physics IB will normally be required for entry to Physics II). The treatment will require a minimum of mathematics and will involve an experimental approach throughout. The coverage of the subject will be somewhat broader than in Physics IA.

Texts
Bueche, F. Principles of Physics (2nd ed.)
Bueche, F. Study Guide to accompany Principles of Physics

742200 Electronics & Instrumentation II
Prerequisites Physics IA or IB
Hours Three lecture-hours, four laboratory-hours, two tutorial-hours and directed assignments each week.

Examination One two-hour paper on each of the three topics selected.

Content
Topic A — Basic Theory of Techniques
Instrumentation Practice;
Specialist Instrumentation.

Topic B — Instrumentation Theory

Topic C — Electrical Measurement Principles;
Digital and Linear Integrated Circuits;
Instrumentation Systems.

Topic D — Basic Device Physics;
Measurement Devices.

Students taking Physics II (either previously or concurrently) will be examined in Topics B, C and D. They must also attend the lectures on Instrumentation Practice in Topic A as part of the directed assignments requirements.

Students who have not taken Physics II will be examined in Topics A, C and D.
742100  **Physics II**

**Prerequisites**
Mathematics I, Physics IA or normally a credit pass or better in Physics IB.

**Hours**
Three lecture-hours and six laboratory-hours per week.

**Examination**
Three two-hour papers. One of these papers is given at the commencement of Third term.

**Content**
Mechanics
Thermal Physics
Quantum Physics
Electromagnetics
Physical Optics

Physics II students should include at least one Group II Mathematics subject, incorporating for preference Topics C, E, G and H in their course. (It is possible to achieve this combination with either Mathematics IIB alone, or Mathematics IIA and IIC.)

**Texts**
Baird, D. C.  *Experimentation* (Prentice-Hall)
Smith, F. G. & Thompson, J. H.  *Optics* (Wiley 1971)

Any further texts will be listed in the Physics Department by late in 1974.

743100  **Physics IIIA**

**Prerequisites**
Physics II, Mathematics IIA or IIB or IIC with Topics C, E, G and H or B or D recommended.

**Hours**
Four lecture-hours and eight laboratory-hours per week.

**Examination**
Assessment will be by written papers and special assignments to the equivalent of three three-hour papers, and on laboratory and regular assignment work.

**Content**
Physics IIIA deals primarily with the more basic and fundamental aspects of Physics treated at third year level and covers the areas of classical and quantum physics which are essential to the understanding of both advanced pure physics and also the many applications of physics.

The course can be broadly summarized under the headings of Classical Physics and Modern or Quantum Physics. A sub-section, electronics, treats electron device physics and the use of these devices in electronic circuit design.

**Classical Physics**
Mathematical methods, advanced mechanics, special theory of relativity, electromagnetics including waveguide and antenna theory.

**Modern Physics**
Quantum mechanics, atomic and molecular physics, statistical physics, solid state physics, nuclear physics, electronics.

**Laboratory**
The laboratory course is intended to parallel the lecture course in overall content, having at least one experiment available in each topic listed above, although students are not expected to carry out all the experiments available.

**Texts**
Reif, F.  *Fundamentals of Statistical and Thermal Physics* (McGraw-Hill)
Resnick, R.  *Introduction to Special Relativity* (Wiley)

Some further texts will be specified by the Physics Department and the list displayed in the Department in late 1974. Students should retain their Physics II texts.

743200  **Physics IIIB**

**Prerequisite**
Physics II

**Corequisite**
Physics IIIA
Hours  90 lectures, 180 hours laboratory and two
Mathematics topics.
Examination  Two 21-hour papers and assignment work
during the year. The mathematics topics will
be examined by the Faculty of Mathematics.

Content
The subject emphasizes the experimental and applied aspects of
Physics. The Department considers it desirable that some mathematical
studies should be continued through this level, so two mathematics
topics are included in Physics IIIB, to be selected in consultation with
the Physics Department.
The Physics lecture course will treat the following topics:
Experimental techniques
Photometry and Instrumental Optics
Nuclear Measurements
Radio-frequency Spectroscopy
Electronics
Geophysics
Statistical Mechanics
Solid State Physics
Physics of Fluids

Texts
Larmore, L.  Introduction to Photographic Principles
(Dover)
Millman, F. & Halkias, C.  Integrated Electronics (McGraw-Hill)
Reif, F.  Fundamentals of Statistical and Thermal
Physics (McGraw-Hill)
Stacey, F. D.  Physics of the Earth (Wiley)

Any further texts required will be listed in the Physics Department
late in 1974.

744100  Physics IV
Prerequisite  Physics IIIA
Hours  As required by the Head of the Department.
Examination  Assessment of the lecture and reading course
will be based on assignment work and written
examinations to the equivalent of three three-
hour papers. Final grading will also include
evaluation of the research project, and the
examiners may also require a brief oral examin-
ation.

Content
Physics IV is intended to give students an advanced understanding
of the fundamental theories of modern physics appropriate for an
Honours graduate in the discipline, as well as an exposure to the
current research interests of the Physics staff, which are mostly in
experimental atomic physics, geophysics, and applied physics. Students
also carry out a research project to develop their research skills.
The lecture and reading course covers topics classified below under
several major headings. Students have some degree of choice for
examination purposes. Not all topics may be offered in a given year,
and others may be added, depending on student interest and staff
availability. The Head of the Department must approve the final
programme of study.

