FOREWORD

On behalf of the staff of the Faculty of Engineering, I wish to extend a very warm welcome to all students—those who are entering the University and the Faculty for the first time and those who are returning to commence another year of studies.

To new and prospective students may I begin by briefly acquainting you of the structure of the Faculty of Engineering. The Faculty comprises five Departments: Chemical, Civil, Electrical and Mechanical Engineering and Metallurgy. In addition to the Bachelors degree programmes offered in these five major areas, the Department of Civil Engineering currently offers part of the Bachelor of Surveying course, Electrical Engineering the B.E. in Computer Engineering, and Mechanical Engineering the B.E. in Industrial Engineering. Courses are available on a full-time or part-time basis, or a combination of these, and in each degree programme the opportunity for some specialization exists in the later course years through a wide selection of technical electives. The Faculty is also active at the postgraduate level, offering formal courses leading to the Diploma in Industrial Engineering and Master of Engineering Science, as well as providing opportunities for postgraduate research at Masters and Doctorate levels. Through the specialized research interests of the various Departments, a wide range of study areas is available.

The Engineering Faculty is conscious of the need to maintain professional standards and is continually up-dating course material, critically evaluating teaching and assessment methods, and introducing many innovations to meet the current demands and future requirements of the professions and society. Whilst students are required to gain an in-depth knowledge of the fundamental principles of their chosen field, it is also important that they gain some breadth of understanding in other subject areas. Besides the essential core material, our degree programmes provide some flexibility in the choice of electives with the opportunity to study subjects in other faculties. For those seeking a wider educational experience, opportunities exist for study in one of the several five-year full-time combined degree programmes the Engineering Faculty has introduced in conjunction with the Faculties of Arts, Science, Mathematics and Economics and Commerce.

As an integral part of the degree requirements, all students must obtain a period of approved industrial experience. Full-time students are encouraged to gain this experience during University vacations. Part-time students in appropriate employment have the opportunity of taking Industrial Experience Elective Units which count towards their degree. These units were first introduced in 1974 and have proved to be very successful. Not only do they encourage students in industry to gain a great deal more benefit from their work experience
but in addition they provide important feed-back to the members of the Engineering Faculty on the relationship of the academic work of the University with students' work assignments in industry.

Besides the emphasis given to meeting academic requirements, it is essential that students gain a well rounded tertiary educational experience. The University environment, with its excellent campus and facilities, together with the many extra-curricula activities, creates an opportunity for obtaining a total experience, indeed a unique experience in one's lifetime. For this reason I would encourage you to take full advantage of the opportunities available to you and, where time permits, take an active interest in the various facets of University life.

The staff of the Faculty will do everything possible to make your work both interesting and enjoyable and will be anxious to help you with any problems you may have. I personally would be most happy to assist you wherever I can and would be grateful for any feed-back of a constructive nature that you may wish to offer.

In conclusion, I wish you well in your studies at this University. There is no doubt that a course of study leading to an Engineering or Metallurgy degree requires a great deal of dedication and perseverance, but the task is certainly a rewarding one.

A. W. Roberts

Dean

Faculty of Engineering
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Faculty of Engineering

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

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A. UNDERGRADUATE COURSES

DEGREE REQUIREMENTS

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1. GENERAL

1. Definitions

In these Requirements, unless the contrary intention appears: “the Faculty” means the Faculty of Engineering and “the Faculty Board” means the Faculty Board of the Faculty of Engineering; “the Dean” means the Dean of the Faculty of Engineering and “the Department” means the Department responsible for the course in which the candidate is enrolled.

2. Grading of Degrees

(a) (i) Each of the degrees of Bachelor of Engineering and Bachelor of Metallurgy may be conferred either as an ordinary degree or as a degree with honours.

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

(iii) In each degree course, the most distinguished of the candidates being awarded First Class Honours may be awarded a University Medal.

(b) Each of the degrees of Bachelor of Science (Engineering) and Bachelor of Science (Metallurgy) may be conferred either as an ordinary degree or as a degree with merit.

3. Approval of Enrolment

In any year a candidate shall enrol only in those subjects in which his enrolment has been approved by the Dean or a nominee of the Dean on the recommendation of the Head of Department in which the candidate is enrolling.
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. **A Subject**

(a) To complete a subject qualifying towards a degree, hereinafter called a subject, a candidate shall attend such lectures, tutorials, seminars, laboratory classes and field work and carry out such other work as the Department offering the subject may require.

(b) To pass a subject, a candidate shall satisfy the requirements of sub-section (a) of this section to the satisfaction of the examiners and pass such examinations as the Faculty Board shall require.

(c) Subjects for which the course of instruction extends over the first half of the academic year only, the second half of the academic year only, the whole or the substantially greater part of the academic year, shall be classified as Type A, Type B and Type AB subjects respectively.

6. **Annual Examinations**

The Annual Examination in each subject may be held at any time after the end of the course of instruction in that subject as the Faculty Board may determine. Such Examination may be written, oral or practical, or any combination of these, and may be supplemented or replaced by progressive assessments made during the course of instruction.

7. **Special and Deferred Examinations**

A candidate may be granted special or deferred examinations in accordance with the provisions of By-law 5.9.3.

8. **Examination Grades**

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

(b) The result of a successful candidate at a Deferred Examination shall be classified only as a Pass.

9. **Withdrawal**

(a) A candidate may withdraw from a subject or course only by notifying the Secretary to the University in writing and the withdrawal shall take effect from the date of receipt of such notification in writing.
(b) A candidate who after:
the eighth Monday in First Term, in the case of a Type A subject;
the sixth Monday in Second Term, in the case of a Type AB subject;
the second Monday in Third Term, in the case of a Type B subject;
withdraws from any subject shall be deemed to have failed in that subject, unless granted permission by the Dean to withdraw without penalty.

10. Unsatisfactory Progress
A candidate whose progress is unsatisfactory will be dealt with under the provisions of By-laws 5.4.1, 5.4.2 and 5.4.3.

11. Prerequisites and Corequisites
A candidate may not enrol in any subject unless he has satisfied the requirements for prerequisites and has enrolled in or has already passed the corequisite prescribed for that subject except with the permission of the Dean acting on the recommendation of the Head of Department offering the subject.

12. Standing
(i) A candidate may be granted standing in subjects prescribed for the course in which he is enrolled in recognition of work completed in this University or another institution subject to the provisions of By-law 5.8.1.3.
(ii) A candidate may be granted credit for elective units in recognition of subjects passed elsewhere which are not offered in this University.

13. Progression
(i) Progression in the course shall be by subject.
(ii) Except with the permission of the Dean a candidate may not enrol for a programme having a greater work load than a normal year's programme as set out in the Schedules attached.

14. Mutually Exclusive Subjects or Part Subjects
A candidate may not have counted towards the degree units derived from more than one of such subjects or part subjects as the Faculty Board may deem to be mutually exclusive.

15. Alternative Subjects
A candidate may, with the permission of the Head of Department, substitute for any subject another subject deemed by the Faculty Board to be an acceptable alternative.
2. **BACHELOR OF ENGINEERING**

To qualify for admission to the degree of Bachelor of Engineering, a candidate shall satisfy the requirements of one of the following courses, as prescribed in the Schedules to these Requirements, and satisfy the industrial experience requirements as prescribed by the Faculty Board.

Bachelor of Engineering in Chemical Engineering — Schedule 1.1
Bachelor of Engineering in Civil Engineering — Schedule 1.2
Bachelor of Engineering in Electrical Engineering — Schedule 1.3
Bachelor of Engineering in Industrial Engineering — Schedule 1.4
Bachelor of Engineering in Mechanical Engineering — Schedule 1.5
Bachelor of Engineering in Naval Architecture — Schedule 1.6
Bachelor of Engineering in Computer Engineering — Schedule 1.7

3. **BACHELOR OF METALLURGY**

To qualify for admission to the degree of Bachelor of Metallurgy, a candidate shall satisfy the requirements for the course as prescribed in Schedule 2.1 to these Requirements and satisfy the industrial experience requirements as prescribed by the Faculty Board.

4. **BACHELOR OF SCIENCE (ENGINEERING)**

(a) To qualify for admission to the degree of Bachelor of Science (Engineering) a candidate shall satisfy, normally by part-time study, the requirements of one of the following courses as prescribed in the Schedules to these Requirements and satisfy the industrial experience requirements prescribed by the Faculty Board.

Bachelor of Science (Engineering) in
Chemical Engineering — Schedule 3.1

Bachelor of Science (Engineering) in
Civil Engineering — Schedule 3.2

Bachelor of Science (Engineering) in
Electrical Engineering — Schedule 3.3

Bachelor of Science (Engineering) in
Industrial Engineering — Schedule 3.4

Bachelor of Science (Engineering) in
Mechanical Engineering — Schedule 3.5

Bachelor of Science (Engineering) in
Naval Architecture — Schedule 3.6
(b) The following additional requirements shall apply to the Bachelor of Science (Engineering) course in Civil, Electrical, Mechanical and Industrial Engineering and Naval Architecture.

(i) No candidate shall be permitted to enrol or re-enrol in these courses unless he was enrolled in the course prior to the 1st January, 1974.

(ii) A candidate who was enrolled in the course prior to the 1st January, 1974, may Either
(a) transfer to the Bachelor of Engineering course with the transition arrangements as set out in Appendix B to the Requirements Or
(b) continue in the course for as long as he has passed sufficient subjects in the course to enable him to complete all requirements for admission to the degree before the end of the 1979 academic year.

5. BACHELOR OF SCIENCE (METALLURGY)

To qualify for admission to the degree of Bachelor of Science (Metallurgy) a candidate shall satisfy, normally by part-time study, the requirements for the first three years of the course as set out in Schedule 2.1 to these Requirements and satisfy the industrial experience requirements as prescribed by the Faculty Board.

6. COMBINED DEGREE COURSES

(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 Credit level.

(iii) The Deans of both Faculties, after consultation with the Heads of Departments concerned, 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) Bachelor of Engineering
A candidate may satisfy the requirements for admission to the degree of Bachelor of Engineering in any specialisation together with the requirements for admission to the degree of Bachelor of Arts or Bachelor of Commerce or Bachelor of Science by completing a combined course approved by the Faculty Board of the Faculty of Engineering and the Faculty Board, Faculty of Arts, Faculty of Economics and Commerce or Faculty of Science as appropriate.
provided that:
A combined course leading to admission to the degrees of Bachelor of Arts and Bachelor of Engineering shall include, in addition to the requirements for admission to the degree of Bachelor of Engineering, five subjects which must include not less than one Part III and one Part II subject and at least four of which shall be selected from Group I of the Schedule of Subjects to the Requirements for the degree of Bachelor of Arts.

(v) Bachelor of Metallurgy
A candidate may satisfy the requirements for admission to the degree of Bachelor of Metallurgy together with the requirements for admission to the degree of Bachelor of Mathematics by completing a combined course approved by the Faculty Board of the Faculty of Engineering and the Faculty Board, Faculty of Mathematics.

provided that:
An approved course leading to admission to the degrees of Bachelor of Mathematics and Bachelor of Metallurgy shall satisfy the requirements for admission to each degree except that:

(1) Mathematics II may not be included in the five subjects prescribed in Section 12 (a)(i) of the Requirements for the degree of Bachelor of Mathematics.

(2) In Schedule 2.1—
(a) Mathematics I shall be replaced by Chemistry I or Geology I or any other subject approved by the Deans.
(b) Metallurgical Computations shall be replaced by Mathematics II, which may be taken in two parts, each of two lectures per week for three terms.
(c) No Mathematics subjects may be taken as electives.

7. ELECTIVE REQUIREMENTS
The Elective subjects included in the courses shall be selected in accordance with the Elective requirements as set out in Appendix A to these Requirements.

8. RELAXING CLAUSE
In order to provide for exceptional circumstances arising in particular cases, the Senate, on the recommendation of the Faculty Board, may relax any provision of these Requirements.
APPENDIX A — ELECTIVE REQUIREMENTS

Elective units must be selected with the approval of the Head of Department and the Dean in accordance with the following rules. Where a student elects to take an Industrial Experience unit, the responsibility for organising the necessary facilities shall rest entirely with the student, subject to the approval of the arrangements by the Head of Department concerned. The University can accept no responsibility for organising suitable employment.

1. DEPARTMENT OF CHEMICAL ENGINEERING

Elective I

Students must take Chemistry I as Elective I.

