FACULTY OF APPLIED SCIENCE
HANDBOOK 1975

THE UNIVERSITY OF NEWCASTLE
NEW SOUTH WALES 2308
FACULTY OF APPLIED SCIENCE
HANDBOOK 1975

THE UNIVERSITY OF NEWCASTLE
NEW SOUTH WALES 2308

Telephone — Newcastle 68 0401
One dollar
CONTENTS

Faculty of Applied Science

The colour band on the spine of this Handbook is the lining colour of the hood worn by Bachelors of Metallurgy of this University.

Page
5 Faculty Staff
6 Courses Available
Degree Requirements — Undergraduate
6 Bachelor of Metallurgy
7 Combined Degree Course
8 Schedule of Subjects
10 Students Academic Progress
10 Bachelor of Science (Metallurgy)
11 Schedule of Subjects
13 Student Academic Progress
14 Accelerated Course
15 Prerequisites and Corequisites
15 Industrial Experience Requirements
15 Combined Degree Course
Degree Requirements — Postgraduate
17 Master of Science
19 Doctor of Philosophy
22 Doctor of Science
23 Doctor of Engineering
## CONTENTS (Continued)

<table>
<thead>
<tr>
<th>Page</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>Subject Description</td>
</tr>
<tr>
<td></td>
<td>Subjects Offered by Other Faculties</td>
</tr>
<tr>
<td>33</td>
<td>Faculty of Economics and Commerce</td>
</tr>
<tr>
<td>34</td>
<td>Faculty of Engineering</td>
</tr>
<tr>
<td>46</td>
<td>Faculty of Mathematics</td>
</tr>
<tr>
<td>52</td>
<td>Faculty of Science</td>
</tr>
<tr>
<td>56</td>
<td>Postgraduate Degrees and Research Facilities</td>
</tr>
</tbody>
</table>

---

### FACULTY OF APPLIED SCIENCE

**Dean**
Professor E. O. Hall

**Sub-Dean**
J. E. McLennan

**METALLURGY**

**Professor**
E. O. Hall, MSc(New Zealand), PhD(Cambridge), FinstP, MAusIMM, FIM(Lond.), FAIP, FRSA

**Associate Professor**
W. A. Oates, BMet(Sheffield), MSc

**Senior Lecturers**
- J. D. Browne, BSc(London), MSc(New South Wales), PhD(Monash), AAIP
- R. D. Holliday, BA, PhD(Cambridge), ACS, AIME
- J. E. McLennan, MSc(New South Wales), ASTC, AIM(Lond.)
- N. A. Molloy, BE(Queensland)

**Lecturer**
D. Jaffrey, BSc(Queensland), MSc(McMaster), PhD(Cambridge)

**Professional Officers**
- J. A. Grahame, ASTC
- G. B. Johnston, MSc(New South Wales), PhD, ASTC, AIM
- D. D. Todd, MSc(New South Wales), PhD, ASTC, ARACI, DipOen(ORI Surrey)

**Honorary Associate**
D. J. Milne, BSc(Edinburgh)

**Departmental Office Staff**
Elizabeth M. Burns

**Student Advisor**
J. E. McLennan
COURSES AVAILABLE
The Faculty of Applied Science comprises the Department of Metallurgy in which two types of undergraduate courses are available.

The full-time course of four years leads to the degree of B.Met., an honours degree; while the part-time course of six years leads to the degree of B.Sc.(Met.).

Full-time students are required to obtain four months approved industrial experience before completion of their course.

The part-time courses are designed for students engaged in approved occupations in industry. Three concurrent years of approved industrial experience are required before completion of the course. The duration of the course may be reduced by one year by taking one year full-time in accordance with the scheduled "accelerated" course.

Before they can proceed to a higher degree, students who have obtained the B.Sc.(Met.), must complete the subjects normally offered in the fourth year of the full-time course. The Head of the Department should be consulted for particulars.

Provisions exist for transfer from full-time to part-time courses and vice versa and for some variation from the approved programmes for "accelerated" courses. Formal approval must be obtained from Senate. Students wishing to make such changes should consult the Head of the Department.

Postgraduate research leading to the degrees of M.Sc., M.E., Ph.D., D.Sc. and D.Eng. is offered. Full details may be obtained from the Head of the Department.

REQUIREMENTS FOR THE DEGREE OF BACHELOR OF METALLURGY

1. In these Requirements, "the Faculty" means the Faculty of Applied Science, "the Faculty Board" means the Faculty Board of the Faculty of Applied Science and "the Dean" means the Dean of the Faculty of Applied Science.

2. In order to qualify for admission to the degree of Bachelor of Metallurgy in the Faculty of Applied Science a candidate shall —
   (a) complete, normally by full-time study, the course prescribed by the Faculty Board; and
   (b) satisfy the requirements of industrial experience prescribed by the Faculty Board.

3. The Faculty Board shall publish a Schedule of Subjects prescribed for the course and the industrial experience requirements.

4. To complete a subject qualifying towards a degree a candidate shall attend such lectures, tutorials, seminars, laboratory classes, and field work and submit such written work and pass such examinations as the Department may require.

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

6. A candidate shall normally progress by year except that, with the permission of the Dean he may enrol in a subject or subjects from another year provided that he has met any prerequisites prescribed for the subjects.

7. A candidate may be granted standing in the course in recognition of work completed in another tertiary institution.

8. A candidate may withdraw from a subject in which he has enrolled only by informing the Secretary to the University in writing and the withdrawal shall take effect from the date of receipt of such notification.

9. A candidate who withdraws from a subject in which he has enrolled shall be deemed to have failed in that subject unless he has secured written permission from the Dean to withdraw without penalty. This permission is not normally granted beyond the sixth Monday of Second Term.

10. Honours may be awarded at graduation. There shall be three classes of Honours, namely, Class I, Class II and Class III. Class II shall have two divisions.

11. In each Department, the most distinguished candidate of candidates gaining First Class Honours may, if of sufficient merit, be awarded a University Medal.

COMBINED DEGREE COURSE

12. Mathematics/Metallurgy
A candidate may complete the Requirements for the Bachelor of Metallurgy degree in conjunction with a Bachelor of Mathematics degree by completing a combined course approved by the Faculty Board of the Faculty of Applied Science and the Faculty Board, Faculty of Mathematics, 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 is no less in quantity and quality than if the two degrees were taken separately.

(iv) An approved combined course leading to the degrees of B.Math. and B.Met. shall satisfy the requirements of both degrees except that —

(1) In the Requirements for the degree of Bachelor of Mathematics Clause 12 (a) (I) Mathematics II B may not be included in the five subjects chosen.

(2) In the Requirements for the degree of Bachelor of Metallurgy, Schedule of Subjects,

(a) Metallurgical Computations Part A shall be replaced by Mathematics II B, which may be taken in two parts, each of two lectures per week for three terms.