Atomic Physics — Associate Professor Ramsey & Mr Roberts
Solid state physics and physics of surfaces.

Quantum Mechanics — Mr Balfe
Advanced quantum mechanics, nuclear and particle physics.

Relativity and Electromagnetism — Dr McGovern
Special relativity theory (tensor analysis developed as required and
not prerequisite), advanced electromagnetic theory.

Upper Atmosphere and Space Physics
— Professor Ellyett
Structure of the ionosphere, theory of electromagnetic wave propa-
gation in the ionosphere and its applications.
— Dr Fraser
Plasma physics with emphasis on magnetohydrodynamics and geo-
magnetic applications.

Electronic Techniques
— Associate Professor Keay
Digital electronics, signal processing.
— Mr Cleary
Fast pulse techniques, high speed atomic processes.

The research project is carried out under the supervision of a staff
member and results are embodied in a formal report. The Depart-
ment generally provides to prospective students, a short list of
research projects carefully chosen for suitability as Physics IV
projects, and for relevance to research within the Department. The
choice is not necessarily confined to this list. Students should consult
with staff members on choice of project topic.

Texts
Texts and literature references will be given as needed by the lecturers
concerned.
DEPARTMENT OF PSYCHOLOGY

751100 Psychology I
Prerequisites Nil
Hours Three lecture hours, one one-hour practical session and one one-hour tutorial per week.
Examination One three-hour paper plus an assessment of the practical work carried out by the student throughout the year.
Content A general introduction to psychology and includes such topics as social psychology, learning theory, perception, developmental psychology, physiological psychology, theory of measurement and descriptive statistics and statistical analysis of data.
Additional texts may be recommended at the beginning of the course.

752100 Psychology II
Prerequisite Psychology I
Hours Three lecture hours, one two-hour practical session and one one-hour tutorial per week.
Examination Two three-hour papers plus an assessment of the practical work carried out by the student throughout the year.
Content Such topics as developmental psychology, developmental psychobiology, clinical neuropsychology, individual differences, personality, social ethology, and social psychology. Statistical methods will be taught and tested during the year.
Texts No specific texts are set, but recommendations are made at the beginning of the course.

* The following transitional arrangements apply. Students who have completed Psychology II prior to 1975 and wish to proceed to Psychology IIIB will be required to attempt such topics from Psychology II A and II B as are prescribed by the Head of Department and which would comprise a full Part II subject.

753100 Psychology III A
Prerequisite Psychology II
Hours Four lecture hours and up to five hours practical work per week.
Examination Two three-hour papers plus an assessment of practical work carried out during the year.
Content The course includes such topics as cognition, verbal learning, perception, physiological psychology, and animal behaviour. The practical work is divided into
(a) Laboratory sessions, totalling three hours per week.
(b) An investigation carried out under supervision. The topic of this work will usually be selected by the student, although some restrictions may be decided by the Department. Work on this will take two hours per week.
Texts No specific texts are set but recommendations are made at the beginning of the course.
753200 Psychology IIA
Prerequisite Psychology IIA
Corequisite Psychology IIIA
Hours Four lecture hours and five hours practical work per week.
Examination Two three-hour papers plus an assessment of practical work carried out during the year.
Content The lecture course includes lectures on such topics as social psychology, psychopathology, human operant conditioning, personality assessment, developmental psychology, and quantitative psychology.

Texts
No specific texts are set but recommendations are made at the beginning of the course.

754100 Psychology IV
Prerequisites In 1975 completion of ordinary degree requirements including a major in Psychology and permission of both the Head of Department and the Dean.
Hours As prescribed by the Head of the Department.
Examination Two three-hour papers together with an assessment of the thesis material.
Content The student is expected to cover such fields as abnormal and clinical psychology, animal behaviour, developmental psychology, learning and cognition, motivation, perception, personality, physiological psychology, quantitative psychology, and social psychology.

Texts
No specific texts are set but recommendations are made at the beginning of the course.

DEPARTMENT OF GEOGRAPHY
351100 Geography I
Prerequisites Nil
Hours Two lecture-hours, one tutorial hour, three hours practical work and four days of field work.
Examination As prescribed by the Head of the Department.
Content The subject is designed to introduce students to the cultural aspects of geography, with reference to the broad geographical distribution of culture complexes, and the examination of processes involved in the evolution of culture patterns and culture systems.

Practical courses to extend and enrich this study are also designed to enable students to gain proficiency in and understanding of the tools of geographical analysis. Methods in the cartographic and statistical organisation of geographic data will be studied.

Text
References
Lists will be distributed to students at the commencement of the year, and at appropriate times thereafter.

352100 Geography IIA
Prerequisite: Geography I
Hours: Four hours of lectures, two hours of practical/tutorial work per week and eight days' field work.
Examination: As prescribed by the Head of the Department.