Elective II

Elective II requires the completion of professionally relevant topics of a total rating of not less than five units (normally 7½ hours/week) taken from other departments in the University. Normally students will include EE203 Introduction to Electrical Information — EE204 Introduction to Electrical Energy and materials science and structural mechanics (e.g. CE202). Students of a sufficient level of achievement may, with the approval of the Head of Department of Chemical Engineering, replace these topics with advanced work in Chemistry, Mathematics, Metallurgy or Industrial Engineering.

Elective IIA

Elective IIA consists of six units to be taken between Stage 5 and Stage 6 and may include up to four units of advanced topics in Chemical Engineering III for students who wish to specialise in some particular field of Process Engineering (e.g. Fuels and High temperature Processes, Hydrometallurgy, etc.) In this case the remaining units of this elective must be selected appropriately by consultation with the Head of Department of Chemical Engineering.

Elective III

Elective III is normally a full first year level subject or equivalent material taken in breadth and depth in a faculty other than Engineering.

INDUSTRIAL EXPERIENCE ELECTIVES

One Elective unit will accrue for each year's satisfactorily reported experience of adequate technical content. At least two reports will be required for each year. A maximum of four units will be allowed and may be equated to Elective III or to units from Elective II.
6. Chemistry I may be taken in lieu of Chemistry IS and two non-engineering electives and Physics II in lieu of PH221 and two non-engineering electives.

7. For the Bachelor of Arts/Bachelor of Engineering degree in Electrical Engineering, the rules are as for the Bachelor of Engineering degree save that the eight elective units to be taken outside the Faculty of Engineering must all be applied to Arts subjects. As the student is required to take a Part III Arts subject in the Arts year, one of the subjects taken as an Elective must be a Part II subject.

8. For the Bachelor of Science/Bachelor of Engineering degree in Electrical Engineering, the rules are as for the Bachelor of Engineering degree save that the eight elective units to be taken outside the Faculty must be applied to four units of Arts, two units towards Physics II, and two units of second-year Mathematics topics.

9. In any year, except the first year of the course, when a student enrolls on a part-time basis, one year of industrial experience may be substituted for one elective unit up to a total of five elective units. Not more than four such units may be substituted for non-engineering units and not more than four such units may be substituted for units within the eight engineering elective units. A first year Arts subject or the equivalent in a non-technical area must still be taken. To earn this substitution, the student must submit a report concerning his practical experience for the year to the department secretary by the 31st October of the year for which the substitution is being sought and such other reports as may be required.

Bachelor of Science (Engineering) in Electrical Engineering

The twelve elective units in the B.Sc.(Eng.) course are to be selected by the student, with the advice and approval of his academic advisor, subject to the following requirements:

1. A minimum of four elective units are to be taken within the Faculty of Engineering, at least two of which must be from outside the Department of Electrical Engineering.

2. One first-year Arts subject or the equivalent must be taken in a non-technical area. It will be counted as four elective units.

3. If a student elects to do a subject at one level which is required at a later level, the later requirement is to be replaced with elective units.

4. The first digit in the number of a topic is not to be interpreted as the year in which the topic must be taken. In particular, students are encouraged to elect EE400 topics at any level in their programme subject to pre- and corequisite requirements.
5. A first-year subject in another faculty taken as an elective is normally equivalent to four units. Half a first-year subject in these faculties is normally equivalent to two units.

6. Any student enrolled in the Faculty of Engineering who is required, or who elects, to take Economics I as part of his course must take the two subjects:

Microeconomics and Economic History I

with the exception of those students whose courses do not include Mathematics II, Topic H. Such students may replace Economic History I by Economic Statistics I. However a student taking this combination will not be allowed to take Mathematics II, Topic H at a later stage and count it towards his degree.

Students enrolling for Electives which are normally three hours per week only, may enrol in Microeconomics or Economic History I.

4. **DEPARTMENT OF MECHANICAL ENGINEERING**

1. At least 2 units of 4-unit elective in Year III must be taken outside the Faculty.

2. Not more than 6 units may be taken outside the Faculty.

3. At least 3 of the 6 elective units taken in Year IV must be selected from the departmental list of technical electives.

4. For students in full employment proceeding as part-time students, each year of appropriate employment that is supervised and approved by the Head of Department is credited as 1 unit of elective.

A maximum of 5 such units is allowed, described as:

- **ME092 Industrial Experience** 1 unit
- **ME093 Industrial Experience** 1 unit
- **ME094 Industrial Experience** 1 unit
- **ME095 Industrial Experience** 1 unit
- **ME096 Industrial Experience** 1 unit

These elective units may be used to meet any elective requirements in Clauses 1 and 2 above, except the departmental technical elective requirement in Clause 3.
5. DEPARTMENT OF METALLURGY

**Elective I**

The four elective units in the second year programme must be chosen from:

- Physics II (4)
- Maths II Topics (1 each)
- Electronics & Instrumentation (4)
- EE203 Introduction to Electrical Information (1)
- ME251 Fluid Mechanics (1) or
- ME372 Heat Transfer (1) or
- ME223 Mechanical Technology (1)
- ME131 Dynamics (1)
- ME111/112 Graphics/Engineering Drawing & Elementary Design (2)
- CE221 Statics (1)
- ME241 Properties of Materials (1) or
- ME202 Dynamics of Engineering Systems (1)

or other appropriate subjects approved by the Head of Department.

**Elective II**

The six elective units in the third year programme may be selected from:

(a) Any third or fourth year subjects offered by other Engineering Departments or the Faculty of Mathematics or the Faculty of Science subject to the approval of Head of Department.

(b) Up to 2 units selected from the list of second year electives not already taken.

(c) Any other appropriate subject approved by the Head of Department.
APPENDIX B

TRANSITION ARRANGEMENTS 1976

(a) **DEPARTMENT OF CIVIL ENGINEERING**

Any student currently enrolled for the degrees of Bachelor of Engineering (Civil) or Bachelor of Science (Engineering) (Civil) and who has not completed requirements for the award of those degrees by the end of 1975 shall, subject to Section 4 (b)(ii)(b) of the Requirements, be deemed to be enrolled thereafter for the new degree courses introduced in 1976, with credit for all subjects passed in the old courses, subject to the following conditions:

Any student who has passed or has been granted standing in the subject or part subject shown in the first column shall be given standing in the subject shown in the second column:

<table>
<thead>
<tr>
<th>Subject 1</th>
<th>Subject 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME121 Workshop Practice</td>
<td>ME121 Workshop Practice</td>
</tr>
<tr>
<td>EE101 Introduction to Electrical Engineering</td>
<td>2 Units of Elective I</td>
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<tr>
<td>EE101 and</td>
<td>EE203 and</td>
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<tr>
<td>EE201</td>
<td>EE204</td>
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<tr>
<td>GE350J General Studies Seminar</td>
<td>GE350 Seminar</td>
</tr>
<tr>
<td>ME481 Engineering Administration</td>
<td>CE352 Civil Engineering Systems I</td>
</tr>
<tr>
<td>ME212 Engineering Design</td>
<td>ME271 Thermodynamics</td>
</tr>
<tr>
<td>CE221 Properties of Materials I</td>
<td>CE212 Mechanics of Solids</td>
</tr>
<tr>
<td>CE212 Mechanics of Solids I</td>
<td>CE221 Properties of Materials</td>
</tr>
<tr>
<td>3 units</td>
<td>and one unit</td>
</tr>
<tr>
<td></td>
<td>of Elective I</td>
</tr>
</tbody>
</table>

(b) **DEPARTMENT OF ELECTRICAL ENGINEERING**

Any student currently enrolled for the degrees of Bachelor of Engineering or Bachelor of Science (Engineering) in Electrical Engineering and who has not completed the requirements for the award of those degrees by the end of 1975 shall, subject to Section 4 (b)(ii)(b) of the Requirements, be deemed to be enrolled thereafter for the new degree courses with credit for all subjects passed in the old courses, subject to the following conditions:

Any student who has passed or has been granted standing in the subject or part subject shown in the first column shall be given standing in the subject shown in the second column:

<table>
<thead>
<tr>
<th>Subject 1</th>
<th>Subject 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE101 Introduction to Electrical Engineering</td>
<td>EE203 and</td>
</tr>
<tr>
<td>EE201</td>
<td>EE204</td>
</tr>
<tr>
<td>GE350J General Studies Seminar</td>
<td>GE350 Seminar</td>
</tr>
<tr>
<td>ME481 Engineering Administration</td>
<td>CE352 Civil Engineering Systems I</td>
</tr>
<tr>
<td>ME212 Engineering Design</td>
<td>ME271 Thermodynamics</td>
</tr>
<tr>
<td>CE221 Properties of Materials I</td>
<td>CE212 Mechanics of Solids</td>
</tr>
<tr>
<td>CE212 Mechanics of Solids I</td>
<td>CE221 Properties of Materials</td>
</tr>
<tr>
<td>3 units</td>
<td>and one unit</td>
</tr>
<tr>
<td></td>
<td>of Elective I</td>
</tr>
</tbody>
</table>
EE101  Introduction to Electrical Engineering
EE203  Introduction to Electrical Information
EE221  Semiconductor Devices, provided the student passes EE321 Electronics in 1976. Otherwise standing will be granted for 1 elective unit and the student will be required to take EE221.

EE204  Introduction to Electrical Energy
EE211  Energy Conversion

(c) DEPARTMENT OF MECHANICAL ENGINEERING

All students currently enrolled in the Bachelor of Engineering in Mechanical Engineering, Bachelor of Engineering in Industrial Engineering, or the combined degree programmes who have not completed the requirements for the award of the degree by the end of 1975 shall be deemed to be enrolled thereafter for the new degree courses to be introduced in 1976 with credit for all subjects passed in the old courses, subject to the transition conditions given hereunder.

Year by Year, Stage by Stage Progression

Completed in 1975  Subsequent Years

(a) Mechanical and Industrial Full Time Bachelor of Engineering —

Year I  Years II III IV
Year II  Years III IV of new course
         plus EE203 and EE204
         less 2 units of Elective
Year III  Year IV
         plus GE350

(b) Full Time Bachelor of Arts/Bachelor of Engineering in Mechanical Engineering —

Year I  Years II III IV V
Year II  Years III IV V
         plus ME223, ME232
Year III  Years IV V
Year IV  Year V

(c) Full Time Bachelor of Arts/Bachelor of Engineering in Industrial Engineering —

Year I  Years II III IV V
Year II  Years III IV V
         plus ME223
Year III  Years IV V
         plus ME381
Year IV  Year V

Note: Departmental Technical Electives must include ME487, ME488.
Completed in 1975

Subsequent Years

(d) Full Time Bachelor of Science/Bachelor of Engineering in Mechanical Engineering —

Year I

Year II

Year III

plus ME232, ME223

class 1 unit of Elective

Year IV

(e) Full Time Bachelor of Science/Bachelor of Engineering in Industrial Engineering —

Year I

Year II

Year III

plus ME232, ME223

class 1 unit of Elective

Year IV

Year V

Note: Departmental Technical Electives must include ME487, ME488

(f) Full Time Bachelor of Commerce/Bachelor of Engineering in Mechanical Engineering —

Year I

Year II

plus EE203, EE204

plus one of —

Economic History I

Economic Statistics I

Legal Studies I

less Macroeconomics

Year III

Year IV

Year V

plus GE350, 1 unit of Elective

less CE303

(g) Full Time Bachelor of Commerce/Bachelor of Engineering in Industrial Engineering —

Year I

Year II

plus EE203, EE204

plus one of —

Economic History I

Economic Statistics I

Legal Studies I

less Macroeconomics
Completed in 1975  
Subsequent Years

Year III  
Year IV  
Year V  
plus GE350

Note: Departmental Technical Electives must include ME487, ME488.

(b) Bachelor of Engineering in Mechanical and Industrial Engineering by Part Time Study —

<table>
<thead>
<tr>
<th>Stage</th>
<th>Year</th>
<th>Year</th>
<th>Year</th>
<th>Year</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV</td>
<td>V</td>
</tr>
<tr>
<td>Stage 1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4 5</td>
<td>VI</td>
</tr>
<tr>
<td>Stage 2</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4 5</td>
<td>VI</td>
</tr>
<tr>
<td>Stage 3</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4 5</td>
<td>VI</td>
</tr>
<tr>
<td>Stage 4</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4 5</td>
<td>VI</td>
</tr>
<tr>
<td>Stage 5</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4 5</td>
<td>VI</td>
</tr>
</tbody>
</table>

Stage 1
- Stage 2
- Stage 3
- Stage 4
- Stage 5

Stage 1
- Year VI Full Time
- plus ME223,
- less 2 units of Electives

Stage 2
- Year VI Full Time
- plus EE203, EE204
- less 3 units of Electives

Stage 3
- Year VI Full Time
- plus GE350, ME313
- less 2 units of Elective

Stage 4
- Year VI Full Time
- plus ME221

Stage 5
- Year VI Full Time
- plus ME382

Individual Subjects

Students out of phase with year by year or stage by stage progression will be granted standing in all units passed in 1975 and previous years. The following additional information may be used to determine standing.