(b) Mathematics I shall be replaced by one of Engineering I, Chemistry I, Geology I or any other subject approved by the Dean.

(c) Mathematics II B shall not be taken as Year II elective.

(d) Elective Mathematics shall not be taken as a Year III elective.

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

SCHEDULE OF SUBJECTS

<table>
<thead>
<tr>
<th>Subject</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>YEAR I</td>
<td></td>
</tr>
<tr>
<td>Materials Science I</td>
<td>6</td>
</tr>
<tr>
<td>Mathematics I</td>
<td>6</td>
</tr>
<tr>
<td>Physics IA</td>
<td>6</td>
</tr>
<tr>
<td>AND EITHER</td>
<td></td>
</tr>
<tr>
<td>Engineering I</td>
<td></td>
</tr>
<tr>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>Chemistry I</td>
<td>6</td>
</tr>
<tr>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>Geology I</td>
<td></td>
</tr>
<tr>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>any other subject approved by the Head of Department</td>
<td>24</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Subject</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>YEAR II</td>
<td></td>
</tr>
<tr>
<td>Metallurgical Computations</td>
<td></td>
</tr>
<tr>
<td>Part A</td>
<td>6</td>
</tr>
<tr>
<td>Part B</td>
<td>6</td>
</tr>
<tr>
<td>Metallurgy I</td>
<td></td>
</tr>
<tr>
<td>AND EITHER</td>
<td></td>
</tr>
<tr>
<td>Physics II</td>
<td>OR</td>
</tr>
<tr>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>Mathematics II B</td>
<td>OR</td>
</tr>
<tr>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>Engineering Metallurgy I A</td>
<td>OR</td>
</tr>
<tr>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>Engineering Metallurgy I B</td>
<td>OR</td>
</tr>
<tr>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>Electronics and Instrumentation II</td>
<td>9</td>
</tr>
</tbody>
</table>

| Year III |                |
| Metallurgy IIA |                |
| Part I | 6 |
| Part II | 6 |
| Metallurgy IIB |                |
| Elective Subject | 3 |

| Year IV |                |
| Metallurgy III |                |
| Metallurgy Project | 25 |

| Elective Subjects |                |
| Elective Mathematics |                |
| Geology II Z (Mineralogy) |                |
| Microeconomics |                |

<table>
<thead>
<tr>
<th>Subject</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME111</td>
<td>Graphics</td>
</tr>
<tr>
<td>ME112</td>
<td>Engineering Drawing and Elementary Design</td>
</tr>
<tr>
<td>ME381</td>
<td>Methods Engineering</td>
</tr>
<tr>
<td>ME481</td>
<td>Engineering Administration</td>
</tr>
<tr>
<td>ME482</td>
<td>Engineering Economics</td>
</tr>
<tr>
<td>ME487</td>
<td>Operations Research — Deterministic Models</td>
</tr>
<tr>
<td>ME401</td>
<td>Systems Analysis</td>
</tr>
<tr>
<td>ME402</td>
<td>Systems Planning, Organisation and Control</td>
</tr>
<tr>
<td>ME481</td>
<td>Engineering Administration</td>
</tr>
<tr>
<td>ME482</td>
<td>Engineering Economics</td>
</tr>
</tbody>
</table>

or any other subject, including First Year Arts subjects, approved by the Head of the Department.
Prerequisite is Mathematics IIB

Engineering I comprises the following topics
ME111, ME112, CE111, ME131.

excluding topics C, F and G.

Engineering Metallurgy IA comprises the following topics
ME121 Workshop Practice
EE101 Introduction to Electrical Engineering
OR
EE203 Introduction to Electrical Information
ME222 Process Technology
CE212 Mechanics of Solids I or ME223.

Engineering Metallurgy IB comprises the following topics
EE101 Introduction to Electrical Engineering
OR
EE203 Introduction to Electrical Information
ME251 Fluid Mechanics or CE231
ME372 Heat Transfer or approved subject
Mathematics II, Topic B, Complex Analysis.

STUDENT ACADEMIC PROGRESS

Students are reminded of the need to maintain satisfactory academic progress and, in particular, attention is drawn to By-Laws, 5.4.1 and 5.4.2 (refer to the General Supplement to the Handbook).

Apart from the policy of the University which is self evident under the terms of By-law 5.4.2, the Faculty Board has laid down its policy for the operation of By-law 5.4.1.2. This policy follows:

- Full-time students must pass at least one subject in their first year of enrolment. Students who do not meet this provision will be recommended to the Admissions Committee for exclusion from the degree course.

REQUIREMENTS FOR THE DEGREE OF BACHELOR OF SCIENCE (METALLURGY)

1. In these Requirements, “the Faculty” means the Faculty of Applied Science, “the Faculty Board” means the Faculty Board of the Faculty of Applied Science, and “the Dean” means the Dean of the Faculty of Applied Science.

2. In order to qualify for admission to the degree of Bachelor of Science (Metallurgy) in the Faculty of Applied Science a candidate shall —

   (a) complete, normally by part-time study, the course prescribed by the Faculty Board; and

   (b) satisfy the requirements of industrial experience prescribed by the Faculty Board.

3. The Faculty Board shall publish a Schedule of Subjects prescribed for the course and the industrial experience requirements.

4. To complete a subject qualifying towards a degree a candidate shall attend such lectures, tutorials, seminars, laboratory classes and field work and submit such written work and pass such examinations as the Department may require.

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

6. A candidate may not enrol in a subject until he has completed any prerequisites prescribed in the Schedule of Subjects or is enrolled in or has completed any corequisites prescribed in the Schedule of Subjects.

7. A candidate may be granted standing in the course in recognition of work completed in another tertiary institution.

8. A candidate may withdraw from a subject in which he has enrolled only by informing the Secretary to the University in writing and the withdrawal shall take effect from the date of receipt of such notification.

9. A candidate who withdraws from a subject in which he has enrolled shall be deemed to have failed in that subject unless he has secured written permission from the Dean to withdraw without penalty. This permission is not normally granted beyond the sixth Monday of Second Term.