Content
This subject is concerned with human geography. It reviews the methods and concepts of economic geography, with selected studies of the location of agricultural, of manufacturing and of tertiary economic activity. Elements in the structure and organisation of societies are considered with emphasis on urban forms and urban life. The subject is a prerequisite for the urban elective in Geography III.

Text
Smith, Taaffe & King  *Readings in Economic Geography* (Rand McNally 1968)

References
Lists will be distributed to students at the commencement of the year, and at appropriate times thereafter.

352200 Geography IIB
Prerequisite: Geography I
Hours: Four hours of lectures, two hours of practical/tutorial work per week and eight days' field work.
Examination: As prescribed by the Head of the Department.

Content
This a study of processes and patterns in man's physical environment. One section of the course is concerned with the exchanges and transformations of solar energy and of water as these occur at the earth/atmosphere interface. These studies are organised into the frameworks of the radiation, heat and water budgets and the spatial variations of these. The other section deals with geomorphic processes on the one hand, and problems of historical geomorphology on the other. The subject is a prerequisite for the Fluvial Geomorphology elective in Geography III.

Texts
OR
Holmes  *Principles of Physical Geology* (2nd ed. Nelsons Paperback 1965)

References
Lists will be distributed to students at the commencement of the year, and at appropriate times thereafter.

353100 Geography IIIA
Prerequisite: Geography IIA or IIB
Hours: Five hours per week of lectures, practical work and seminars. Eight days' field work are an integral part of the subject.
Examination: As prescribed by the Head of the Department

Content
(i) Core Topic
(ii) Two Electives

References
Lists will be distributed to students at the commencement of the year, and at appropriate times thereafter.

353200 Geography IIIB
Prerequisite: Geography IIA or IIB
Corequisite: For full-time students: Geography IIIA (see Schedule of Subjects appended to degree Requirements, page 23)
Hours: Five hours per week of lectures, practical work and seminars. Eight days' field work are an integral part of the subject.
Content
(i) Core Topic: 353201 Problems of the Australian Region.
(ii) Two Electives: Which have not been, or are not being studied in Geography IIIA, selected from the list below.

ELECTIVES FOR IIIA AND IIIB
Topic (a) 353102 Advanced Economic Geography
Prerequisite: Geography IIA
Hours: Two hours per week and related fieldwork.
Examination: As prescribed by the Head of the Department.
Content
The lectures will fall into four major sections:
(i) an introductory conceptual section;
(ii) an examination of selected aspects of location theory;
(iii) a discussion of some methods of location analysis;
(iv) an introduction to regional economics.

Practical classes will be chiefly concerned with the methods of analysis useful in economic geography.

References
Smith, Taaffe & King  *Readings in Economic Geography* (Rand McNally 1965)

**Topic (b) 353103 Biogeography**

*Prerequisite*  (Recommended) Geography IIB

*Hours*  Two hours per week and related fieldwork.

*Examination*  As prescribed by the Head of the Department.

**Content**
The topic deals with:
(i) some basic concepts in Biogeography;
(ii) an introduction to Ecology, with emphasis on man as an inseparable part of nature;
(iii) approaches towards ecological harmony between man and the rest of nature.

*Texts*
Bates  *The Forest and the Sea* (Mentor 1961)
Billing  *Forbush and the Penguins* (Fawcett Crest 1967)

*References*
Lists will be distributed to students at the commencement of the year, and at appropriate times thereafter.

**Topic (c) 353104 Fluvial Geomorphology**

*Prerequisites*  Geography IIB

*Hours*  Two hours per week and related fieldwork.

*Examination*  As prescribed by the Head of the Department.

**Content**
The elective will expand the fluvial geomorphology taught in second year. Fluvial processes and resultant land forms will be studied.

*Texts*
Leopold, Wolman & Miller  *Fluvial Processes in Geomorphology* (Freeman 1964)

*References*
Lists will be distributed to students at the commencement of the year, and at appropriate times thereafter.

**Topic (d) 353106 Geographical Techniques**

*Prerequisites*  Nil

*Hours*  Two hours per week and related fieldwork.

*Examination*  As prescribed by the Head of the Department.

**Content**
This topic is concerned with the methods of data collection, manipulation, interpretation and presentation. The elective is of value for all students, but is especially relevant for those intending to proceed to Honours.

**Topic (e) 353107 Historical Geography**

*Prerequisites*  Nil

*Hours*  Two hours per week and related fieldwork.

*Examination*  As prescribed by the Head of the Department.

**Content**
The elective examines the time element in Geography and the need to search for origins. The importance of previous evolution to the systematic study of existing phenomena in any region will be illustrated by reference to specific themes. The elective includes a substantial section on aspects of the historical geography of Australia.

*Text*
Jeans  *An Historical Geography of New South Wales to 1901* (Reed Education 1972)
Topic (f) 353108 Southeast Asia
Prerequisites Nil
Hours Two hours per week.
Examination As prescribed by the Head of the Department.
Content This topic is designed to study the regional variety which exists in the monsoon Asian region. Because this is largely an underdeveloped area, the elective will concentrate on the study of the characteristics of under-development and the areal manifestations of these characteristics.
Text Buchanan, *The Southeast Asian World* (Bell 1967)

Topic (g) 353109 Urban Environments
Prerequisite Geography IIA
Hours Two hours per week and related fieldwork.
Examination Progressive assessment and final examination
Content The elective reviews selected elements of urban environments emphasising Anglo-American systems. Students are required to develop an independent study which may be field-based or theoretical. Statistical and other methods of analysing urban data are an important component of the course.