Subject or group of subjects of previous courses which have been passed or given standing

<table>
<thead>
<tr>
<th>Subject</th>
<th>Subject or group of subjects of new courses for which standing shall be given</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year I Elective (2 units)</td>
<td>ME122 and Met151</td>
</tr>
<tr>
<td>ME222</td>
<td>ME202</td>
</tr>
<tr>
<td>CE212 (1.1/3 units)</td>
<td>ME214 (1 unit)</td>
</tr>
<tr>
<td>ME241 (1.2/3 units)</td>
<td>ME241 (1 unit)</td>
</tr>
<tr>
<td>ME241, CE212 (3 units)</td>
<td>ME214, ME241, plus 1 unit of Elective</td>
</tr>
<tr>
<td>ME221</td>
<td>1 unit of Elective</td>
</tr>
<tr>
<td>ME382</td>
<td>1 unit of Elective</td>
</tr>
</tbody>
</table>

(d) DEPARTMENT OF METALLURGY

Any student currently enrolled for the degrees of Bachelor of Metallurgy or Bachelor of Science (Metallurgy) and who has not completed the requirements for the award of those degrees by the end of 1975 shall be deemed to be enrolled thereafter for the new degree courses with credit for all subjects passed in the old courses.
COMBINED DEGREE COURSES

A student may enrol in the combined courses leading to the Bachelor of Arts/Bachelor of Engineering, Bachelor of Commerce/Bachelor of Engineering, Bachelor of Science/Bachelor of Engineering, Bachelor of Metallurgy/Bachelor of Mathematics degrees on the successful completion of his first year course. Students wishing to transfer to a combined degree course will be expected to be above average quality and the minimum standard looked for will be credit level. Only in exceptional circumstances will a student be allowed to transfer to a combined degree course during his second year or later.

Students who are considering transferring to a combined course at the end of the first year should familiarise themselves with the requirements for both degrees and pay particular attention to the choice of elective subjects. Students are advised to consult their Student Advisor at an early stage.

Extract from the Requirements for the degree of Bachelor of Arts:

*Arts/Engineering*

(b) A candidate may, after completing the first year of a course for the degree of Bachelor of Engineering in the Faculty of Engineering enrol in a combined Arts/Engineering course. Subject to the special conditions stated below, a candidate who has enrolled in such a combined course shall qualify for admission to the ordinary degree of Bachelor of Arts if he passes, subsequently to his first enrolment for the degree of Bachelor of Engineering, nine subjects chosen from those listed in the Schedule of the subjects offered for the ordinary degree of Bachelor of Arts. The special conditions above referred to shall be these:

(i) The candidate shall comply with all the provisions of these Requirements other than Clause 12 (c);

(ii) Not more than five of the nine subjects shall be Part I subjects;

(iii) At least three of the nine subjects shall be passed after approval of the candidate's enrolment in the combined course;

(iv) A candidate whose enrolment in a combined course is withdrawn or otherwise terminated before he has passed the nine subjects required by this section shall not be eligible to qualify for admission to the ordinary degree of Bachelor of Arts under this section;

(v) A candidate enrolled in a combined course may, upon satisfying the Requirements for either the degree of Bachelor of Arts or the degree of Bachelor of Engineering, be admitted to that degree while continuing in the combined course.
Extract from the Requirements for the degree of Bachelor Science:

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.

Extract from the Requirements for the degree of Bachelor of Mathematics:

Mathematics/Metallurgy

After completing a successful first year of study towards either the degree of Bachelor of Mathematics or the degree of Bachelor of Metallurgy a candidate may enrol in a Mathematics/Metallurgy course. A candidate who has enrolled in such a combined course shall qualify for admission to the ordinary degrees of Bachelor of Mathematics and Bachelor of Metallurgy by passing 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 by satisfying all the requirements for the degree of Bachelor of Metallurgy,

except that
(a) Mathematics I shall be replaced by Chemistry I or Geology I or any other subject approved by the Deans;
(b) Metallurgical Computations shall be replaced by Mathematics IIB, which may be taken in two parts, each of three terms duration;
(c) No Mathematics subjects may be taken as electives.

Commerce/Engineering

There are no specific requirements for Commerce/Engineering courses except that the candidate shall meet the requirements for both degrees. Approved or recommended combined courses are set out in the Departmental sections of this Handbook.

FACULTY POLICIES

The Faculty Board has laid down policies in relation to certain matters. These policy statements are reproduced here for the guidance of students.
AWARD OF HONOURS

The award of Honours in the degree of Bachelor of Engineering is based on the complete record of the candidate over the whole four years of his course, the last two years of the course being given significantly greater weight than each of the first two years of the course. Defining the average performance in terms of grades, the average performances required to reach the various classes of Honours are as follows:

**Honours**
- Class I: Midway between Distinction and Credit Level
- Class II Division I: Credit level
- Class II Division II: Midway between Credit and Pass level.

The standard for the Pass with Merit in the degree of Bachelor of Science (Engineering) is to be as for Honours Class II Division I, and the average grade is to be computed in the same general manner as for the Bachelor of Engineering degree.

These standards are used as a guideline only, and may be modified by Faculty in particular cases where the record of the candidate appears to warrant such action.

INTERPRETATION OF THE ACADEMIC PROGRESS BY-LAWS

By-Law 5.4.1 (2) leaves it open to each particular faculty to decide what constitutes unsatisfactory progress calling for action under sub-headings (a), (b) or (c) of the By-Law.

The Faculty Board, Faculty of Engineering, has resolved that the following guidelines shall be applied to students enrolled in the Faculty.

(a) **First Year full-time or first two years part-time**
Failure to pass at least one quarter of the approved programme in the first year of enrolment as a full-time student, or the first two years of enrolment as a part-time student, shall constitute unsatisfactory progress, to be acted on under sub-heading (c) of the By-Law. “Approved programme” means the student’s programme for the whole period in question, and the fraction one-quarter is to be measured by the “units” defined on page 33.

(b) **First two years full-time or first four years part-time**
Students must meet the requirements of By-law 5.4.2.

(c) **Later years of the course**
A student will be expected to pass at least one third of the subjects attempted each year and maintain an overall average pass rate of at least 50% of the normal programme for the whole period of enrolment. The progress of any student who fails to meet this standard will
be reviewed by the Faculty Board which may recommend to the Admissions Committee that the student be excluded from the Faculty. A student will be required to Show Cause for a second failure in any subject (By-law 5.4.2.).

INDUSTRIAL TRAINING

This is a general statement covering all aspects of industrial training. Students wishing to take Industrial Experience Elective units should refer to Departmental entries for details of the requirements.

For a full-time Bachelor of Engineering or Bachelor of Metallurgy degree students are normally required to complete periods of practical experience totalling twenty weeks or more, of a type acceptable to the Faculty Board. Students who transfer from part-time to full-time courses or vice versa will be advised individually of their practical training requirements.

For a Bachelor of Engineering degree on a part-time basis students may choose to take Industrial Experience units as part of their Elective programme. The University can accept no responsibility for finding suitable employment for students wishing to enrol for Industrial Experience units. To be eligible for an Industrial Experience Unit, the student must be in approved employment on the 1st November preceding the year in which the unit is to be taken. The approved employment must continue for one calendar year, i.e. until the 30th October of the year in which the unit will be counted. Normally no Industrial Experience unit will be allowed in the first year of enrolment. Students must attend lectures, seminars etc. and submit such reports as the Head of Department may require. All reports will be retained by the Department.

For a Bachelor of Science (Engineering) or Bachelor of Science (Metallurgy) degree students must complete three years of practical experience before 31st January in the year in which the degree is to be awarded. Otherwise the award of the degree may be deferred.

MUTUALLY EXCLUSIVE SUBJECTS

(See Section 14 of the Requirements)

The Faculty Board has deemed the following subjects or part subjects to be mutually exclusive:—


(3) ME482 Engineering Economics and ME385 Accounting and Financial Studies.

(4) ME385 Accounting and Financial Studies and Accounting I.
YEAR/STAGE CLASSIFICATION

Full-time students are classified by year.

Part-time students are classified by stage.

Classification is determined by the number of units passed in accordance with the following table:

<table>
<thead>
<tr>
<th>Units</th>
<th>Year</th>
<th>Units</th>
<th>Year</th>
<th>Units</th>
<th>Stage</th>
<th>Units</th>
<th>Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-15</td>
<td>I</td>
<td>0-17</td>
<td>I</td>
<td>0-7</td>
<td>1</td>
<td>0-7</td>
<td>1</td>
</tr>
<tr>
<td>16-31</td>
<td>II</td>
<td>18-33</td>
<td>II</td>
<td>8-16</td>
<td>2</td>
<td>8-15</td>
<td>2</td>
</tr>
<tr>
<td>32-47</td>
<td>III</td>
<td>34-49</td>
<td>III</td>
<td>17-25</td>
<td>3</td>
<td>16-23</td>
<td>3</td>
</tr>
<tr>
<td>Over 47</td>
<td>IV</td>
<td>Over 49</td>
<td>IV</td>
<td>26-34</td>
<td>4</td>
<td>24-31</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>35-43</td>
<td>5</td>
<td>32-39</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>44-52</td>
<td>6</td>
<td>Over 39</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Over 52</td>
<td>7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Students enrolled for the final year of any combined course will be classified as Year V.

Publication of Faculty Board Minutes

A copy of Faculty Board decisions on matters of general interest will be displayed on all Departmental Notice Boards, in the Library, the University Union and the Staff House.

Decisions in relation to individual students, personal staff matters and other items which are of a confidential nature will not be included in the published list.

Use of Electronic Calculators in Examinations

The Faculty of Engineering favours the use of unprogrammed electronic calculators in examinations provided that the calculators used are noiseless and self-contained. However, the final decision whether calculators may be used in a particular examination is a matter for the examiner. If calculators are to be permitted, the examiner should take precautions in setting the examination and in invigilation to ensure that there is no undue advantage for any student using such equipment. In particular, the calculators are not to be used as a means of bringing information into the examination room, e.g. in the form of programmed cards, unless permission to do so is explicitly given by the examiner.

Submission of Project Reports

All Undergraduate Project reports must be submitted no later than the Friday which follows the 47th Monday of the year.

All Master of Engineering Science Project reports must be submitted up to, but not later than the Wednesday of the fourth week of the year in which the candidate wishes to graduate.
Replacement of Subjects Failed in First-half Year by Second Half-year Subjects

A student who fails one or more first half-year subjects will be permitted to take up to two additional second half-year units provided that he has the prerequisite requirements. He cannot, however, replace compulsory first half-year units by optional second half-year ones. He will be required to repeat the compulsory subjects the following year.

Special Consideration/Special Examinations

Senate has ruled that a student may apply for special consideration or special examination for mid-year examinations. This will also apply to assignments and term quizzes which are considered in assessing the student's final grading.

Consequently, any student who is prevented by illness or other circumstances from sitting a mid-year examination or quiz or from submitting an assignment should submit a request for special consideration, accompanied by a medical certificate where appropriate, to the Secretary to the University.

ALTERNATIVE SUBJECTS

(see Section 15 of the Requirements)

The Faculty Board has deemed the following groups of subjects to be acceptable alternatives:—

(1) CE212 Mechanics of Solids I and ME214 Mechanics of Solids I.
(2) CE221 Properties of Materials I and ME241 Properties of Materials.
(3) ChE211 Fluid Statics and Dynamics, CE231 Fluid Mechanics I and ME251 Fluid Mechanics.
(4) ChE212 Heat and ME372 Heat Transfer.

STANDING AND EXEMPTION EXAMINATIONS FOR HOLDERS OF TECHNICAL COLLEGE CERTIFICATES

A student may apply for standing in any subject. The Head of the appropriate Department will decide whether the student shall be granted standing on the basis of qualifications held or whether the student shall be required to sit for an exemption examination.