10. The degree of Bachelor of Science (Metallurgy) may be conferred either as a pass degree, or as a degree with merit.

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

SCHEDULE OF SUBJECTS

<table>
<thead>
<tr>
<th>Subject</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAGE I</td>
<td></td>
</tr>
<tr>
<td>Mathematics I</td>
<td>6</td>
</tr>
<tr>
<td>AND EITHER</td>
<td></td>
</tr>
<tr>
<td>3Engineering I</td>
<td></td>
</tr>
<tr>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>Chemistry I</td>
<td>6</td>
</tr>
<tr>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>Geology I</td>
<td></td>
</tr>
<tr>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>any other subject approved by the Head of Department</td>
<td>12</td>
</tr>
<tr>
<td>Subject</td>
<td>Hours per week</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>STAGE 2</td>
<td></td>
</tr>
<tr>
<td>Materials Science I</td>
<td>6</td>
</tr>
<tr>
<td>Physics IA</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>12</td>
</tr>
<tr>
<td>STAGE 3</td>
<td></td>
</tr>
<tr>
<td>Metallurgical Computations</td>
<td></td>
</tr>
<tr>
<td>Part A</td>
<td>6</td>
</tr>
<tr>
<td>Part B</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>12</td>
</tr>
<tr>
<td>STAGE 4</td>
<td></td>
</tr>
<tr>
<td>Metallurgy I</td>
<td>6</td>
</tr>
<tr>
<td>AND EITHER</td>
<td></td>
</tr>
<tr>
<td>Physics II</td>
<td></td>
</tr>
<tr>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>Mathematics IIB</td>
<td>6</td>
</tr>
<tr>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>Engineering Metallurgy IA</td>
<td>6</td>
</tr>
<tr>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>Engineering Metallurgy IB</td>
<td>9</td>
</tr>
<tr>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>Electronics and Instrumentation II</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12 15</td>
</tr>
<tr>
<td>STAGE 5</td>
<td></td>
</tr>
<tr>
<td>Metallurgy II A</td>
<td></td>
</tr>
<tr>
<td>Part I</td>
<td>6</td>
</tr>
<tr>
<td>Part II</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>12</td>
</tr>
<tr>
<td>STAGE 6</td>
<td></td>
</tr>
<tr>
<td>Metallurgy II B</td>
<td></td>
</tr>
<tr>
<td>Elective</td>
<td>9</td>
</tr>
<tr>
<td>OR</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>12</td>
</tr>
</tbody>
</table>

Elective Subjects
- Elective Mathematics
- Geology II (Mineralogy)
- Microeconomics
- (ME111) Graphics
- (ME112) Engineering Drawing and Elementary Design
- (ME381) Methods Engineering
- (ME481) Engineering Administration

*Prerequisite is Mathematics IIB

Engineering I comprises the following topics:
- ME111, ME112, CE111, ME131

Excluding topics C, F and G.

Engineering Metallurgy IA comprises the following topics:
- ME121 Workshop Practice
- EE101 Introduction to Electrical Engineering
- OR
- EE203 Introduction to Electrical Information
- ME222 Process Technology
- CE212 Mechanics of Solids I or ME223.

Engineering Metallurgy IB comprises the following topics:
- EE101 Introduction to Electrical Engineering
- OR
- EE203 Introduction to Electrical Information
- ME251 Fluid Mechanics or CE231
- ME372 Heat Transfer or approved subject

STUDENT ACADEMIC PROGRESS

Students are reminded of the need to maintain satisfactory academic progress and, in particular, attention is drawn to By-Laws 5.4.1 and 5.4.2 (refer to the General Supplement to the Handbook).

Apart from the policy of the University which is self-evident under the terms of By-law 5.4.2, the Faculty Board has laid down its policy for the operation of By-law 5.4.1.2. This policy follows:

Part-time students must pass at least one subject in their first two years of enrolment. Students who do not meet this provision will be recommended to the Admissions Committee for exclusion from the degree course.
BACHELOR OF SCIENCE (METALLURGY)

ACCELERATED COURSE

A student reading for the degree of Bachelor of Science (Metallurgy) B.Sc. (Met.) may reduce the time required to complete the academic requirements by undertaking the following programme of combined part-time/full-time study.

Stage 1 — 30 weeks Part-time Course (as for Stage 1 B.Sc. (Met.) Course).

Stage 2 — 30 weeks Part-time Course (as for Stage 2 B.Sc. (Met.) Course).

Stage 3A — 30 weeks Full-time Course (as for Year II Full-time B.Met. Course).

Stage 4A — 30 weeks Full-time Course (as for Year III Full-time B.Met. Course).

Stage 5A — 30 weeks Part-time Course (as set out below).

STAGE 5A

30 WEEKS PART-TIME COURSE

<table>
<thead>
<tr>
<th>Subject</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Term 1</td>
</tr>
<tr>
<td>Metallurgy Project</td>
<td>4</td>
</tr>
</tbody>
</table>

Project — Project may involve laboratory work or a report on a literature survey or a combination of these by arrangement with the Head of Department.

In the event that it is elected to make a report on a literature survey, this is to be submitted not later than the end of the fifth week of third term. The survey is to be of approximately 10,000 words on a topic of relevance to the student's employment and which has been approved by the Head of Department. The topic proposed must be submitted to the Head of Department for approval before the end of the third week of first term.

PREREQUISITES AND COREQUISITES FOR THE COURSES IN METALLURGY

<table>
<thead>
<tr>
<th>Subject</th>
<th>Prerequisite</th>
<th>Pre- or Corequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metallurgical Computations</td>
<td>Mathematics I</td>
<td>—</td>
</tr>
<tr>
<td>Part A</td>
<td>Materials Science I</td>
<td>—</td>
</tr>
<tr>
<td>Metallurgy I</td>
<td>Materials Science I</td>
<td>Metallurgical Computations</td>
</tr>
<tr>
<td>Metallurgy IIA</td>
<td>(Metallurgy I</td>
<td>—</td>
</tr>
<tr>
<td>Metallurgy IIB</td>
<td>(Metallurgical (Computations</td>
<td>—</td>
</tr>
<tr>
<td>Metallurgy III</td>
<td>(Metallurgy IIA</td>
<td>(Metallurgy IIB</td>
</tr>
</tbody>
</table>

INDUSTRIAL EXPERIENCE REQUIREMENTS

Full-time students are required to obtain four months approved industrial experience before completion of their course.

The part-time courses are designed for students engaged in approved occupations in industry. Three concurrent years of approved industrial experience are required before completion of the course. The duration of the course may be reduced by one year by taking one year full-time in accordance with the scheduled "accelerated" course.

COMBINED DEGREE COURSE

Sample Programme

(for students wishing to enrol for the combined degree course under Section 12 of the Requirements for the degree of Bachelor of Metallurgy)

Metallurgy/ Mathematics

The details for the combined course in Mathematics and Applied Science follow simply from the Requirements for each degree. The degree in Mathematics requires nine subjects, that in Applied Science, thirteen, so that the combined degree requires 22 subjects, less four subjects for which standing may be given. Thus the combined degree should contain 18 subjects. The Bachelor of Mathematics requires Mathematics I, Mathematics IIA, Mathematics IIC, Mathematics IIIA and either Mathematics IIIB or a Part III subject from Schedule B of the Requirements. This leaves 13 subjects which must clearly satisfy the Requirements for Bachelor of Metallurgy.
The course could be pursued in the following manner:

YEAR I
Mathematics I
Materials Science I
Physics IA
and one of
Engineering I
Chemistry I
Geology I
OR any other subject approved by the Deans

YEAR II
Mathematics IIA¹
Mathematics IIB Part I¹
Metallurgical Computations Part B
Metallurgy I¹
and one of
Engineering II²
Chemistry I
Geology I
OR any other subject approved by the Deans

YEAR III
Mathematics IIC¹
Mathematics IIB Part 2¹
Metallurgy IIA
Metallurgy IIB

YEAR IV
Mathematics IIIA
and either
Mathematics IIIB
OR Schedule B Part III subject from the Requirements for B.Math.
and one of
Electronics & Instrumentation II
Physics II
Engineering Metallurgy IA
OR
Engineering Metallurgy IIB³

YEAR V
Metallurgy III
Metallurgy Project
Elective Subject¹

¹ Mathematics IIA — Topics A, C, D, E.
² Mathematics IIB Part I — Topics F, G.
³ Mathematics IIB Part 2 — Topics B, J.
Mathematics IIC — Topics H, I, K, L.