354100 Geography IV
Prerequisite In order to qualify for admission to Geography IV, a student must normally have passed at Credit level or better in at least four Geography subjects. In exceptional cases students who do not quite reach these requirements but who can satisfy the Head of the Department that they are suitable candidates may be admitted to the Part IV subject. Students considering entry to Geography IV should consult the Head of the Department before the beginning of the third term of the preceding year. Those accepted for entry will be expected to commence their thesis field programmes early in January.
Hours To be arranged
Examination As prescribed by the Head of the Department.

**Content**
This subject is designed in part as an introduction to research work in Geography. Each student is required to submit a thesis embodying the result of an original investigation on a topic approved by the Head of the Department of Geography.

Seminars and field work will be offered in the following:
(a) The impact of man and society on nature.
(b) A systematic topic approved by the Head of the Department.

**References**
Lists will be distributed to students at the commencement of the year, and at appropriate times thereafter.

**DEPARTMENT OF MATHEMATICS**

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

(Students who passed some mathematics subjects before this arrangement of subjects was introduced should consult the "transition arrangements" set out on p. 155 of the 1970 Faculty of Arts handbook, and p. 76 of the 1973 Faculty of Mathematics handbook. Note that the "code letters" for the topics may vary slightly from year to year.)

Students should take particular note of Clause 13(iii)(b) of the degree requirements for the ordinary degree of Bachelor of Science which states that not more than four mathematics subjects may be counted.

**Progressive Assessment**
From time to time during the year students will be given assignments, tests, etc. The student's performance in this work will be taken into account in the following manner.

(a) For the implementation of By-law 5.4.1-1, which deals with unsatisfactory progress. A copy of this By-law appears in the *General Supplement* to the Faculty Handbook.

(b) Where a student's performance during the year has been better than his performance in the final examination, then the former will be taken into account in determining his final result. On the other hand, when a student's performance during the year has been worse than his performance in the final examination, then his performance during the year will be ignored in determining his final result.
661100 Mathematics I

Prerequisites
Nil (Mathematics 2S Advisory)

Hours
Four lecture-hours and two tutorial-hours per week for three terms.

Examination
Two papers of three hours duration.

Content
Topics AN — Real Analysis
AL — Algebra
CA — Calculus
NM — Numerical Mathematics

Summaries and extended booklists for these topics will appear in the handbook of the Faculty of Mathematics and will also be available from the Department.

Topic AN—Real Analysis—M. J. Hayes

Prerequisites
Nil

Hours
One lecture-hour per week and one tutorial-hour per fortnight.

Content

Texts
Apostol, T. Calculus Vol. I 2nd ed. (Ginn Blaisdell 1967)
(Gin this is the general text for the course).
Giles, J. R. Real Analysis— an Introductory Course
(Wiley 1973)
(If is recommended that students intending to major in Mathematics should have this book).

Topic AL—Algebra—W. Brisley

Prerequisites
Nil

Hours
One lecture-hour per week and one-tutorial hour per fortnight.

Content
Introduction to basic algebraic objects and ideas. Matrices, permutations, complex numbers. Linear Algebra: vectorspaces, homomorphisms, matrices, determinants; algorithms for solution of equations; rank, nullity: eigenvectors and eigenvalues; applications various.
Part II Subjects

The Department offers three Part II subjects. Students whose course restricts them to one such subject must study Mathematics IIA or Mathematics IIB. The subject Mathematics IIA is a prerequisite for Mathematics IIC, and IIA and IIC together a prerequisite for any Part III subject, so students wishing to take two Part II subjects would normally choose Mathematics IIA and IIC. Students taking all three of the Part II subjects would study all twelve of the topics listed below. Summaries and extended booklists for these topics will appear in the handbook of the Faculty of Mathematics and will also be available from the Department.

LIST OF TOPICS FOR PART II MATHEMATICS

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<td>Topic in Applied Mathematics e.g. Mechanics</td>
</tr>
<tr>
<td>K</td>
<td>Topic in Pure Mathematics e.g. Group Theory</td>
</tr>
<tr>
<td>L</td>
<td>Analysis of Metric Spaces</td>
</tr>
</tbody>
</table>

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

662100 Mathematics IIA

<table>
<thead>
<tr>
<th>Prerequisite</th>
<th>Mathematics I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours</td>
<td>Four lecture-hours and two tutorial-hours per week for three terms.</td>
</tr>
<tr>
<td>Examination</td>
<td>Each topic is examined separately.</td>
</tr>
</tbody>
</table>

Content

Topics B, C, D, and E. In exceptional circumstances and with the consent of the Head of Department, one topic from A, F, G, or H may be substituted for B. Additional substitutions may be allowed in the case of candidates who have passed the subject Mathematics IIB.