As a guide to students the holder of a Technical College Certificate containing appropriate subjects may expect to be granted standing in the following subjects or subject units:—
ME111  Graphics
ME121  Engineering Drawing and Elementary Design
ME121  Workshop Practice
ME222  Process Technology
ME223  Mechanical Technology
EE101  Introduction to Electrical Engineering
EE151  Microstructure of Materials
CE161  Land Surveying I

The following subjects (or subject units) are those in which a student holding the appropriate Technical College Certificate may expect to be granted an exemption examination:

CE111  Statics
EE203  Introduction to Electrical Energy
EE204  Introduction to Electrical Information
ME131  Dynamics
ME212  Engineering Design
ME213  Engineering Design

UNITs

In undergraduate courses, a unit is approximately one-sixteenth of a full-time year or one-eighth of a part-time year. In engineering subjects, one unit involves a total of 42 hours (1½ hours per week) of lectures, laboratories, and tutorials. Where subjects from other Faculties form part of an engineering course, Part I subjects each count as four units, Part II subjects as five, and Part III subjects as eight units. Where such a subject may be taken at alternative levels, e.g., Part I or Part II, the number of units assigned to the subject is an appropriate average figure calculated from the figures given above.

In the Master of Engineering Science Requirements a unit is defined as exactly one-twelfth of a full-time year, and in all postgraduate courses, including the Master of Engineering and Doctor of Philosophy the unit is understood to have the same value. This “postgraduate unit” is also defined as a programme which involves a student in a total of approximately 120 hours’ work. This total includes all formal course work plus assignments and study. If the “unit” is a formal instructional course the 120-hour total includes 42 hours of lectures or the equivalent.

What the two “units” — undergraduate and postgraduate — have in common is therefore the same 42 “contact-hours” per year. The postgraduate unit is a larger fraction of the year’s work than the undergraduate unit because in postgraduate work the student is expected to do more work per contact-hour than he is in undergraduate work.
# First Year Programmes

Students enrolling for the first year of an Engineering course should study the following notes carefully before completing their enrolment form.

Your programme will vary slightly according to the Department in which you are enrolling. For details of Engineering I, Electives and ME121 Workshop Practice see the notes below.

**Full-time students enrol for**

<table>
<thead>
<tr>
<th>Department</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chemical Engineering</strong></td>
<td>Chemistry I (as Elective I)</td>
</tr>
<tr>
<td></td>
<td>Engineering I</td>
</tr>
<tr>
<td></td>
<td>Mathematics I</td>
</tr>
<tr>
<td></td>
<td>Physics IA or IB</td>
</tr>
<tr>
<td></td>
<td>ME121 Workshop Practice</td>
</tr>
<tr>
<td><strong>Civil Engineering</strong></td>
<td>Engineering I</td>
</tr>
<tr>
<td>(including Mining Engineering)</td>
<td>Mathematics I</td>
</tr>
<tr>
<td></td>
<td>Physics IA</td>
</tr>
<tr>
<td></td>
<td>Chemistry IS</td>
</tr>
<tr>
<td></td>
<td>CE171 Engineering Surveying I</td>
</tr>
<tr>
<td><strong>Electrical Engineering</strong></td>
<td>Engineering I</td>
</tr>
<tr>
<td></td>
<td>Mathematics I</td>
</tr>
<tr>
<td></td>
<td>Physics IA</td>
</tr>
<tr>
<td></td>
<td>4 Elective Units</td>
</tr>
<tr>
<td></td>
<td>ME121 Workshop Practice</td>
</tr>
<tr>
<td><strong>Mechanical Engineering</strong></td>
<td>Engineering I</td>
</tr>
<tr>
<td>(including Industrial Engineering)</td>
<td>Mathematics I</td>
</tr>
<tr>
<td></td>
<td>Physics IA</td>
</tr>
<tr>
<td></td>
<td>Chemistry IS</td>
</tr>
<tr>
<td></td>
<td>ME121 Workshop Practice</td>
</tr>
<tr>
<td></td>
<td>Met 151 Microstructure of Materials</td>
</tr>
<tr>
<td></td>
<td>ME122 Process Technology</td>
</tr>
<tr>
<td><strong>Metallurgy</strong></td>
<td>Mathematics I</td>
</tr>
<tr>
<td></td>
<td>Physics IA</td>
</tr>
<tr>
<td></td>
<td>ME121 Workshop Practice</td>
</tr>
<tr>
<td></td>
<td>ChE101 Industrial Process Principles</td>
</tr>
<tr>
<td></td>
<td>Met141 Mechanical Properties of Materials</td>
</tr>
<tr>
<td></td>
<td>Met151 Microstructure of Materials</td>
</tr>
<tr>
<td></td>
<td>Met181 Atomic Structure of Materials</td>
</tr>
<tr>
<td></td>
<td>Met182 Electronic Structure of Materials</td>
</tr>
<tr>
<td></td>
<td>Met121 Chemical Stability of Materials</td>
</tr>
<tr>
<td></td>
<td>and two of</td>
</tr>
<tr>
<td></td>
<td>ME131 Dynamics</td>
</tr>
<tr>
<td></td>
<td>ME111 Graphics</td>
</tr>
<tr>
<td></td>
<td>ME112 Engineering Drawing &amp; Elementary Design</td>
</tr>
</tbody>
</table>

34
Surveying

CE101 Civil Engineering IS
Mathematics I
Physics IA
Microeconomics
SV111 Surveying I
SV121 Survey Camp

Recommended programmes for part-time students are:—

Chemical Engineering

Engineering I
Physics IA or IB
ME121 Workshop Practice

Civil Engineering

Engineering I
Mathematics I

Surveying

Mathematics I
CE101 Civil Engineering IS
Microeconomics

Electrical Engineering

Engineering I
Mathematics I
ME121 Workshop Practice

Mechanical Engineering
(including Industrial Engineering)

Engineering I
Mathematics I
ME121 Workshop Practice

Metallurgy

Mathematics I
Physics IA

Students are advised to discuss the full course which they propose to take with a departmental representative before completing their enrolment form. By doing so they should be able to avoid difficulties in arranging a programme suitable for their particular needs in the later years of the course.

NOTES

1. Engineering 1 consists of four units selected from

   (a) EE101 Introduction to Electrical Engineering
   (b) CE111 Statics
   (c) ME111 Graphics
   (d) ME112 Engineering Drawing & Elementary Design
   (e) ME131 Dynamics
   (f) ChE101 Industrial Process Principles
Departmental Requirements are

Chemical Engineering— (b), (c), (d) and (f)
Civil Engineering— (b), (c), (d) and (e)
(including Mining Engineering)
Electrical Engineering— (a) plus any three other units
Mechanical Engineering— (b), (c), (d) and (e)
(including Industrial Engineering and Naval Architecture)

2. Elective 1 or Electives

Chemical Engineering
Students must enrol in Chemistry I this being the prerequisite for Chemistry IIA which is a compulsory subject for the second year of the course.

Electrical Engineering
First year Electives must be selected in accordance with the Elective Requirements on page 18.

3. Workshop Practice

ME121 Workshop Practice is a compulsory subject in all courses except Surveying.
Standing for the subject may be granted to those students with equivalent training or relevant experience and applications for standing should be made at the time of enrolment.

Students required to take the subject should enrol for it as follows:—

Chemical Engineering & Mechanical Engineering
In the first year of enrolment

Civil Engineering
Normally in the second year of enrolment

Electrical Engineering
In either the first or second year of enrolment

Metallurgy
Full-time—In the first year of enrolment
Part-time—In the first or second year of enrolment
Guide to Subject Entries

Subject Name
The name shown is the official name which should be used on all enrolment, re-enrolment and variation forms.

Each subject has an identification number with prefixed letters indicating the Department responsible for the subject —

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>ChE</td>
<td>Chemical Engineering</td>
</tr>
<tr>
<td>CE</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>EE</td>
<td>Electrical Engineering</td>
</tr>
<tr>
<td>ME</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Met</td>
<td>Metallurgy</td>
</tr>
<tr>
<td>GE</td>
<td>Interdepartmental Subjects</td>
</tr>
</tbody>
</table>

The first numeral generally indicates the Year of the full-time course in which the subject is normally taken; the second numeral indicates the field of study; the third numeral for undergraduate courses indicates the level, or sequence in the field.

The fields of study are shown at the beginning of each departmental subject entry.

A suffix letter J indicates that the subject is a joint offering of more than one department.

The six digit number which precedes the name is the Computer Code Number for the subject.

Prerequisites and Corequisites
Prerequisites are those subjects which the student must have already passed before enrolling in the subject.
Corequisites are those subjects in which the student must enrol concurrently unless he has already passed them.

The Dean, on the recommendation of the Head of Department, may relax pre- and corequisites. Prerequisites in the Department of Mechanical Engineering marked with an asterisk may with the approval of the Head of Department be read concurrently with the subject unit named.

Hours
All subjects in the Faculty of Engineering are based in units of 42 contact hours each. A full explanation of the unit is given on page 33.

The 42 contact hours are spread over a whole year (1-1/2 hours per week for 28 weeks) or over a half year (3 hours per week for 14 weeks). As far as possible this information has been given in the entries but students should check with Departments before completing their timetables.
Examinations

Progressive Assessment based on assignments, practical work etc. is used throughout the Faculty and in some subjects the final grade is based entirely on progressive assessment. The hours shown for examinations refer to final examinations only.

However, the method of examination as set out under the various subject headings is tentative and may be varied at the discretion of the Lecturer concerned. Students will be advised of any such variations before the end of first term.

Content

This section gives a general description of the content of the subject and indicates the broad areas covered.

Preliminary Reading is included where applicable. Students should make every effort to complete the preliminary reading before starting the subject.

Texts

Essential books which are recommended for purchase.

References

Students should not restrict their reading to the 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.
Chemical Engineering is the “engineering of processes in which materials undergo chemical or physical change”. As a discipline Chemical Engineering may claim to be among the most modern of the branches of Engineering, having developed mainly since about 1920. Chemical Engineers are now being recognised as “process engineers” in the widest sense and are engaged in the preparation and smelting of metaliferous ores, in power-production, in food-processing and ceramics and as fuel-engineers, as well as in the industries producing conventional “chemicals”. The new fields of biochemical and bio-medical engineering apply chemical engineering principles to bacterial processes and to research into the functions of and artificial substitution for such systems as kidneys and other organs. The “energy crisis” is creating a large demand for Chemical Engineers in the fuel processing industry.

Currently there is a heavy demand for Chemical Engineers in the whole range of fields from research and development, through operations and administration to technical sales. A number of cadetships are available, but a large proportion of firms recruit at graduate level and broad opportunities are available for students who read independently for a full-time course.

Three types of course are available:—

*Bachelor of Engineering* (B.E.) may be read as a four year full-time course or with up to five years part-time and one final year full-time (or equivalent). A course of two years part-time followed by three years full-time is an excellent pattern. The degree is recognised for the full academic requirements of corporate membership of The Institution of Engineers, Australia and The Institution of Chemical Engineers (Great Britain).

*Combined Degrees* — B.A./B.E., B.Com./B.E., B.Sc./B.E., for honours level students are normally five years full-time. The combined Science degree may be taken with a major in Chemistry, Mathematics, Biology or Geology.

*Bachelor of Science (Engineering)* is normally a six year part-time degree. The syllabus has been developed to provide for some specialization in the fields of Applied Chemistry, Fuel Technology or Mineral Processing with the objective of professional recognition in these fields. It is recognised by the Royal Australian Chemical Institute and the Institute of Fuel. The Institution of Chemical Engineers recognises it as exempting from two of their examinations.
All courses are broadly based on a foundation of Chemistry, Mathematics, Physics and general Engineering Science. In his professional subjects, the Chemical Engineer studies the application of scientific method and knowledge to chemical processes and equipment. Electives are available permitting students to widen their education or deepen their specialist ability by selection from subjects throughout the whole university.