4 Excluding the subject taken in Year I.
5 With another (Engineering) topic substituted for Mathematics II,
   Topic B Complex Analysis.
6 Excluding Elective Mathematics.

Postgraduate Degrees

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—
(a) conduct the major proportion of the research or design work in the University; and
(b) take part in research seminars within the Department in which he is working.

(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 double-spaced typescript, shall include a summary of approximately 200 words, and a certificate signed by the candidate to the effect that the work has not been submitted for a higher degree to any other university or institution. The ORIGINAL copy of the thesis for deposit in the Library shall be prepared and bound in a form approved by the University. The other two copies of the thesis shall be bound in such manner as allows their transmission to the examiners without possibility of their disarrangement.

(vi) It shall be understood that the University retains the three copies of the thesis and is free to allow the thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act (1968) the University may issue the thesis in whole or in part in photostat or microfilm or other copying medium.

7. No candidate shall be considered for the award of the degree until the lapse of six complete terms from the date from which the registration becomes effective, save that in the case of a candidate who has obtained the degree of Bachelor with Honours or a qualification deemed by the Faculty Board to be equivalent or who has had previous research experience, this period may, with the approval of the Faculty Board, be reduced by up to three terms.

8. For each candidate there shall be two examiners appointed by 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.

**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;
   (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;
   (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;

1 Separate sheet on the preparation and binding of higher degree theses is available on application.
(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.

REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF ENGINEERING

1. The degree of Doctor of Engineering may be awarded by the Council, on the recommendation of the Senate, for an original contribution or contributions of distinguished merit to the science and/or practice of engineering.

2. A candidate for the degree of Doctor of Engineering 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 of the candidate although in special circumstances unpublished work may be considered provided that these circumstances are recognised as sufficient by the Senate.

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. A candidate for the degree shall make an application in writing to the Secretary setting out a statement of his academic qualifications. With the application he shall submit:

(a) Four copies of the work referred to in Clause 4 of these Requirements.

(b) Four copies of any additional work, published or unpublished, which he may desire to submit in support of his application.

(c) A Statutory Declaration indicating those sections of the work, if any, which have been accepted previously in partial fulfilment of the requirements for a degree or diploma in any 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 University may at the request of an examiner require the candidate to answer any questions concerning his work.

8. The result of the examination shall be in accordance with the decision of a majority of the examiners.

1 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 purpose of requiring publication is to ensure that the work submitted has been available for criticism by relevant experts, and examiners are given discretion to disregard any of the work submitted if, in their opinion, the work has not been so available for criticism.
Preface to Subject Description

Subject Outlines and Reading Lists are set out in a standard format to facilitate easy reference. The policy adopted in this Handbook for interpretation of the various sections is set out below. This may not necessarily be the same policy adopted for other Faculty Handbooks.

(1) Name
The official subject name as included in Schedule of the degree requirements. This name must be used when completing any forms regarding enrolment or variation of enrolment.

(2) Prerequisites
Before enrolling in the subject, a student shall have passed the subjects listed as prerequisites.

(3) Corequisites
A corequisite is a subject which should be taken concurrently with another subject if not previously passed.

(4) Hours
Formal sessions which students should attend.

(5) Examination
As well as formal examinations progressive assessment is used in most cases and students are required to submit exercises and assignments as specified by lecturers and tutors. Class tests may also be held during the year. Work completed during the year will be taken into account with a student's results at the final examination.

Failure to submit written work may involve exclusion from examinations.

(6) Content
An outline of subject content.

(7) Texts
Essential books which are recommended for purchase.

(8) References
Students should not restrict their reading to texts and other references are listed to cover various aspects of the subject. Students may need to read all or part of a reference to gain an appreciation of a particular topic.

Subject Description

111100 Materials Science I
Prerequisites Nil
Hours To be advised
Examination To be advised
Content
A unified introductory treatment of the structure and properties of materials generally.
Atomic arrangements in solids and errors in the regularity of stacking. The structure of liquids and gases. The physical properties of materials primarily dependent on atomic structure.
The electronic structure of atoms, molecular and condensed materials. The physical properties of materials primarily dependent on electronic structure.
Generation of microstructure and phase transformations in solid materials using simplified thermodynamic concepts as a unifying principle. Composite materials of all types where the microstructure is specifically controlled.
The deformation characteristics of materials including explanations based on dislocation theory. Environmental effects such as time and temperature.
The durability of materials with regard to surface effects and internal changes.
At all stages reference is made to technologically important materials in the illustration of principles.

Texts
1Dieter, G. E. Mechanical Metallurgy (McGraw-Hill 1964)
1 Available as paperback.

112301 Metallurgical Computations Part A
Prerequisites Material Science I, Mathematics I
Hours Six lecture hours per week
Examination To be advised
Content
Topics A, C, F & G (including tutorials) of Mathematics IIB.
112302 Metallurgical Computations Part B

Prerequisites
Material Science I, Mathematics I

Hours
Six lecture hours per week

Examination
To be advised

Content
Mass, Momentum and Energy balances.
Stoichiometry of metallurgical processes.
Thermochemistry and Electrochemistry calculations.
Thermodynamics of metallurgical processes.
Statistics and Experimental Design.

Texts
Wonnacott, T. H. & Wonnacott, R. J. Introductory Statistics (Wiley I. E.)

References
Pehlke, R. D. Unit Processes of Extractive Metallurgy (Elsevier 1973)


Prerequisite or Corequisite
Topic C

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

Examination
One 2-hour paper

Content
This topic is designed to introduce students to the idea of a mathematical model. Four or five realistic situations will be treated beginning with an analysis of the non-mathematical origin of the problem, the formulation of the mathematical model, solution of the mathematical problem and interpretation of the theoretical results. For example, models involving applications of operations research, probability and differential equations will be developed.