662200 Mathematics IIB

<table>
<thead>
<tr>
<th>Prerequisite</th>
<th>Mathematics I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours</td>
<td>Four lecture-hours and two tutorial-hours per week for three terms.</td>
</tr>
<tr>
<td>Examination</td>
<td>Each topic is examined separately.</td>
</tr>
</tbody>
</table>

Content

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.

662300 Mathematics IIC

<table>
<thead>
<tr>
<th>Prerequisite</th>
<th>Mathematics I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corequisite</td>
<td>Mathematics IIA</td>
</tr>
<tr>
<td>Hours</td>
<td>Four lecture-hours and two tutorial hours per week for three terms.</td>
</tr>
<tr>
<td>Examination</td>
<td>Each topic is examined separately.</td>
</tr>
</tbody>
</table>

Content

Either topics G, J, K and L or topics H, I, K and L. Subject to the consent of the Head of the Department one topic from A to J may be substituted for one of the topics I or J.

Notes

1. Mathematics IIB is no longer offered in two parts in the Faculty of Science. Students who passed Mathematics IIB part (i) before 1971 should consult Note 1 on page 90 of the 1971 handbook.
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 corequisite or prerequisite 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 courses include Physics IIIA are advised to include topics C, E, G and H in their Part II Mathematics subjects. This may require the use of the substitution rules.
6. Students who passed a Part II Mathematics subject prior to 1974 and who wish to take further Part II Mathematics subjects should note that the topic coded “L” in 1974 and 1975 corresponds to the topic coded “A” in previous years. Such students may require special permission for their selection of Part II topics, and should consult with the Head of the Department.

Texts for Part II Topics

662101 Topic A — Mathematical Models
No prescribed text.

662102 Topic B — Complex Analysis

662103 Topic C — Calculus and Vector Calculus

662104 Topic D — Linear Algebra
Lipschutz, S. *Linear Algebra* (Schaum 1968)

662201 Topic E — Differential Equations and Integral Transforms

662202 Topic F — Numerical Analysis and Computing

OR


662203 Topic G — Fourier series, Partial Differential Equations and Special Functions
Weinberger, H. F. *A First Course in Partial Differential Equations* (Ginn Blaisdell 1965)

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

662204 Topic H — Probability and Statistics

OR

662301 Topic I — Topic in Statistics
e.g. Non-parametric Methods
Conover, W. J. *Practical Nonparametric Statistics* (Wiley 1971)

662302 Topic J — Topic in Applied Mathematics
e.g. Mechanics

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

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

662304 Topic L — Analysis of Metric Spaces
Giles, J. R. *Analysis of Metric Spaces* (University of Newcastle)

Part III Subjects

The Mathematics Department offers two Part III subjects, each comprising four topics chosen from the list below. Students wishing to proceed to Honours in Mathematics are required to take both these subjects. They will also be required to study additional topics as prescribed by the Heads of the Departments concerned.

Passes in both Mathematics IIA and IIC are prerequisite for entry to Mathematics IIIA, and Mathematics IIIA is pre- or corequisite for Mathematics IIIB. It will be assumed that students taking a third-year subject in 1975 have already studied topics C, D, E, K in their Part II subjects.

Summaries of the Part III topics together with extended booklists will appear in the handbook of the Faculty of Mathematics and will also be available from the Department.
### LIST OF TOPICS FOR PART III MATHEMATICS

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

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

### Mathematics IIIA

**Prerequisites**
Mathematics IIA and IIC

**Hours**
Four lecture-hours and two tutorial-hours per week for three terms.

**Examination**
Each topic is examined separately.

**Content**
A subject comprising four topics, which must include O, and at least one of P, Q, R, or U. In addition, students taking this subject will be required to complete an essay on a topic chosen from the history or philosophy of Mathematics.

### Mathematics IIIB

**Corequisite**
Mathematics IIIA

**Hours**
Four lecture-hours and two tutorial-hours per week for three terms.

**Examination**
Each topic is examined separately.

### Notes
1. In order to take both Mathematics IIIA and Mathematics IIIB, a student must study eight topics from M to Z above with the restriction that Topic O, and at least one of P, Q, R or U must be included in these eight topics.
2. Students whose course includes a subject from Schedule B may have their choice of topics further restricted.
3. Students aiming to take Mathematics IV may be required to undertake study of more topics than the eight comprising the two part III subjects.

### Texts for Part III Topics

663101 Topic M — General Tensors
No prescribed text.

663102 Topic N — Variational Methods
Elsgolc, L. E. *Calculus of Variations* (Pergamon Press 1963)

663103 Topic O — Mathematical Logic

663104 Topic P — Differential and Integral Equations
Sanchez, D. A. *Ordinary Differential Equations and Stability Theory: an Introduction* (San Francisco, Freeman 1968)

663105 Topic PD — Theory of Partial Differential Equations
No prescribed text.

663106 Topic Q — Fluid Dynamics
Text

663107 Topic R — Probability and Statistics
Examination

At least seven final papers, each of two hours duration.
Each student will be required to present a thesis; i.e. a study under direction of a special topic using relevant published material and presented in written form.
The topics offered may be from any branch of Mathematics including Pure Mathematics, Applied Mathematics, Statistics, Computing Science and Operations Research as exemplified in the publication Mathematical Reviews.