**SCHEDULE 1.1**

**BACHELOR OF ENGINEERING IN CHEMICAL ENGINEERING**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year I</strong></td>
<td></td>
</tr>
<tr>
<td>Chemistry I (As Elective I)</td>
<td>4</td>
</tr>
<tr>
<td>Engineering I</td>
<td>4</td>
</tr>
<tr>
<td>Mathematics I</td>
<td>4</td>
</tr>
<tr>
<td>Physics IA or IB</td>
<td>4</td>
</tr>
<tr>
<td>ME121</td>
<td>1</td>
</tr>
<tr>
<td>Workshop Practice</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>17</td>
</tr>
<tr>
<td><strong>Year II</strong></td>
<td></td>
</tr>
<tr>
<td>Chemical Engineering I</td>
<td>6</td>
</tr>
<tr>
<td>Chemistry II A</td>
<td>5</td>
</tr>
<tr>
<td>Mathematics II B</td>
<td>4</td>
</tr>
<tr>
<td><strong>Industrial Experience</strong></td>
<td>15</td>
</tr>
<tr>
<td><strong>Year III</strong></td>
<td></td>
</tr>
<tr>
<td>Chemical Engineering II A</td>
<td>7</td>
</tr>
<tr>
<td>Chemical Engineering II B</td>
<td>3</td>
</tr>
<tr>
<td>Elective II</td>
<td>5</td>
</tr>
<tr>
<td><strong>Industrial Experience</strong></td>
<td>15</td>
</tr>
<tr>
<td><strong>Year IV</strong></td>
<td></td>
</tr>
<tr>
<td>Chemical Engineering III</td>
<td>5</td>
</tr>
<tr>
<td>Projects II</td>
<td>6</td>
</tr>
<tr>
<td>Elective III</td>
<td>4</td>
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<tr>
<td><strong>Total</strong></td>
<td>15</td>
</tr>
</tbody>
</table>

1 Standing may be granted in all or part of ME121 Workshop Practice on production of a certificate that equivalent training has been obtained.

2 See Elective Requirements—Appendix A.

3 Mathematics II B may be taken in two parts each of three terms duration.

4 See Year I programme details on page 34.
Recommended Programme for the
Bachelor of Engineering in Chemical Engineering
By Part-time Study

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stage 1</strong></td>
<td></td>
</tr>
<tr>
<td>Engineering I</td>
<td>4</td>
</tr>
<tr>
<td>Physics IA or IB</td>
<td>4</td>
</tr>
<tr>
<td>ME121 Workshop Practice</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>9</td>
</tr>
<tr>
<td><strong>Stage 2</strong></td>
<td></td>
</tr>
<tr>
<td>Chemistry I (as Elective I)</td>
<td>4</td>
</tr>
<tr>
<td>Mathematics I</td>
<td>4</td>
</tr>
<tr>
<td>3Elective-Industrial Experience</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>9</td>
</tr>
<tr>
<td><strong>Stage 3</strong></td>
<td></td>
</tr>
<tr>
<td>Chemistry IIA</td>
<td>5</td>
</tr>
<tr>
<td>Mathematics IIB Part 1</td>
<td>2</td>
</tr>
<tr>
<td>Chemical Engineering I Part 1</td>
<td>1</td>
</tr>
<tr>
<td>3Elective-Industrial Experience</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>9</td>
</tr>
<tr>
<td><strong>Stage 4</strong></td>
<td></td>
</tr>
<tr>
<td>Mathematics IIB Part 2</td>
<td>2</td>
</tr>
<tr>
<td>Chemical Engineering I Part 2</td>
<td>5</td>
</tr>
<tr>
<td>Chemical Engineering IIA Part 1</td>
<td>2</td>
</tr>
<tr>
<td>3Elective-Industrial Experience</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td><strong>Stage 5</strong></td>
<td></td>
</tr>
<tr>
<td>Chemical Engineering IIA Part 2</td>
<td>5</td>
</tr>
<tr>
<td>Chemical Engineering IIB</td>
<td>3</td>
</tr>
<tr>
<td>3Elective II</td>
<td>1</td>
</tr>
<tr>
<td>3Elective-Industrial Experience</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td><strong>Year VI Full Time</strong></td>
<td></td>
</tr>
<tr>
<td>Chemical Engineering III</td>
<td>5</td>
</tr>
<tr>
<td>Projects II</td>
<td>6</td>
</tr>
<tr>
<td>3Elective II (allowing for Industrial units)</td>
<td>2</td>
</tr>
<tr>
<td>3Elective III (allowing for Industrial units)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

1 Standing may be granted in all or part of ME121 Workshop Practice on production of a certificate that equivalent training has been obtained.

2 Any student who is unable to complete Year VI as a full-time student may do so over two part-time years.

3 See Elective Requirements—Appendix A.
**SCHEDULE 3.1**

**BACHELOR OF SCIENCE (ENGINEERING) IN CHEMICAL ENGINEERING**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stage 1</strong></td>
<td></td>
</tr>
<tr>
<td>Engineering I</td>
<td>4</td>
</tr>
<tr>
<td>Physics IA or IB</td>
<td>4</td>
</tr>
<tr>
<td>ME121 Workshop Practice</td>
<td>1</td>
</tr>
<tr>
<td><strong>Stage 2</strong></td>
<td></td>
</tr>
<tr>
<td>Chemistry I (as Elective I)</td>
<td>4</td>
</tr>
<tr>
<td>Mathematics I</td>
<td>4</td>
</tr>
<tr>
<td><strong>Stage 3</strong></td>
<td></td>
</tr>
<tr>
<td>Chemistry IIA</td>
<td>5</td>
</tr>
<tr>
<td>Mathematics IIB Part 1</td>
<td>2</td>
</tr>
<tr>
<td>Chemical Engineering I Part 1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Stage 4</strong></td>
<td></td>
</tr>
<tr>
<td>Mathematics IIB Part 2</td>
<td>2</td>
</tr>
<tr>
<td>Chemical Engineering I Part 2</td>
<td>5</td>
</tr>
<tr>
<td>Chemical Engineering IIA Part 1</td>
<td>2</td>
</tr>
<tr>
<td><strong>Stage 5</strong></td>
<td></td>
</tr>
<tr>
<td>Chemical Engineering IIA Part 2</td>
<td>5</td>
</tr>
<tr>
<td>Chemical Engineering IIB</td>
<td>3</td>
</tr>
<tr>
<td>2 Elective IIA</td>
<td>1</td>
</tr>
<tr>
<td><strong>Stage 6</strong></td>
<td></td>
</tr>
<tr>
<td>Process Engineering</td>
<td>2</td>
</tr>
<tr>
<td>Design Project</td>
<td>1</td>
</tr>
<tr>
<td>2 Elective IIA</td>
<td>5</td>
</tr>
</tbody>
</table>

**Industrial Experience Units**

1 Standing may be granted in all or part of ME121 Workshop Practice on production of a certificate that equivalent training has been obtained.

2 See Elective Requirements—Appendix A.
**BACHELOR OF ARTS/BACHELOR OF ENGINEERING IN CHEMICAL ENGINEERING**

The candidate shall complete in the Faculty of Arts five subjects selected as shown below, in addition to the professional requirements for the degree of Bachelor of Engineering in Chemical Engineering (i.e. subjects Chemistry I and II, Mathematics I and IIB, Physics I (A or B), Engineering I and Chemical Engineering I, IIA, IIB and III, together with the industrial experience specified for the B.E. degree).

The five Arts subjects must include not less than one Part III and one Part II subject, and at least four of the five subjects must be selected from Group I of the Schedule of Subjects included in the Requirements for the degree of Bachelor of Arts.

A typical programme for the Department of Chemical Engineering would be:

<table>
<thead>
<tr>
<th>Subject</th>
<th>Year I</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chemistry I</td>
</tr>
<tr>
<td></td>
<td>Engineering I</td>
</tr>
<tr>
<td></td>
<td>Physics IA or IB</td>
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<tr>
<td></td>
<td>Mathematics I</td>
</tr>
<tr>
<td></td>
<td>ME121 Workshop Practice</td>
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<table>
<thead>
<tr>
<th></th>
<th>Year II</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mathematics IIB Part 1</td>
</tr>
<tr>
<td></td>
<td>Chemistry IIA</td>
</tr>
<tr>
<td></td>
<td>Chemical Engineering I</td>
</tr>
<tr>
<td></td>
<td>Arts Subject I</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Year III</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mathematics IIB Part 2</td>
</tr>
<tr>
<td></td>
<td>Chemical Engineering IIA Part 1</td>
</tr>
<tr>
<td></td>
<td>Chemical Engineering IIB Part 1</td>
</tr>
<tr>
<td></td>
<td>Arts Subject II</td>
</tr>
<tr>
<td></td>
<td>Arts Subject I or II</td>
</tr>
<tr>
<td></td>
<td>Industrial Experience</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Year IV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chemical Engineering IIA Part 2</td>
</tr>
<tr>
<td></td>
<td>Chemical Engineering IIB Part 2</td>
</tr>
<tr>
<td></td>
<td>Arts Subject III</td>
</tr>
<tr>
<td></td>
<td>Industrial Experience</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Year V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chemical Engineering III</td>
</tr>
<tr>
<td></td>
<td>Arts Subject I, II or III</td>
</tr>
<tr>
<td></td>
<td>Projects II</td>
</tr>
</tbody>
</table>
**BACHELOR OF COMMERCE/BACHELOR OF ENGINEERING IN CHEMICAL ENGINEERING**

The course followed must comply with Section 19 of the Requirements for the degrees of Bachelor of Engineering and Bachelor of Science (Engineering). The following programme has been approved by the two Faculty Boards:

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year I</strong></td>
<td></td>
</tr>
<tr>
<td>*Chemistry I (As Elective I)</td>
<td>4</td>
</tr>
<tr>
<td>*Mathematics I</td>
<td>4</td>
</tr>
<tr>
<td>Engineering I</td>
<td>4</td>
</tr>
<tr>
<td>Physics IA/IB</td>
<td>4</td>
</tr>
<tr>
<td>ME121 Workshop Practice</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>17</td>
</tr>
<tr>
<td><strong>Year II</strong></td>
<td></td>
</tr>
<tr>
<td>Chemical Engineering I</td>
<td>6</td>
</tr>
<tr>
<td>Chemistry II</td>
<td>5</td>
</tr>
<tr>
<td>Mathematics IIB Part 1</td>
<td>2</td>
</tr>
<tr>
<td>*Microeconomics</td>
<td>2</td>
</tr>
<tr>
<td><strong>One of</strong></td>
<td></td>
</tr>
<tr>
<td>*Economic Statistics I</td>
<td></td>
</tr>
<tr>
<td>*Economic History I</td>
<td></td>
</tr>
<tr>
<td>*Legal Studies I</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td>2</td>
</tr>
<tr>
<td><strong>Year III</strong></td>
<td></td>
</tr>
<tr>
<td>Chemical Engineering IIA</td>
<td>7</td>
</tr>
<tr>
<td>*Mathematics IIB Part 2</td>
<td>2</td>
</tr>
<tr>
<td>*Accounting I</td>
<td>4</td>
</tr>
<tr>
<td>*Macroeconomics</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>17</td>
</tr>
<tr>
<td><strong>Year IV</strong></td>
<td></td>
</tr>
<tr>
<td>Chemical Engineering IIB</td>
<td>3</td>
</tr>
<tr>
<td>***Economics and Commerce (3) subjects</td>
<td>12</td>
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<tr>
<td>Elective II</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td>18</td>
</tr>
<tr>
<td><strong>Year V</strong></td>
<td></td>
</tr>
<tr>
<td>Chemical Engineering III</td>
<td>5</td>
</tr>
<tr>
<td>Project II</td>
<td>5</td>
</tr>
<tr>
<td>***Economics and Commerce (2) subjects</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>18</td>
</tr>
</tbody>
</table>

The subjects which count towards the B.Com degree are those marked * plus six Engineering units chosen from subjects normally taken in 3rd or 4th year of the full-time Engineering programme which may be counted as one Group C subject.
BACHELOR OF SCIENCE/BACHELOR OF ENGINEERING IN CHEMICAL ENGINEERING

The candidate shall complete all requirements for the Bachelor of Engineering in Chemical Engineering and comply with the requirements of the Faculty of Science for the degree of Bachelor of Science with the provision that Engineering I is recognised as a Science Group I subject and Chemical Engineering I as a Science Group II subject (Clause 12b of the Science degree requirements) and that a subject taken for the Science degree may be accepted as Elective III for the Engineering degree. Normally the requirements for the Bachelor of Science degree shall be completed before the candidate enrols for the final year of the Engineering degree.

A typical course structure would be as follows for a candidate majoring in Chemistry:

Subject

Year I
- Chemistry I
- Engineering I
- Mathematics I
- Physics IA or IB
- ME121 Workshop Practice

Year II
- Chemical Engineering I
- Chemistry IIA
- Mathematics IIB

Year III
- Chemistry IIIA
- Chemical Engineering IIA Part 1
- Chemical Engineering IIB Part 1
- Industrial Experience

Year IV
- Chemical Engineering IIA Part 2
- Chemical Engineering IIB Part 2
- and one of:
  - Chemistry IIB, IIIB, Geology I, Biology I, Physics II
- Industrial Experience

Year V
- Chemical Engineering III
- Elective III
- Projects II

Similar programmes can be made to major in Mathematics, Biology or Geology.