Text
Nil

References
Kemeny, J. G. & Snell, J. L. Mathematical Models in Social Sciences (Ginn Blaisdell 1963)
Noble, B. Applications of Undergraduate Mathematics in Engineering (M.A.A./Collier-Macmillan 1967)
Rapoport, Anatol & Chammah, A. M. Prisoner's Dilemma (University of Michigan Press 1965)

662103 Topic C — Calculus and Vector Calculus — R. J. Vaughan

Prerequisites
Nil

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

Examination
One 2-hour paper

Content

Text

References
Courant, R. Differential and Integral Calculus Vols. I & II (Blackie 1949)
Kaplan, W. Advanced Calculus (Addison-Wesley 1952)
Keane, A. & Senior, S. A. Mathematical Methods (Science Press Sydney 1961)


Prerequisites
Nil

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

Examination
One 2-hour paper
Content
Revision and extension of Fortran programming. Sources of error in computation. Solution of a single nonlinear equation. Interpolation and the Lagrange interpolating polynomial. Finite differences and applications to interpolation. Padé approximants. Numerical differentiation and integration including the trapezoidal rule, Simpson’s rule and Gaussian integration formulae. Numerical solution of ordinary differential equations — Runge-Kutta and predictor-corrector methods. Applications of numerical methods to applied mathematics, engineering and the sciences will be made throughout the course.

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

662203 Topic G — Fourier Series, Partial Differential Equations and Special Functions — E. R. Smith

Prerequisite or Corequisite
Topic C

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

Examination
One 2-hour paper

Content
Outline of derivations of partial differential equations; inadequacy of equations alone to specify solutions; boundary conditions; classification. Solutions using characteristics, solution by separation of variables. Fourier series; computation of cosine and sine series; Convergence properties of Fourier series; representation of functions by Fourier series; differentiation and integration of Fourier series; Solution of partial differential equations using Fourier series.
Solution of partial differential equations with two-dimensional space co-ordinates; separation of variables in polar and rectangular co-ordinates.
The Bessel equations and Bessel functions. Gamma and Beta functions. Solution of partial differential equations with three dimensional space co-ordinates; separation of variables in spherical co-ordinates and other co-ordinate systems; spherical harmonics; Legendre equations and Legendre polynomials.

Texts
Sneddon, I. N. Fourier Series (Routledge 1961)
AND
Weinberger, H. F. A First Course in Partial Differential Equation (Ginn Blaisdell 1965)

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

112200 Metallurgy I

Prerequisites
Material Science I

Corequisites
Metallurgical Computations

Hours
To be advised

Examination
To be advised

Content
A course of lectures on the operations and equipment, the scientific and engineering principles used in the production of metals from ores. Fuels, furnaces and combustion. The structure, properties and use of refractories.
The structure, properties and technique of examination of metals and alloys, with a consideration of the common alloy types, binary and ternary diagrams. Instrumentation in metallurgical techniques. Industrial alloys and metallurgical aspects of their fabrication.
Transformations in metallic systems, including generally used heat treatment processes, characteristics of martensite formation.
Theories of strength of metals, effect of stress state, temperatures and strain rate, metallurgical aspects of creep and fatigue, fracture types, effect of heating cold worked metals, mechanical testing of metals.

Texts
Dieter, G. E. Mechanical Metallurgy
Reed Hill, R. E. Physical Metallurgy Principles (Van Nostrand 1964)

Reference
Pehlke, R. D. Unit Processes of Extractive Metallurgy (Elsevier 1973)
### 113101 Metallurgy IIA Part I

**Prerequisites**  
Metallurgy I, Metallurgical Computations

**Hours**  
Six lecture hours, three tutorial hours and three hours laboratory per week

**Examination**  
To be advised

**Content**  
Experimental design, extractive metallurgy, rate processes, thermodynamics, and report writing and seminar.

**Texts**  
- Burke, J. *Kinetics of Phase Transformations* (Pergamon)

1 Denotes available as a paperback.

### 113102 Metallurgy IIA Part II

**Prerequisites**  
Metallurgy I, Metallurgical Computations

**Hours**  
Six lecture hours, three tutorial hours and three hours laboratory per week

**Examination**  
To be advised

**Content**  
Alloy steels, dislocation theory, electrochemistry, materials selection, metallography, solidification, x-ray metallography.

**Texts**  
- Flemings, M. C. *Solidification Processing*
- West

### 113200 Metallurgy IIB

**Prerequisites**  
Metallurgy I, Metallurgical Computations

**Hours**  
4½ lecture hours, 1½ tutorial hours and three hours laboratory per week

**Examination**  
To be advised

**Content**  
Subjects are to be chosen from selected topics of one of the following strands:

- **Extractive Metallurgy & Materials Technology**
  - Control theory
  - Operational research
  - Rate processes
  - Reactor analysis
  - Advanced extractive metallurgy and other topics as available.

- **Physical Metallurgy & Materials Science**
  - Advanced fabrication techniques
  - Diffraction methods
  - Electron theory
  - Dislocation theory
  - Transformations
  - Non-destructive testing and other topics as available.

**Texts**  
- Azaroff
- Flemings, M. C. *Elements of X-ray Crystallography* (McGraw-Hill)

### 114100 Metallurgy III

**Prerequisites**  
Metallurgy IIA, Metallurgy IIB

**Hours**  
To be advised

**Examination**  
To be advised

**Content**  
An advanced series of lectures on a wide range of topics is offered. From these and from any other approved course offered in other Departments the student may select areas of particular interest to himself.

A research project is carried out in First Term under the supervision of a member of staff.

Course topics offered within the Metallurgy Department are:
- Advanced dislocation theory — its applications to creep, fatigue, recovery and fracture.
The determination of crystal structures using X-ray and neutron diffraction:
Electron Microscopy
Thermodynamics of Alloys
Solidification Mechanisms
Physical Chemistry of Extraction Processes
Analysis of Metallurgical Reactors
Advanced Strengthening Mechanisms
Fracture Mechanics

**Engineering Metallurgy (Part of CE221)**

**Prerequisites**
Nil

**Hours**
To be advised

**Examination**
To be advised

**Content**
An introductory course on the elementary structure and properties of industrially important metals. The topics covered include lattice arrangement of atoms, strengthening mechanisms, fracture, fatigue, corrosion and welding, with the emphasis on current civil engineering problems and practices.

**Text**

**Engineering Metallurgy (Part of ME241)**

**Prerequisites**
Nil

**Hours**
To be advised

**Examination**
To be advised

**Content**
An introduction to the structure, properties and behaviour of metals. The fundamental relationships between atomic structure, microstructure and mechanical properties is developed. The microstructural and strength characteristics of steels, brasses, bronzes, aluminium alloys, titanium alloys, and cast irons are described. The special features of and difficulties associated with the techniques of welding are also covered.

**Text**

---

**SUBJECTS OFFERED BY OTHER FACULTIES**

The Faculty of Economics and Commerce

**421101 Microeconomics**

**Prerequisites**
Nil

**Hours**
Two lecture hours per week and one tutorial hour per fortnight

**Examination**
One 3-hour paper

**Content**
Microeconomics is the branch of economics that is concerned with the behaviour of individual consumers, firms and resource owners.