Content

A selection of topics, each of about 27 lectures, will be offered. Summaries of topics which may be offered in 1975 will appear in the handbook of the Faculty of Mathematics and will also be available from the Department.

RESEARCH IN THE FACULTY OF SCIENCE

DEPARTMENT OF BIOLOGICAL SCIENCES

Professor Boettcher's research interests are in the field of immunogenetics, particularly in relation to humans. Current projects include a study of infertility due to immunity to spermatozoa, and the genetics of an Australian Aboriginal group.

Dr Conroy is interested in the ecology and genetics of populations, and is currently studying geographic variation and hybrid zones in Lepidoptera.

Dr Jones's research interests are in the field of physiology of reproduction, particularly the biology and preservation of gametes.

Dr Murdoch's special research interest is the hormonal regulation of enzymatic reactions associated with histotrophic nutrition and implantation of the conceptus in the female reproductive tract. This topic is within his general field of interest of mammalian reproductive physiology and biochemistry.

Within the broad framework of a research interest in factors determining crop yield, Dr Patrick is currently investigating the control of nutrient distribution in vascular plants.

Dr Roberts's research interests are the field of protein chemistry and immunology. Current projects include a study of proteins in blood plasma and external secretions.

Dr Quinn is interested in developmental biology and is concerned with the study of factors affecting the normal development of embryos and their application to livestock production.
DEPARTMENT OF CHEMISTRY

The research programme in the Department is pursued in a number of loosely knit groups each concentrating on some branch of the subject, but with sufficient overlap to promote effective internal discussion and criticism. The wide range of specific interests is indicated by the list which follows.

Analytical Chemistry (Professor W. F. Pickering)
Studies of the role of solution equilibria in reactions involving a solid phase and a solvated species; development of methods of measuring pollution levels in water.

(Dr M. W. Blackmore)
Use of atomic absorption spectroscopy for measuring levels of metal pollution.

Chemical Education (Mr H. R. Tietze)
Development of new experiments for undergraduate courses in Chemistry.

Electrochemistry (Dr R. A. Fredlein)
Electrosorption at solid metal-solution interphases and catalysis of the electrorreduction of oxygen on oxide bronzes.

Metal Catalysis (Dr R. P. Cooney)
Use of laser Raman and far-infrared spectroscopy to investigate mechanisms of both heterogeneous and homogeneous reactions.

Metal Complexes (Associate Professor W. R. Walker)
Syntheses and structures of metal complexes; measurement of equilibrium constants; solvent extraction; the role of inorganic complexes in biological systems.

Natural Products (Associate Professor H. Duewell)
Elucidation of the components of Xanthorrhoea resin and the synthesis of related compounds.

Organic Reaction Mechanism (Associate Professor L. K. Dyall)
Studies on the mechanism of oxidations which involve a neighbouring group in a cyclization process.

Organic Synthesis and Anagesics (Dr K. H. Bell)
Development of new organic reactions, the preparation of potential local anaesthetics.

Polymers (Mr E. B. Jacobs)
Synthesis of cyclic siloxanes, polymerization studies including those induced by radiation.

Potential Photosynthesis Inhibitors (Associate Professor L. A. Summers)
Synthesis and study of potential photosynthesis inhibitors; preparation of new fungicides and pharmaceuticals and studies of their mode of action.

Theoretical Chemistry (Dr E. A. Magnusson)
Experimental and computational studies on metal prophyrin complexes.

Thermodynamics (Associate Professor G. C. Curthoys)
Properties of electrolyte solutions; aspects of the adsorption of gases on solids.

DEPARTMENT OF GEOLOGY

The detailed geology of the Hunter Valley in all its aspects is the concern of all members of staff but other individual or team research projects are as follows:

Professor B. Nashar is investigating the mineralogy, geochemistry and genetic relations of the Carboniferous and Permian andesitic associations of eastern New South Wales. Her other interest is in the conditions of formation of secondary minerals in basalt lavas.

The role of chromatography in geology has claimed the attention of Associate Professor A. S. Ritchie who is developing semi-quantitative chromatographic methods of analysis of geologic materials. The concept of chromatography (or selective retention) as a natural geological process is being investigated.

Associate Professor C. F. K. Diessel and Dr K. H. R. Moelle are attempting to interpret the sedimentary and structural history of the Sydney Basin and fringe areas. Professor Diessel's particular interests lie in coalfield geology, coal petrology, palaeocurrent analysis and reflectivity measurements of the sediments in the Sydney Basin while those of Dr. Moelle are the assessment of joint systems and their interpretation in a regional setting. A further interest of Dr Moelle is the design and stability of mine openings and open-cut operations in rocks of the coalfields in New South Wales.

Associate Professor S. St. J. Warne is concerned with multi-method investigations into the development and application of advanced mineralogical techniques to mineral mixtures with special reference to minerals in and associated with coal.

Dr B. A. Engel is concerned with the detailed description of Carboniferous trilobites, fenestrate cryptostome polyzoans and brachiopods from the marine faunas of Eastern Australia.