1 A candidate must have taken Physics IA to enrol for Physics II as the Science subject.
DESCRIPTION OF SUBJECT ENTRIES

Indicating Numerals  
ChE-0-  General  
ChE-1-  Chemical Engineering Science  
ChE-2-  Unit Operations  
ChE-3-  Engineering Practice

Field Excursions

Inspections of Chemical Engineering plants of particular technical interest or relevance to course material are an integral part of the Chemical Engineering subjects. Normally students are expected to take part in several half day or full day inspections of plants in the Newcastle area for Chemical Engineering I, Chemical Engineering IIA, Chemical Engineering IIB. In addition, an excursion to the Sydney area of about four days duration is arranged in Year III (Stage 5).

541100  Engineering I

(i) ME111  Graphics
(ii) ME112  Engineering Drawing and Elementary Design
(iii) CE111  Statistics
(iv) ChE101  Industrial Process Principles

541201  ME121  Workshop Practice

(iv) 511101  ChE101  Industrial Process Principles

Hours  
1½ hours per week

Examination  
One 3-hour paper

Content

The preparation of process flowsheets. Engineering calculations illustrating material and energy balances, together with pressure, temperature and volume conditions involved in physical or chemical changes. Balancing chemical equations and elementary stoichiometry. Phase rule applications, graphical methods. These principles will be illustrated from such processes as water treatment, metallurgical ore smelting and steel production, cement manufacture, combustion of coal and oil, production of tonnage oxygen, ammonia and acids.

1 For the description of ME111, ME112 and CE111 see the appropriate departmental entry.

2 For the description of ME121 see the entry under Department of Mechanical Engineering.
Text


Wall, T. F. *An Outline of Industrial Process Principles* (Dept of Chemical Engineering, Univ. of Newcastle)

References

Himmelblau, J. *Basic Principles and Calculations in Chemical Engineering* (Van Nostrand 1973)


512200 Chemical Engineering I

Prerequisites Mathematics I and Physics IA or IB

Hours 9 hours per week

Examination Two 3 hour final examinations and term quizzes

Content Chemical Engineering I consists of the following units:

Part I

(i) & (ii) ChE201/202 Fuels and Processes

Part II

(iii) ChE203 Laboratory

(iv) & (v) ChE211/2 Fluids and Heat

(vi) ChE221 Stage Separation Processes

(vii) ChE231 Design

Part-time students may take the subject in two parts as indicated.

(i) & (ii) ChE201/202 Fuels and Processes

(i) ChE201 Fuels and Combustion

Hours Approx. 42 hours
Content

Origin and composition of the major fossil fuels: processing of natural fuels for gaseous and liquid secondary fuels; the technical requirements of a fuel, specification and testing. Behaviour of fuels on pyrolysis; the nature of flame, flame speed and temperature, explosive mixture limits, ignition temperatures; premix and diffusion flames; excess air requirements and losses; the requirements of mixing and reaction time; burner and combustion chamber construction to meet fuel flame and heat transfer requirements. Combustion of solid fuel; grates and gas producers; pulverised fuel. Calculation of quantities; thermal efficiency.

Text

Harker, J. H. & Allen, D. A.  
*Fuel Science* (Oliver & Boyd 1972)

Content

ChE202 Industrial Chemical Processes and Equipment

Chemical engineering principles of chemical processing, chemical equilibrium and process selection, process equipment and materials of construction. Major chemical industries discussed include: Water and waste water treatment, Coal chemicals, Industrial gases, Ammonia and methanol, Acids and Chloro-Alkali industries, Phosphate fertilisers, Petroleum refining and Petrochemicals.

Text

Shreve  
*Chemical Process Industries* 3rd edn  
(McGraw-Hill 1967)

Reference

Kent  
*Riegels Handbook of Industrial Chemistry*  
7th edn (Van Nostrand 1973)

Content

ChE203 Laboratory

Hours  
84 hours

A set of experiments covering measurement and character of fluid flow, heat transfer measurements, gas and fuel properties, gas burner characteristics, and measurement of temperature, viscosity, refractive index, etc. This includes a minor project in which the student is expected to take the initiative in designing an experiment. Introductory lectures on statistical methods and computer use will be given and throughout the assignments, elementary statistical treatment and interpretation of data are required together with an error analysis.
Texts

Anderson, Durston & Thesis and Assignment Writing (Wiley Aust. Poole 1970)
Crow, Davis & Statistics Manual (Dover Press 1972)
Maxfield

(iv) & (v) ChE211/2 Fluids and Heat

Hours
Approx 84 hours

Examination
One 3-hour paper in November and term tests

(iv) ChE211 Fluid Statics and Dynamics

Content
Concept of a fluid, real fluids and ideal fluids, compressible and incompressible flow. The barometric equation, two fluid manometer, continuous decanter. Concept of streamline and streamtube, continuity, energy equation and momentum equation for fluids. Boundary layer equations for streamline flow. Flow through pipes and fittings, fluid meters, fans and pumps.

Text
Hughes, W. F., & Fluid Dynamics (Schaum 1967)
Brighton, J. A. (and see ChE212)

(v) ChE212 Heat

Content
Conduction of heat; Fouriers equation, steady state unidirectional and uniform radial flow, surface transfer coefficients, extended surfaces. Heat exchangers, mean convection coefficients. Convection transfer, dimensionless numbers and their significance; natural convection. Relationships between mass, momentum and heat transfer. Condensation film theory; effect of surfaces, of non-condensible gases; boiling nucleate and film; condensers and evaporations. The nature and spectral distribution of thermal radiation; optical and total radiation pyrometry, corrections for grey emitters; exchange areas between black surfaces; simple systems with grey and adiabatic surfaces.

Texts
Coulson, J. M. & Chemical Engineering Vol. I 2nd edn
Richardson, J. P. (Pergamon 1970)
ChE221 Stage Separation Processes

**Hours**
Approx. 21 hours

**Content**
Introduction to the concept of single and multi-stage separation processes. Definition of an ideal equilibrium stage, stage efficiency and introduction to methods for determining the number of ideal stages required for a given separation. Solid liquid extraction will be used to illustrate the above.

**Text**

**Reference**

ChE231 Design (Chemical Engineering I)

**Hours**
21 hours

**Content**
Unfired pressure vessels to code design, design of simple structures and piping systems. Elementary instrumentation.

**Texts**
SAA Code *Engineering Drawing Practice AS CZ1-1966*
SAA Code *Unfired Pressure Vessels AS 1210-1972*
SAA Code *Steel Structures Code AS 1250-1972*
Nash, W. A. *Theory and Problems of Strength of Materials* (Schaum 1957)

513100 Chemical Engineering II A

**Prerequisites**
Chemical Engineering I and Chemistry I

**Hours**
10½ hours per week
Examination

Four 3-hour written papers and internal assessment

Content

Chemical Engineering IIA consists of the following units:

Part I

(i) ChE301 Computations
(iii) ChE311 Thermodynamics
(iv) ChE312 Reaction Engineering

Part II

(ii) ChE302 Unit Operations Laboratory
(v) ChE313 Transport Principles
(vi) ChE321 Continuous Contacting Processes
(vii) ChE322 Particulate Systems

(i) ChE301 Computations

Hours

Approx. 21 hours

Content

Computations for heat and mass transfer, thermodynamic functions and data processing will be used as an introduction to numerical methods emphasising iterative techniques. Extensive use of FORTRAN IV and Input/Output operations, sub-programs, subroutines, ICL computer packages and efficient programming in FORTRAN will be made.

Topic outlines

Curve fitting by classical graphical methods.
Curve fitting with data transforms by least squares polynomial approximation, mini-max polynomials; coefficient errors.
Iterative solution of algebraic and transcendental single-simultaneous equations by first or second order methods, weighting factors on convergence efficiency.
Matrix methods in solving sets of equations.
Solution of single/simultaneous differential equations of first or higher order.
ICL Analogue Simulation package.

Texts

Scheid, F.  Numerical Analysis (McGraw-Hill 1968)
Basic-Plus Language Manual DEC.II.0.  RBPA-B-D
References
Luther, H. & Wilkes, J.

ChE301 Unit Operations Laboratory

Hours
Approx. 84 hours

Content
A number of experiments study in depth the principles of lecture topics. Applied statistical techniques are used to obtain the maximum amount of useful information from raw data. Techniques include curve fittings of empirical equations; analysis of variance and error analyses.

Texts
Crow, Davis & Maxfield *Statistics Manual* (Dover Press 1972)

ChE311 Thermodynamics

Hours
Approx. 42 hours

Content
Thermodynamics applied to the description of the properties of gases and liquids both ideal and non ideal cases; the expansion and compression processes leading to power generation and cryogenics, to solution equilibria leading to phase and chemical reaction equilibria, to the application of reaction equilibria to corrosion and electrolytic solutions.

Text
(iv) ChE312 Reaction Engineering

**Hours**
Approx. 42 hours

**Content**
Design and operation of chemical reactors for homogeneous and heterogeneous reacting systems. Elementary reaction kinetics leading to interpretation of experimental data needed to design batch and continuous reactors. Effect of heat of reaction and changes of temperature and pressure on design, use of catalysts and residence time estimation. An introduction to design for heterogeneous reacting systems.

**Text**
Levenspiel, O. *Chemical Reaction Engineering* 2nd edn (Wiley 1972)

(v) ChE313 Transport Principles

**Hours**
Approx. 42 hours

**Content**
Heat and mass transfer in unsteady state conditions, transport theory for momentum, heat and mass transfer in laminar and turbulent flow conditions. Boundary layer theory. The course stresses the application of mathematics to the solution of engineering problems. Analogies between heat mass and momentum transfer.

**Text**

(vi) ChE321 Continuous Contacting Processes

**Hours**
Approx. 42 hours

**Content**
Continuous contact separation processes applied to humidification, gas absorption, distillation and liquid-liquid extraction processes.

**Texts**
ChE322 Particulate Systems

Hours
Approx. 42 hours

Examination
To be advised

Content
Definition of size and shape of solid particles, laws of breakage, analytical description of size distributions, matrix description of breakage and classification operations, crushing and grinding equipment, separation of solids; partition curves; pressure and flow of granular material. Drying operations, movement of moisture in solids; drying systems, drying equipment; design methods. Furnace and kiln analysis by heat and mass balance on well-stirred and parallel flow reactors. Size and solids separation in gas or liquids; action of gravitational and centrifugal fields, design and performance of separation and pollution control equipment under these conditions — settling chambers, gas and liquid cyclones, centrifuges; flocculation, hindered settling, sludge thickening; Flow through fixed beds-Fluidisation-Filtration-analytical and design methods. Agitation and mixing scale-up and shape considerations; Evaporation and crystallisation. Dust and gas removal for environmental control.

Text
Coulson, J. M. & Richardson, J. F. Chemical Engineering Vol. 11 2nd edn (Pergamon 1970)

References
Kuni & Levenspiel Fluidization Engineering (Wiley 1968)

513200 Chemical Engineering IIB

Prerequisites
Chemical Engineering I

Pre- or Corequisite
Chemical Engineering IIA

Hours
4½ hours per week

Examination
One 3-hour paper and one 8-hour paper

Content
Chemical Engineering IIB consists of the following units:
(i) ChE314 Process Control
(ii) ChE331 Process Economics
(iii) ChE332 Equipment Design — including materials and corrosion
ChE314 Process Control

Prerequisites
Nil

Hours
Approx. 42 hours

Content
Introduction to process dynamics, the well stirred vessel, treatment of experimental data, Laplace Transform Applications. Block diagram notation, open loop and closed loop systems, the transfer function application and limitations. Control modes. Stability of closed loop system, elementary root locus., Bode diagram. Feed forward. Control, cascade control with applications to control of temperature, flow pressure and composition. Laboratory exercises.

Text
Couganowr, D. R.  
& Koppel, L. B.  
Process Systems Analysis & Control  
(McGraw-Hill 1965)

ChE331 Process Economics

Prerequisites
Nil

Hours
Approx. 42 hours

Examination
To be advised

Content

2. Cost estimation procedures — cost indices — six tenths rule and economy of scale.

3. Economic production charts (break even analysis)
Capacity factors, incremental costs.

4. Depreciation — Purpose of depreciation studies in process costs — types and requirements of depreciation methods — taxation allowances in process plant and equipment — economic life.