The course begins with a brief introductory account of the major problems of economics and the methods of economic analysis. It then reviews the theory of individual and market demand. After an analysis of the production function and costs of production, it examines the theory of firms' price and output policies in different market situations, paying attention to the results of both theoretical and empirical studies. The final section is concerned with the analysis of pricing and employment of productive resources.

**Suggested Preliminary Reading**

**Texts**
One of the following:

OR

OR

OR
References
Breit, W. & Hochman, H. M. Reading in Microeconomics (2nd ed. Holt, Rinehart & Winston 1971)
Clower & Due Microeconomics (Irwin 1972)
Mansfield, E. Microeconomics — Selected Readings (Norton 1971)
Shows, E. W. & Burton, R. H. Microeconomics (Heath 1972)

The Faculty of Engineering

521101 CE111 Statics
Prerequisites Nil
Hours One lecture hour and one ½ hour tutorial per week
Examination One 3-hour paper
Content Two-dimensional force systems; equilibrium, funicular polygon; rigid bars, shear force, axial force, bending moment; pin-jointed frames, analytical and graphic treatment; equilibrium of three-dimensional force systems, cables under distributed leads.

texts
Hall, A. S. & Archer, F. Principles of Statics (University of New South Wales Students Union)

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

522102 CE212 Mechanics of Solids I
Prerequisites Engineering I, Mathematics I
Hours 1½ lecture hours and ½ tutorial hour per week
Examination One 3-hour paper
Content Uniaxial loading, states of stress and strain, stress and strain relationships; internal forces, internal stresses, deflexion of beams, torsion, buckling.

531201 EE101 Introduction to Electrical Engineering
Prerequisites Nil
Hours 1½ hours of lectures, tutorial and laboratory work per week
Examination Progressive assessment and final examination
Content The systems concept in electrical engineering: relay communication systems, components of satellite relays, typical control systems, instrumentation systems. System building blocks, signal wave forms, signal processing for information transmission, amplitude modulation and other forms of modulation. Electromechanical devices. Topics in computer science; Introduction to switching theory, Boolean algebra, number representation and arithmetic operations, binary arithmetic, basic computer organisation. Engineering applications of computers.
Application of electrical engineering to biological and socio-economic and industrial systems.
532103 EE203 Introduction to Electrical Information

Prerequisites
Mathematics I and Physics IA or IB

Hours
Three hours of lectures, tutorials and laboratory work per week

Examination
Progressive assessment and final examination

Content

Correct use of safety features to be observed in laboratory instruments. Component Codes. Descriptive explanation of basic laboratory instruments.

Diodes and transistors as circuit elements (via characteristics and one equivalent circuit). Basic amplifier and oscillator circuits, including simple transistor switches, multivibrators, amplitude modulation and demodulation. A short description of pulse and frequency modulation (qualitative approach, without amplifier frequency response).

Fundamental principles of measuring non-electrical quantities by electrical means.

541101 ME111 Graphics

Prerequisites
Nil

Hours
42 hours

Examination
Progressive assessment

Content
A study of communication and analysis by pictorial means.

Graphical Presentation and Analysis of Data
Vector diagrams, charts, graphs, plotting and curve fitting Log-log plotting. Graphical differentiation and integration.

Projection
A detailed study of the methods of projection covering: sketching; orthogonal projection of points, lines, planes and solids; lengths of lines, angles and intersections between lines, planes and contoured surfaces; orthographic projection, dimensioning and sectioning; isometric projection; perspective projection.

References
Barle, J. H. Design Drafting (Addison Wesley 1972)
Levens, A. S. Graphics (Wiley 1968)
OR
Luzadder, W. J. Basic Graphics (Prentice-Hall 1968)
541102 ME112 Engineering Drawing and Elementary Design

Prerequisites  Nil
Hours  42 hours
Examination  Progressive assessment

Content

Texts
ASCZI  Australian Standard Engineering Drawing Practice (Institution of Engineers, Australia 1973)
Levans, A. S.  Graphics (Wiley 1968)
OR
Luzadder, W. J.  Basic Graphics (Prentice-Hall 1968)

References
Earle, J. H.  Design Drafting (Addison Wesley 1972)

541201 ME121 Workshop Practice

Prerequisites  Nil
Hours  48 hours
Examination  Progressive assessment

Content
A study of basic methods and processes used in the engineering trades with instruction, practice and assignments related to fitting and machining, drilling, welding processes, boilermaking, patternmaking, foundry practice, and the engineering inventory of materials and components.

Patternmaking and foundry practice will only be available for Metallurgy Students in ME121.

Text
Tech. Education  Trade Technology Notes

References
DeGarmo, E. P.  Materials and Processes in Manufacturing (McMillan)
Doyle, L. E. et al  Manufacturing Processes and Materials for Engineers (Prentice-Hall)

H. Ford Trade School  Shop Theory (McGraw-Hill)

541103 ME131 Dynamics

Prerequisites  Nil
Hours  42 hours
Examination  One 3-hour paper

Content
A Study of Force and Motion
The forces involved in motion; gravity, dry friction, viscous friction, rolling friction. The “free body” and control volume techniques. Internal and external forces and equilibrium.

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

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

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

Text

Reference
### 542101 ME222 Process Technology

**Prerequisites**
ME121

**Hours**
42 hours

**Examination**
Progressive assessment

**Content**

**Texts**
DeGarmo, E. P. *Materials and Processing in Manufacturing* (Macmillan)

Doyle, L. E. et al *Manufacturing Processes and Materials for Engineering* (Prentice-Hall)

**References**
Campbell, J. S. *Processes and Materials in Manufacturing* (McGraw-Hill)

Datsko, I. *Materials, Properties and Manufacturing Processes* (Wiley)

### 542202 ME251 Fluid Mechanics

**Prerequisites**
Mathematics I and ME131

**Hours**
42 hours

**Examination**
Progressive assessment

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

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

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

**References**


### 543202 ME372 Heat Transfer

**Prerequisites**
Mathematics IIB

**Hours**
42 hours

**Examination**
Progressive assessment

**Content**
Conduction; steady and unsteady, one and two dimensional, with and without internal heat generation and including convection boundaries. Numerical and analogue solutions.

Convection; laminar and turbulent. Analytical and empirical solutions. Analogy between momentum and heat transfer.