At present Dr R. Offler is carrying out investigations on the low grade metamorphic rocks of Carboniferous and Devonian age, north of Newcastle, and structural and petrographical studies of the Globe-Vauxhall Retrograde Schist Zone, Broken Hill. He is also carrying out a joint project with Professor Diessel on the relationship between metamorphic grade and reflectance of coalified and graphitized plant fragments.

Mr J. A. Gamble has interests in the fields of Carboniferous and Tertiary volcanism and in the geochemistry and petrogenesis of such rock suites.
Mr. S. W. McKnight is concerned with mineralization in the Lachlan Geosyncline and in particular in studying base-metal sulphides associated with the Silurian of Central Southern New South Wales.

DEPARTMENT OF PHYSICS

Infra-Red Studies (Professor C. D. Ellyett)
The Department operates the only airborne infra-red scanner in any Australian University. It has been flown extensively in Australia and New Guinea to study areas of particular geological or hydrogeological interest, and is used within the department to develop improved detection methods. New interpretation techniques, both photographic and computer plotted, have been devised.

Spectroscopy (Associate Professor S. C. Baker)
Work continues on measurement of the temperature of plasma by studies of the spectra of highly excited iron atoms.

Surface Physics (Associate Professor J. A. Ramsey & Mr R. H. Roberts)
(i) Studies of exoelectron emission from freshly abraded aluminium have been extended to tensile deformation of aluminium coated with various thicknesses of oxide.
(ii) Work function changes on the major crystal faces of single crystals due to adsorbed species.
(iii) LEED and AES are currently being developed.

Ionospheric Physics (Professor C. D. Ellyett & Associate Professor C. S. L. Keay)
(i) A low power radar, using signal processing to reveal echoes buried in noise is available to measure echoes from meteor trails in the ionosphere.
(ii) An ionosonde is available to investigate Sporadic-E ionization of Meteor origin.
(iii) Analytical work continues on the occurrence and duration of individual meteor echoes recorded at relatively low search frequencies.

Geomagnetic Micropulsations (Dr B. J. Fraser)
The time occurrence, velocity, polarisation and direction of travel of hydromagnetic waves in an ionospheric duct is being extensively investigated, using recording equipment near Newcastle, Woomera, Launceston, Perth and Macquarie Island, together with data supplied by the University of Auckland.

Atomic Physics (Mr J. E. Cleary)
An all-metal ultra-high vacuum system is being assembled to permit lifetimes of the excited states of atoms to be measured directly. Initially, lifetimes ranging from 1 nanosecond to 1 microsecond will be determined for hydrogen and helium.

Signal Processing (Associate Professor C. S. L. Keay)
Instrumentation has been developed for the retrieval of small signals of short duration from a background of thermal and impulse noise. Digital techniques employing integrated-circuit logic enable processing to be carried out in real time. Applications to the infra-red scanner and meteor radar are in use. A powerful mini-computer is being incorporated for improved presentation of the output data.

Electromagnetics (Dr P. A. McGovern)
Analysis of EM wave propagation in non-uniform structures using perturbation and non-orthogonal coordinate techniques and experimental investigation of pulse propagation in non-uniform transmission lines.

DEPARTMENT OF PSYCHOLOGY

The research activities of the Department may be grouped under different broad headings reflecting the special interests of the staff members. However, there is sufficient overlap among the groups to maintain communication at a high level.

Abnormal Psychology
A programme of research is being carried out on the effects of stress on the function of the hypothalmic-pituitary-adrenal system in early infantile autism. Also the use of biofeedback as a therapeutic technique is being investigated in a variety of disorders.

Cognitive Processes and Computer Simulation
Research into the development of cognitive processes has continued with particular emphasis on factors associated with the acquisition of concepts. Computer simulation of concept identification is being investigated together with the estimation of relevant parameters. Several theoretical formulations are being explored as part of this research.

Developmental Psychology
The efficacy of various types of treatments on behavioural development in infancy is being studied.

Learning, Perception and Memory
The research interests in this area include instrumental avoidance conditioning, structure and parameters of perception, perceptual learning, and short-term memory.

Linguistics
Language behaviour is being investigated in terms of linguistic models and redundancy measures. The effects of language in acquiring concepts and on measures of motivation are being studied. Specific problems in reading are also being identified.
Mathematical Psychology
In mathematical psychology, experimental studies of new methods of measuring abilities and personality are continuing. The analysis of two dimensional patterns in relation to perceptual characteristics is being explored.

Physiological and Comparative Psychology
Physiological and biochemical systems involved in behaviour are being investigated with both human and infrahuman subjects. Drugs and evoked responses in the nervous system are being used to study children with reading difficulties. Both human and infrahuman subjects are being used to investigate the role of the autonomic nervous system in stress and emotion. Several parameters of the cardiac response during a range of behaviours, e.g., aversive conditioning, open field activity, are being investigated using biofeedback and telemetric devices. In infrahuman subjects effects of early experience on adult behaviour are being examined.

DEPARTMENT OF GEOGRAPHY
Research in the Department is divisible into the two broad fields of physical and human geography.