5. Project profitability — Concept of equivalence and discounted cash flows — methods for measuring project profitability including rate of return, payout time, interest rate of return (DCF) net present value, annual cost and capitalised cost — continuous discounting.

6. Economic balances — General considerations for economic balance — brief introduction to optimisation — Economic balances applied to selected operations, i.e. mass transfer, cyclic operation, yield and recovery operation.

7. Feasibility studies — selected examples.
Text

References
Buchanan & Sinclair Costs and Economics of the Australian Chemical and Process Industries 2nd edn (Wests 1967)
Peters, M. S. & Timmerhaus Plant Design and Economics for Chemical Engineers (McGraw-Hill 1968)

ChE332 Equipment Design

Hours Approx. 42 hours

Content
Process and engineering flow sheets

Process Heat Exchange — Process and detail design of various classes of heat exchangers for liquids, condensing vapours and boiling liquids.

Process Vessels—Process and detail design of tray and packed process vessels — design of process vessels as free standing vessels — design of simple storage vessels to relevant codes; instrumentation of process vessels.

Materials and Corrosion — The chemistry and physics of corrosion; selection of materials and design methods for corrosive materials and atmospheres. Other factors influencing selection of materials.

Mechanical Drives — Design and selection of bearings, shafts, pulleys and belt drives, seals and glands etc.

Miscellaneous — Outline of types, application design and selection of the following:—
Electric motors, turbines, vacuum systems and process refrigeration systems.

Texts
SAA Code Engineering Drawing Practice AS CZ1-1966
SAA Code Unfired Pressure Vessels AS1210-1972
SAA Code Steel Structures Code AS 1250-1972

Reference
Rase, H. R. & Barrow, M. H. Project Engineering for Process Plants (Wiley 1957)
GENERAL ELECTIVE SUBJECTS

ChE341 — Fuel Technology I — 1 unit

Hours Approx. 1½ hr/week for 3 terms

Prerequisites A first course in Engineering of Metallurgical Chemistry and a first course in fluid mechanics.

Content
Fuel and energy resources and demand. Properties and testing for combustion purposes of common fuels, particularly coal, coke, petroleum products and natural gas. Air quantities for combustion, heat losses in products of combustion, thermodynamics of combustion systems. Gas, oil and pulverized coal flames; burner systems to control stability, flame position and flame shape. Solid fuel combustion and reduction; fixed beds, gas producers and blast furnaces. Abridged bed combustion systems.

References
Beer, J. M. & Chigier, N. A. 
Combustion Aerodynamics (Applied Science 1972)
Brame, J. S. S. & King, J. G. 
Fuel (Arnold)
—
The Efficient Use of Fuel (HMSO 1964)

ChE342 — Furnace Heat Transfer — 1 unit

Hours Approx. 1½ hr/week for 3 terms

Prerequisites First Courses in heat transfer and fluid mechanics

Content
Furnace type and uses; high temperature heat transfer mechanisms. Generalised model of furnace efficiency and losses. Convective heat transfer on large surfaces, from impinging jets; heat transfer in packed beds. Conductive thermal storage losses. Radiative exchange between surfaces; exchange area concept; direct and total interchange in a closed system. Gas radiation; the grey gas model for real gases; gas emissivity and exchange areas.
Models for furnace systems, well-stirred, speckled; plug flow.
Heat exchange characteristics of the model.
Steam boiler furnaces and reheating furnaces as two zone systems. Introduction to zoning methods for more complete systems.
Texts
Trinks, W. & McWhinney Industrial Furnaces (Wiley)

514100 Chemical Engineering III

Prerequisites
Chemical Engineering IIA and IIB

Hours
7 hours per week

Examination
Three 3-hour papers in November, with additional assessment of individual topics.

Content
ChE402 Seminar
ChE431 Process Engineering
Together with not less than six topics selected from:
ChE411 Advanced Combustion (or ChE341 Fuel Technology I 1 or 2 topics)
ChE412 Radiant Heat Transfer (or ChE342 Furnace Heat Transfer — 2 topics)
ChE413 Selected topics in Heat and Mass Transfer
ChE414 Advanced Reaction Engineering
ChE415 Advanced Transport Theory
ChE416 Advanced Process Control
ChE421 Multicomponent Separations
ChE422 Particle Mechanics
ChE432 *Environmental Control
ChE433 Process Evaluation and Optimization
ChE401 Advanced Computations

Texts
As for Level 3 subjects except ChE432
Eckenfelder, W. W. Industrial Water Pollution Control (McGraw-Hill 1966)

References
To be advised

ChE402 Seminar

Hours
Approx. 42 hours

Content
Regular two hour seminar sessions will be held during the year for discussion of literature reviews, chemical engineering practice and of research within the department. Each student will present not less than two half-hour papers in the course of the year.
ChE431 Process Engineering

Hours Approx. 42 hours

Content

1. Plant Location — Factors influencing the location of process plants with particular reference to Australian conditions — Pollution requirements.
2. Plant Layout — Outline of requirements, i.e. safety, operation and maintenance D.L.I. regulations — use of models — selected examples in plant layout for process equipment, utilities and instrumentation.
5. Plant Reliability — Introduction to concept of reliability engineering.
6. Power and Process Reticulation — Design of process piping systems for steam, air, gas and process fluids — trapping and drainage — design of supports and trestles — insulation — introductory piping flexural analysis.
7. Materials Handling — Review of relevant theory, design and selection of the following:
   Process weighing, process storage, conveyor and elevator systems.
8. Engineering responsibilities in environmental and safety control and labour relationships.

Text

Peters, M. S. & Timmerhaus, K. Plant Design and Economics for Chemical Engineers (McGraw-Hill 1968)

ChE401/432 Projects II

Hours The allocation of six units requires a total student time commitment of 20 hours/week

Content

ChE401: An assigned task of experimental investigation, or of design, construction and testing of experimental equipment to be reported formally in a thesis.

ChE432: Preparation of a formal design report for a specified plant for chemical production, including process flow sheets, full mass and energy balances and the detailed design of one or more specified items of equipment.
509200 Elective II

Content
Requires at least five units which may be taken from:

Units

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>Units</th>
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<tbody>
<tr>
<td>CE2021</td>
<td>Materials and Structures</td>
<td>2</td>
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<tr>
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<td>(alternately ME241-1½ units; Materials Science IS 2 units)</td>
<td></td>
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<tr>
<td>EE203-41</td>
<td>Introduction to Electrical Information &amp; Energy</td>
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</tr>
<tr>
<td>ChE341</td>
<td>Fuel Technology I</td>
<td>1</td>
</tr>
<tr>
<td>ChE342</td>
<td>Furnace Heat Transfer</td>
<td>1</td>
</tr>
<tr>
<td>CE471</td>
<td>Energy</td>
<td>2</td>
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</tbody>
</table>

Chemistry Advanced Topics (from IIB, IIIA, IIIB, to not more than 3 units)
Mathematics Advanced Topics (to not more than 3 units)
Metallurgy Advanced Topics (to not more than 3 units)

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>Units</th>
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<tbody>
<tr>
<td>ME361</td>
<td>Automatic Control</td>
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<tr>
<td>ME401 (402)</td>
<td>Systems Analysis</td>
<td>1 (or 2)</td>
</tr>
<tr>
<td>ME487 (488, 489)</td>
<td>Operations Research (1, 2 or 3 units)</td>
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<tr>
<td>ME481 (482)</td>
<td>Engineering Administration &amp; Economics</td>
<td>2</td>
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<tr>
<td></td>
<td>Engineering Geology (with project)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Microeconomics</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Industrial Law</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Accounting &amp; Financial Studies</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Logic &amp; Scientific Method</td>
<td>2</td>
</tr>
</tbody>
</table>

Other preferred 1 or 2 unit courses in Arts or Economics Faculties should be discussed with Head of Department of Chemical Engineering.

Up to 4 units of industrial experience may be credited to Elective II.

1 Normally recommended unless students have a particular case for specialization.

509500 Elective II A

Content
Elective IIA consists of six units to be taken between Stage 5 and Stage 6. It may include topics from the Elective II list or four units either from the Arts Faculty or of advanced topics in Chemical Engineering III for students who wish to specialise in some particular field of Process Engineering. In the latter case the remaining units of this elective must be selected appropriately by consultation with the Head of Department of Chemical Engineering.
509300 Elective III

Content

Elective III is normally a full 1st year level subject or equivalent material taken in breadth and depth. A broad non-professional subject in Languages or Social Science is recommended. Alternatives to this unit may be made up of 4 units as approved by the Head of the Department of Chemical Engineering.

Note:

Not all units for either Elective II or Elective III necessarily have to be taken in the same year.
DEPARTMENT OF CIVIL ENGINEERING

Civil Engineering is the application of science to the improvement of the community's environment. It is concerned with the design and construction of water supply and conservation projects, hydro-electric development, roads, railways, bridges, tunnels, large buildings, irrigation, sewerage, and harbour and river development. The Civil Engineer "adapts the forces of nature for the use and convenience of mankind." His academic training includes the study of science and engineering practice. He must combine this with experience and judgement, and the knowledge and personality necessary to control large organisations of workers. This profession offers to a young man a considerable variety of types of work ranging from specialised research and investigations, through routine design and construction work to higher positions which are largely managerial and organisational in their nature.

The Department of Civil Engineering currently offers the following first degree courses in Civil Engineering — Bachelor of Engineering in Civil Engineering (full-time or part-time course), Bachelor of Arts/Bachelor of Engineering in Civil Engineering (full-time course), Bachelor of Science/Bachelor of Engineering in Civil Engineering (full-time course) and Bachelor of Commerce/Bachelor of Engineering in Civil Engineering (full-time course). These courses are arranged so that all students receive training in the basic principles of mathematics and science, and in the fundamentals of engineering applications of such work to surveying, hydraulics, foundation engineering, structural design, and constructional work in the field. Ancillary subjects from other branches of engineering are also included, such as electrical engineering and mechanical engineering. During the course each student is required to complete at least 20 weeks of industrial training, and to submit detailed reports on each training period. In the final year, the full-time student completes a project covering some aspect of supervised research, and delivers a seminar paper on some selected topic.

Up to and including 1975, the first two years full-time and the equivalent four years part-time of the Bachelor of Surveying degree course of the University of New South Wales have been offered by the University of Newcastle through the Department of Civil Engineering. Students successfully completing the above courses have been able to transfer with full standing into the third year of full-time study in the four-year Bachelor of Surveying degree course at the University of New South Wales.

It is possible that the University of Newcastle will soon offer its own complete Bachelor of Surveying course, starting either in 1976 or 1977. The complete new course is set out on pages 94 et seq. Present plans
are uncertain because of financial decisions which are still pending, but if the University is unable to proceed with this new course in 1976, the courses actually offered will be such as to allow students either to proceed with the whole University of Newcastle course when it becomes available, or to transfer to the University of New South Wales after two years if the University of Newcastle course does not become available.

The first two years of this University's Bachelor of Engineering degree in Civil Engineering is accepted by the University of New South Wales as exemption from the first two year's of that University's Bachelor of Engineering degree course in Mining Engineering.

Postgraduate study in Civil Engineering can be directed either towards the M.Eng.Sc. degree, consisting principally of course work and some project work, or towards the M.E. or Ph.D. degrees, which are essentially research degrees in which the student is required to carry out an investigation having some element of novelty and originality, and to write a thesis on the results.