**Text**

**References**


### 543501 ME381 Methods Engineering

**Prerequisites**
Mathematics I and ME222/3

**Hours**
42 hours

**Examination**
Progressive assessment

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

References
Alford L. P. & Bangs, J. R. (eds)  
Production Handbook (Ronald)
Barnes, R. M.  
Motion and Time Study (Wiley)
Krick, E. V.  
Methods Engineering (Wiley)
Maynard, H. B. (ed.)  
Industrial Engineering Handbook (McGraw-Hill)

544451 ME401 Systems Analysis
Prerequisites  
Maths IIB, ME361
Hours  
42 hours
Examination  
Progressive assessment

Content

Texts
Nil

References
Busacker & Saaty  
Finite Graphs and Networks (McGraw-Hill 1965)
Haberman, C.  
Engineering Systems Analysis (Merril 1965)
Hall, A.  
A Methodology for Systems Engineering (Van Nostrand 1962)
McMillan, C. & Gonzalez, R. F.  
Systems Analysis. A computer approach to Decision Models (Irwin-Dorsey 1968)
Machol, R.  
Systems Engineering Handbook (McGraw-Hill)

544452 ME402 Systems Planning, Organisation and Control
Prerequisites  
Mathematics IIB and ME361
Hours  
42 hours
Examination  
Progressive assessment

Content

Texts
Nil

References
Ackoff, R. L.  
A Concept of Corporate Planning (Wiley 1970)
Antill, J. M. & Woodhead, R. W.  
Critical Path Methods in Construction Practice (McGraw-Hill 1965)
Battersby, A.  
Network Analysis for Planning and Scheduling (Macmillan)
Buffa, E.  
Production Inventory Systems (Irwin)
Carzo, R. & Yanouzas, J. U.  
Formal Organisation, A Systems Approach (Irwin-Dorsey 1965)
Hall, A.  
A Methodology for Systems Engineering (Van Nostrand 1962)
McMillan, C. & Gonzalez, R. F.  
Systems Analysis. A Computer Approach to Decision Models (Irwin-Dorsey)
Machol, R.  
Riggs, J. L.  
Production Systems. Planning Analysis and Control (J. Wiley)
Wayne-Weymore, A.  
A Mathematical Theory of Systems Engineering (Wiley 1967)
### 544101 ME481 Engineering Administration

**Prerequisites**  
Mathematics I

**Hours**  
42 hours

**Examination**  
One 2-hour paper

**Content**

**Text**
Buffa, E. S.  *Modern Production Management* (Wiley)

**References**
Bynt, W. J.  *People and Organization* (McGraw-Hill)

### 544841 ME487 Operations Research — Deterministic Models

**Prerequisites**  
Mathematics II B

**Hours**  
42 hours

**Examination**  
Progressive assessment

**Content**
Concept of optimisation; Optimisation approaches; Formulation of Models; Linear Programming; Allocation and assignment; Simplex Method; Duality; Theory of Games; Parametric Programming; Integer Programming; Zero-one Programming; Quadratic Programming; Decomposition principle. Network theory; Dynamic Programming. Geometric Programming. Applications.

**Texts**
Wagner, H. W.  *Principles of Operation Research* (Prentice-Hall)

**References**
Hillier, I. S. & Lieberman, G. J.  *Introduction to Operations Research* (Holden-Day)
McMillan, C.  *Mathematical Programming* (Wiley)
Taha, H. A.  *Operations Research* (Macmillan)
The Department offers and examines subjects. Each subject is composed of topics, each topic consisting of about 27 lectures and 13 tutorials throughout the year. Each of the Part I, Part II, and Part III subjects consists of four topics. For Mathematics I, there is no choice of topics; for Mathematics IIA, IIB, IIC there is some choice available to students; for Mathematics IIIA and IIIB there is a wider choice. No topic may be counted twice in making up distinct subjects.

(Students who passed some mathematics subjects before this arrangement of subject 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.)

**PART I SUBJECT**

**661100 Mathematics I**

**Prerequisites** Nil

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

**Examination** Two papers each of three hours duration

**Content**

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

**PART I TOPICS**

**Topic AN — Real Analysis — M. J. Hayes**

**Prerequisites** Nil

**Hours** One lecture hour per week and one tutorial hour per fortnight

**Content**

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

Text


(This is the general text for the course.)

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

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

**Reference**

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

**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.

**Text**

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

**References**

Liebeck, H. *Algebra for Scientists and Engineers* (Wiley 1971)

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

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

Tropper, A. Mary *Linear Algebra* (Nelson 1973)

**Topic CA — Calculus — E. R. Smith**

**Prerequisites** Nil

**Hours** One lecture hour per week and one tutorial hour per fortnight
Content

Text

References
Britton, J. R., Kriegh, R. B. & Rutland, L. W. *Calculus and Analytic Geometry* (Freeman 1966)
Hille, E. & Salas, S. *First Year Calculus* (Ginn Blaisdell 1968) (International Textbook Series)

Topic NM — Numerical Mathematics — W. Summerfield

Prerequisites
Nil

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

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

Texts
Blatt, J. M. *Basic Fortran IV Programming* (Computer Systems of Australia Pty Ltd)
Wilkes, M. V. *A Short Introduction to Numerical Analysis* (Cambridge University Press 1971)

References

PART II SUBJECT

662200 Mathematics IIB

Prerequisites
Mathematics I

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

Examination
Each topic is examined separately

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. Students in the Faculty of Applied Science may take Mathematics IIB in two parts, each part consisting of two topics. They are not permitted to take Topics A, C, F and G, which are included in Metallurgical Computations.

LIST OF TOPICS FOR PART II 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.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Corequisite or Prerequisite Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Mathematical Models</td>
</tr>
<tr>
<td>B</td>
<td>Complex Analysis</td>
</tr>
<tr>
<td>C</td>
<td>Calculus and Vector Calculus</td>
</tr>
<tr>
<td>D</td>
<td>Linear Algebra</td>
</tr>
<tr>
<td>E</td>
<td>Differential Equations and Integral Transforms</td>
</tr>
<tr>
<td>F</td>
<td>Numerical Analysis and Computing</td>
</tr>
<tr>
<td>G</td>
<td>Fourier series, Partial Differential Equations and Special Functions</td>
</tr>
<tr>
<td>H</td>
<td>Probability and Statistics</td>
</tr>
<tr>
<td>I</td>
<td>Topic in Statistics</td>
</tr>
<tr>
<td>J</td>
<td>e.g. Non-parametric Methods</td>
</tr>
<tr>
<td>K</td>
<td>Topic in Applied Mathematics</td>
</tr>
<tr>
<td>L</td>
<td>e.g. Mechanics</td>
</tr>
<tr>
<td>M</td>
<td>Topic in Pure Mathematics</td>
</tr>
<tr>
<td>N</td>
<td>e.g. Group Theory</td>
</tr>
<tr>
<td>O</td>
<td>Analysis of Metric Spaces</td>
</tr>
</tbody>
</table>
TEXTS FOR PART II TOPIC

**Topic A**
Nil

**Topic B**

**Topic C**

**Topic D**
Nil

**Topic E**

**Topic F**
OR

**Topic G**
Weinberger, H. F. *A First Course in Partial Differential Equations* (Ginn Blaisdell 1965)
AND
Sneddon, I. N. *Fourier Series* (Routledge 1961)

**Topic H**
OR

**Topic I**
Conover, W. J. *Practical Non-parametric Statistics* (Wiley 1971)

**Topic J**

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

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

Elective Mathematics (for Metallurgy Students)
Students taking this subject will study certain of the Topics A to L above approved by the Head of the Department of Metallurgy.
The Faculty of Science

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 s-block elements (Groups IA and 2A), selected 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; bonding 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)

1An alternative text for the organic section of the course.