Research programmes in physical geography are concerned with the investigation of the problem of past and present tidal geomorphology (Mr W. F. Geyl); Suspended sediment and solute transport from the Congewai Creek drainage basin, near Cessnock (Dr R. J. Loughran); rain forest ecology (Dr J. C. Turner); estuarine hydraulic systems (Mr. W. N. Jenks). Further projects, linking the human and physical fields, are concerned with the general problem of water allocation and water use (Professor A. D. Tweedie); and investigation into organisational aspects of water resources management (Mr K. W. Lee).

Human geography interests reveal a number of specialisms as follows:
A study of New Guinea rubber production, which was commenced in 1968, is being continued (Mr P. G. Irwin).
Aspects of the historical geography of eastern Australia (Dr J. C. R. Camm).
The study of time in urban social and geographical space (Dr D. N. Parkes).
A comparative study of factors influencing the locations and attitudes to expansion of industries in Greater Newcastle and in a sample of Sydney’s western suburbs is being undertaken (Miss M. R. Hal).
An investigation is being made into some aspects of the political geography of regional development and planning (Professor K. W. Robinson).
A study of the timber industry in New Guinea (Mr W. J. Jonas).
An analysis of internal migration in Western Australia (Mrs. L. de Castro Lopo).
The study of intraurban migration in Newcastle (Mrs J. P. Galvin).

DEPARTMENT OF MATHEMATICS
Algebra
Mr R. F. Berghout is pursuing some topics in ring theory and ring-like categories, making use of the theory of radicals, and is also engaged in the extension of this theory to additive categories.

Associate Professor W. Brisley is working on some problems occurring in the laws defining certain varieties of groups, the subsequent lattice of sub-varieties of given varieties, and the location of generating critical groups for varieties of groups.

Basic Biological Forces
Dr E. R. Smith is studying the role of Van der Waals and related forces in the stabilisation of biological arrays and colloids.

Chemical Kinetics
Dr D. L. S. McElwain is working on the mathematical modelling of non-equilibrium phenomena in gases, using the Master Equation approach. A stochastic theory of the dissociation of diatomic gases and exchange reactions is being investigated.

Combinatorial Theory and Operations Research
Professor W. D. Wallis is carrying out research on various parts of graph theory, including graph factorisation. He is also working on rostering and scheduling problems.

Dr R. J. Vaughan is interested in the application of optimisation methods to industrial production problems.

Professor R. W. Robinson is applying combinatorics to the counting of various structures, such as graphs and search trees.

Differential Equations
Dr J. G. Couper has been working on the geometric theory of autonomous systems of ordinary differential equations.

Differential 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 the space-time continuum, especially in relation to the theory of interacting fields.

Dynamic Oceanography
Dr W. Summerfield is interested in the interactions of the various oceanic motions with continental boundaries. He is also studying the various river and lake systems on the N.S.W. coastline.
Environmental and Urban Studies
Dr R. J. Vaughan is investigating mathematical models in urban geography. Professor W. D. Wallis is interested in mathematical models in urban geography.
Dr R. W. Gibberd is studying models of urban structure and urban development. He is also interested in urban sociology, voting patterns and urban demographic models.

Fluid Mechanics
Dr W. T. F. Lau is concerned with potential flow and viscous flow problems.

Functional Analysis
Dr J. R. Giles is involved in determining properties of Banach spaces which can be derived from relations between the points of the space and their support functionals. In particular, he is examining differentiability properties of the norm. He is also working on the development of the theory of the numerical range of operators on locally convex spaces, and of elements of locally m-convex algebras.
Dr V. Ficker and Mr C. J. Ashman are working in measure theory, particularly, in some problems on classes of null sets.

History of Mathematics
Mr R. F. Berghout is pursuing research into the development of algebra, notably modern algebra, as well as the relations between this and classical occidental and oriental algebra.
Mr Berghout, together with Mrs Frost, is working on Greek algebra.
Mrs Frost is currently translating into English some of Euclid's as yet untranslated works.

Information Theory
Professor R. G. Keats is continuing to work in co-operation with research scientists at the Weapons Research Establishment who are active in the study of signal processing. This work, which is supported by a grant from the Department of Manufacturing Industry, involves the study of non-linear systems with stochastic inputs.

Mathematical Logic
Professor R. W. Robinson is studying structures of the recursively enumerable degrees and the degrees below $0'$. 

Number Theory
Dr T. K. Sheng studies the structure of humanly manageable numbers, application of dispersive and explosive linear operators, distribution of algebraic numbers in the complex plane, and functions defined on rational numbers.

Numerical Analysis and Computing
Dr A. J. Guttmann is interested in methods of function approximation, particularly from the viewpoint of using a linear differential equation representation. He is also interested in the analysis of theoretical and experimental data.

Statistical Mechanics
Dr A. J. Guttmann is working on the theory of equilibrium critical phenomena. He is particularly interested in the analysis of power series expansions which are frequently used to study systems exhibiting phase transitions.
Dr E. R. Smith is working on the theory of non-homogenous systems and the theory of polar liquids.
Dr W. P. Wood is investigating the dynamical behaviour of long chain molecules in solution.
Dr R. W. Gibberd is interested in most aspects of statistical mechanics.
Dr C. A. Croxton is working on the statistical mechanics of liquids and liquid interfaces.

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

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