731100 Geology I

Prerequisites
Nil

Hours
Three lecture hours and 2½ laboratory hours per week with 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.

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

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

732800 Geology II

Prerequisites
Geology I

Hours
Normally by an internal assessment determined by the Department of Geology

Examination

Content
This is an elective subject taken during the First Term with Geology IIA students. Crystallography; chemistry and physics of minerals; genesis of minerals.

Texts
Bishop, A. C. An Outline of Crystal Morphology
741200 Physics IA

Prerequisites
Science 2F (advisory)

Hours
Three lecture hours and three hours of laboratory and tutorial work per week

Examination
Three 2-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

Resnick & Halliday Physics (Combined Edition)

742200 Electronics & Instrumentation II

Prerequisites
Physics IA or IB

Hours
Three lecture hours, four laboratory hours and two tutorial hours and directed assignments each week

Examination
One 2-hour paper on each of the three topic selected

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

Topic B — Instrumentation Theory.


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.

Text
Malmstadt, Enke & Crouch Instrumentation for Scientists Series, Texts with Experiments Modules 1, 2, 3 & 4 (Benjamin Inc.)

Supplementary and Reference Texts to be announced later.

742100 Physics II

Prerequisites
Physics IA and Mathematics I

Hours
Three lecture hours and three laboratory hours per week

Examination
Three 2-hour papers

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).

A pass in Physics II by a Metallurgy student will qualify as a prerequisite for Physics IIIA.

Texts
Baird, D. C. Experimentation (Prentice-Hall)
Smith, F. G. & Thompson, J. H. Optics (Wiley 1971)
Young, H. D. Fundamentals of Optics & Modern Physics (McGraw-Hill)

Any further texts will be listed in the Physics Department by late 1974.
POSTGRADUATE DEGREES AND RESEARCH FACILITIES

The Department of Metallurgy has the facilities for undertaking research leading to the degrees of Master of Science (M.Sc.), Master of Engineering (M.E.), Doctor of Philosophy (Ph.D.), Doctor of Science or Doctor of Engineering.

Postgraduate scholarships are available to candidates who have obtained a good Honours degree to allow them to undertake research studies on a fulltime basis. These scholarships pay fees and provide stipends with other supplementary allowances in certain cases. Full details are given in the University Calendar, while information concerning special scholarships is posted from time to time on the departmental notice boards.

RESEARCH FACILITIES

The following is a brief description of some of the facilities available in the Department:

1. Electron Microscopy: an AEI EMGG transmission electron microscope with high angle tilting stage, heating stage, and anti contamination cold finger is available for high resolution work to 5 Å. A Philips EM 75 is also available. A scanning electron microscope with resolution better than 100Å° and fitted with wave dispersive and energy dispersive X-ray analysis attachments is also located in the Department. Spark machining and vacuum coating equipment is available for use with these microscopes.

2. Optical Microscopy: a Zeiss Ultraphot II as well as a Reichert ME F2 and other general microscopes.

3. X-ray diffraction: three X-ray sets are in use for general structure and crystal orientation work. One of these sets is equipped with a Rigaku-Denki horizontal diffractometer, print-out scaler and high temperature attachment. A Unicam S150 high temperature powder camera is also on hand.

4. Melting facilities: the Department has two high frequency units available for the preparation of special alloys — a 30kW Heraeus vacuum melting unit, capable of handling 15lb melts of steel, a 3kW unit for small, special alloy development. There is also a molybdenum furnace for very high temperature work and the usual range of other electrical furnaces.

5. Mechanical working equipment including a rolling mill, swage and wire drawing bench.

6. Mechanical properties: hardness and microhardness testers, two impact machines, and a variety of small tensile testing machines are available. The Department also has access to the other larger tensile machines in Civil Engineering, including a 20,000 lb I Intron and an M.T.S. Universal Testing System.

7. Internal Friction: an inverted pendulum is being constructed.

8. A magnetic balance is under construction for susceptibility measurements on metals and alloys.


10. The Department has presently on extended loan a 5000 amp. D.C. supply for fused salts research.

11. Computational equipment: programmable desk calculator, 8k mini computer and remote access terminal to ICL1904A in the University Computing Centre.

12. A multi purpose 450 amp welding unit with automatic programming facilities is being installed.

RESEARCH INTERESTS

The following is a brief resume of the research interests in the Department:

Yield point phenomena (E. O. Hall)
The effects of interstitial and substitutional elements on the yield points of metals. Systems under consideration include a range of low alloy steels, as well as mild steels of various grades and nonferrous alloys.

Structure of intermetallic compounds (E. O. Hall, J. D. Browne)
A range of these compounds which possess ordering or other unusual magnetic properties is under examination. X-ray and neutron diffraction, and magnetic measurements are used to elucidate these structural transformations.

Thermodynamics of alloys (W. A. Oates)
Work in this area is particularly concerned with metal-gas systems, metal-interstitial alloys and the vapour pressure of alloys.


**Fluid mechanics of pyrometallurgical processes** (N. A. Molloy)
Research in production metallurgy is carried out in the basic fields of fluid mechanics, liquid metal flow, and cold modelling of high temperature reactors, for mathematics modelling of metallurgical reactors.

**Electrochemical engineering** (R. D. Holliday)
Specific areas of interest here include the chemistry of molten salts, electrochemical processes in molten halides, and structural materials and control processes in high temperature systems.

**Internal friction** (J. E. McLennan)
The kinetics of precipitation of carbon and nitrogen from solution during the aging of α-iron after radiation damage or strain aging is being studied. The interaction of carbon and nitrogen with substitutional alloying elements in α-iron is also being studied.

**Mechanical Behaviour of Cast Materials** (D. Jaffrey)
This field is concerned with the basic dependence of mechanical properties, especially toughness, on the as-cast structures and morphologies of materials. The influence of certain solidification variables during the formation of metal castings, ingots, and welds on their final strengths and microstructures is under investigation.

Further details on these research projects may be obtained from the staff members cited above.

Publications by members of staff are listed in the University Calendar.

**OUTSIDE SUPPORT FOR RESEARCH ACTIVITIES**
Support for research activities in the Department is from:
- The Australian Research Grants Committee
- The Australian Institute of Nuclear Science and Engineering
- Commonwealth Steel Co. Ltd.
- Conzinc-Rio Tinto (Australia) Pty. Ltd.