**SCHEDULE 1.2**

**BACHELOR OF ENGINEERING IN CIVIL ENGINEERING**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
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<tr>
<td><strong>Year I</strong></td>
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<tr>
<td>Engineering I</td>
<td>4</td>
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<tr>
<td>Mathematics I</td>
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<tr>
<td>Physics IA</td>
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<tr>
<td>Chemistry IS</td>
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<tr>
<td>CE171 Engineering Surveying I</td>
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<td><strong>Year II</strong></td>
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<tr>
<td>2Mathematics IIB</td>
<td>4</td>
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<tr>
<td>CE212 Mechanics of Solids</td>
<td>1</td>
</tr>
<tr>
<td>CE221 Properties of Materials</td>
<td>1</td>
</tr>
<tr>
<td>CE222 Materials Technology</td>
<td>2</td>
</tr>
<tr>
<td>CE231 Fluid Mechanics I</td>
<td>1</td>
</tr>
<tr>
<td>CE241 Water Resources Engineering</td>
<td>2</td>
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<tr>
<td>CE223J Engineering Geology</td>
<td>1</td>
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<tr>
<td>EE203 Introduction to Electrical Information</td>
<td>1</td>
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<tr>
<td>EE204 Introduction to Electrical Energy</td>
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<tr>
<td>ME121 Workshop Practice</td>
<td>1</td>
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<tr>
<td>ME271 Thermodynamics</td>
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<td><strong>Total</strong></td>
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### Subject Units

#### Year III

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<tr>
<td>CE313</td>
<td>Structural Analysis &amp; Design I</td>
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<tr>
<td>CE324</td>
<td>Soil Mechanics</td>
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<tr>
<td>CE332</td>
<td>Fluid Mechanics II</td>
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<tr>
<td>GE350</td>
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<tr>
<td>CE351</td>
<td>Civil Engineering Systems I</td>
<td>1</td>
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<tr>
<td>CE372</td>
<td>Transportation Engineering</td>
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<tr>
<td>ME301</td>
<td>Engineering Computations</td>
<td>1</td>
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#### Year IV

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<tr>
<td>CE414</td>
<td>Structural Analysis &amp; Design II</td>
<td>4</td>
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<tr>
<td>CE425</td>
<td>Earth &amp; Rock Engineering</td>
<td>1</td>
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<tr>
<td>CE452</td>
<td>Engineering Construction</td>
<td>2</td>
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<tr>
<td>CE453</td>
<td>Project</td>
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<tr>
<td>ME482</td>
<td>Engineering Economics</td>
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<td>3Elective(s) II</td>
<td></td>
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1 Satisfactory completion of 5-day survey camp is required, normally in Year II.
2 Mathematics II B may be taken in two parts each of three terms duration.
3 See Elective Requirements — Appendix A

During the course each full-time student should complete periods of industrial training acceptable to the Faculty Board totalling 20 weeks before 31 January in the year in which the degree is to be awarded.

### Recommended Programme for the Bachelor of Engineering in Civil Engineering By Part-time Studies

#### Stage 1

<table>
<thead>
<tr>
<th>Subject</th>
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<td>Engineering I</td>
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<td>Mathematics I</td>
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#### Stage 2

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<td>Physics IA</td>
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<tr>
<td>Chemistry IS</td>
<td>2</td>
</tr>
<tr>
<td>CE171 1 Engineering Surveying I</td>
<td>2</td>
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<tr>
<td>ME121 Workshop Practice</td>
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64
<table>
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<tr>
<th>Subject</th>
<th>Units</th>
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<tr>
<td><strong>Stage 3</strong></td>
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<tr>
<td>Mathematics II B Part I (C, E)</td>
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<tr>
<td>CE212</td>
<td>Mechanics of Solids</td>
</tr>
<tr>
<td>CE221</td>
<td>Properties of Materials</td>
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<td>CE222</td>
<td>Materials Technology</td>
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<tr>
<td>CE223J</td>
<td>Engineering Geology</td>
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<tr>
<td>EE203</td>
<td>Introduction to Electrical Information</td>
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<tr>
<td>EE204</td>
<td>Introduction to Electrical Energy</td>
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<tr>
<td><strong>Stage 4</strong></td>
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<tr>
<td>Mathematics II B, Part II (D, H)</td>
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<tr>
<td>CE231</td>
<td>Fluid Mechanics I</td>
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<td>CE241</td>
<td>Water Resources Engineering</td>
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<td>Seminar</td>
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<td>CE351</td>
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<td><strong>Stage 5</strong></td>
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<tr>
<td>CE313</td>
<td>Structural Analysis &amp; Design I</td>
</tr>
<tr>
<td>CE324</td>
<td>Soil Mechanics</td>
</tr>
<tr>
<td>CE332</td>
<td>Fluid Mechanics II</td>
</tr>
<tr>
<td>ME301</td>
<td>Engineering Computations</td>
</tr>
<tr>
<td><strong>Stage 6</strong></td>
<td></td>
</tr>
<tr>
<td>CE414</td>
<td>Structural Analysis &amp; Design II</td>
</tr>
<tr>
<td>CE425</td>
<td>Earth &amp; Rock Engineering</td>
</tr>
<tr>
<td>2Elective I</td>
<td></td>
</tr>
<tr>
<td><strong>Stage 7</strong></td>
<td></td>
</tr>
<tr>
<td>CE452</td>
<td>Engineering Construction</td>
</tr>
<tr>
<td>CE453</td>
<td>Project</td>
</tr>
<tr>
<td>ME482</td>
<td>Engineering Economics</td>
</tr>
<tr>
<td>2Elective II</td>
<td></td>
</tr>
</tbody>
</table>

1 Satisfactory completion of 5-day survey camp is required, normally in Stage 3.
2 See Elective Requirements — Appendix A.
**SCHEDULE 3.2**

**BACHELOR OF SCIENCE (ENGINEERING) IN CIVIL ENGINEERING**

Stages 1, 2 and 3 will not be offered after 1975

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stage 4</strong></td>
<td></td>
</tr>
<tr>
<td>Mathematics IIB Part II (Topics D &amp; H)</td>
<td>2</td>
</tr>
<tr>
<td>CE231 Fluid Mechanics I</td>
<td>1</td>
</tr>
<tr>
<td>CE222 Materials Technology</td>
<td>2</td>
</tr>
<tr>
<td>ME301 Engineering Computations</td>
<td>1</td>
</tr>
<tr>
<td>CE223J Engineering Geology</td>
<td>1</td>
</tr>
<tr>
<td>EE204 Introduction to Electrical Energy</td>
<td>1</td>
</tr>
<tr>
<td><strong>Stage 5</strong></td>
<td>8</td>
</tr>
<tr>
<td>CE313 Structural Analysis and Design I</td>
<td>4</td>
</tr>
<tr>
<td>CE332 Fluid Mechanics II</td>
<td>2</td>
</tr>
<tr>
<td>CE372 Transportation Engineering</td>
<td>1</td>
</tr>
<tr>
<td>CE324 Soil Mechanics</td>
<td>2</td>
</tr>
<tr>
<td><strong>Stage 6</strong></td>
<td>9</td>
</tr>
<tr>
<td>CE414B Structural Design II</td>
<td>2</td>
</tr>
<tr>
<td>CE452 Engineering Construction</td>
<td>2</td>
</tr>
<tr>
<td>CE241 Water Resources Engineering</td>
<td>2</td>
</tr>
<tr>
<td>GE350 Seminar</td>
<td>1</td>
</tr>
</tbody>
</table>

Select two units from —

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE425 Earth and Rock Engineering</td>
<td>(1)</td>
</tr>
<tr>
<td>CE351 Civil Engineering Systems</td>
<td>(1)</td>
</tr>
<tr>
<td>ME482 Engineering Economics</td>
<td>(1)</td>
</tr>
<tr>
<td>CE414A Structural Analysis II</td>
<td>(2)</td>
</tr>
</tbody>
</table>

**OR**

any other Department Elective subject to satisfaction of prerequisites.

66
BACHELOR OF ARTS/BACHELOR OF ENGINEERING
AND
BACHELOR OF SCIENCE/BACHELOR OF ENGINEERING
IN
CIVIL ENGINEERING

The course followed must comply with Section 7 of the Requirements for the degrees of Bachelor of Engineering and Bachelor of Science (Engineering). The following programme is recommended:

The first four years are identical with the B.E. programme except that Electives I and II must consist of Arts/Science subjects Parts I and II respectively.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year V</td>
<td></td>
</tr>
<tr>
<td>Arts/Science Subject Part I</td>
<td>4</td>
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<tr>
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<tr>
<td>Arts/Science Subject Part III</td>
<td>8</td>
</tr>
<tr>
<td><a href="https://www.example.com">https://www.example.com</a></td>
<td>17</td>
</tr>
</tbody>
</table>

Note

Students wishing to major in Mathematics should ensure that Mathematics IIB in the B.E. programme is replaced by Mathematics IIA as necessary co- and pre-requisites to Mathematics IIC and Mathematics IIIA respectively.

BACHELOR OF COMMERCE/BACHELOR OF ENGINEERING
IN CIVIL ENGINEERING

The course followed must comply with Section 7 of the Requirements for the degrees of Bachelor of Engineering and Bachelor of Science (Engineering). The following programme has been approved by the two Faculty Boards:

Years I, II and III same as for B.E. degree except that Elective I must consist of

- Microeconomics 2
- Economics History I
- and one of
  - Legal Studies I 2
  - Economic Statistics I
- GE350 Seminar is replaced by Macroeconomics 4
### Schedule 4.1

#### Bachelor of Surveying

**Full-time Course**

<table>
<thead>
<tr>
<th>Year I</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mathematics I</td>
<td>4</td>
</tr>
<tr>
<td>CE101</td>
<td>Civil Engineering IS</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Microeconomics</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Physics IA</td>
<td>4</td>
</tr>
<tr>
<td>SV111</td>
<td>Surveying I</td>
<td>4</td>
</tr>
<tr>
<td>SV121</td>
<td>Survey Camp I</td>
<td>16</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year II</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mathematics IIB</td>
<td>4</td>
</tr>
<tr>
<td>SV231</td>
<td>Survey Computations I</td>
<td>2</td>
</tr>
<tr>
<td>SV212</td>
<td>Surveying II</td>
<td>4</td>
</tr>
<tr>
<td>CE241</td>
<td>Water Resources Engineering</td>
<td>2</td>
</tr>
<tr>
<td>CE372</td>
<td>Transportation Engineering</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Urban &amp; Regional Economics</td>
<td>1</td>
</tr>
<tr>
<td>EE203</td>
<td>Introduction to Electrical Information</td>
<td>1</td>
</tr>
<tr>
<td>SV222</td>
<td>Survey Camp II</td>
<td>15</td>
</tr>
</tbody>
</table>

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*NOTE:* See statement about the Bachelor of Surveying degree on page 62.
<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
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<tbody>
<tr>
<td><strong>Year III</strong></td>
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</tr>
<tr>
<td>SV313 Surveying III</td>
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</tr>
<tr>
<td>SV332 Survey Computations II</td>
<td>1</td>
</tr>
<tr>
<td>SV341 Astronomy I</td>
<td>2</td>
</tr>
<tr>
<td>SV351 Geodesy I</td>
<td>2</td>
</tr>
<tr>
<td>SV361 Photogrammetry I</td>
<td>2</td>
</tr>
<tr>
<td>Geography IIB</td>
<td>4</td>
</tr>
<tr>
<td>Property and Survey Law</td>
<td>1</td>
</tr>
<tr>
<td>Town Planning A</td>
<td>2</td>
</tr>
<tr>
<td>SV323 Survey Camp III</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>15</strong></td>
</tr>
<tr>
<td><strong>Year IV</strong></td>
<td></td>
</tr>
<tr>
<td>SV414 Surveying IV</td>
<td>2</td>
</tr>
<tr>
<td>SV452 Geodesy II</td>
<td>1</td>
</tr>
<tr>
<td>SV462 Photogrammetry II</td>
<td>1</td>
</tr>
<tr>
<td>SV471 Land Valuation</td>
<td>1</td>
</tr>
<tr>
<td>Geography III Elective</td>
<td>2</td>
</tr>
<tr>
<td>Organisational Behaviour</td>
<td>1</td>
</tr>
<tr>
<td>SV481 Project</td>
<td>2</td>
</tr>
<tr>
<td>SV482 Professional/Project Seminar</td>
<td>1</td>
</tr>
<tr>
<td>2 Electives</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>

1. Mathematics IIB may be taken in two parts each of three terms duration.

2. See Elective Requirements — Appendix A.

**Recommended Programme for the Bachelor of Surveying by part-time studies**

**Stage 1**
- Mathematics I            | 4
- CE101 Civil Engineering IS | 2
- Microeconomics            | 2
- **Total**                 | **8**

**Stage 2**
- Physics IA                | 4
- SV111 Surveying I         | 4
- SV121 Survey Camp I       |       
- **Total**                 | **8**

**Stage 3**
- Mathematics IIB           | 4
- SV231 Survey Computations I | 2
- Urban and Regional Economics | 1
- **Total**                 | **7**

**NOTE:** See statement about the Bachelor of Surveying degree on page 62.
### Subject Entries

#### Stage 4

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>SV212</td>
<td>4</td>
</tr>
<tr>
<td>CE241</td>
<td>2</td>
</tr>
<tr>
<td>EE203</td>
<td>1</td>
</tr>
<tr>
<td>CE372</td>
<td>1</td>
</tr>
<tr>
<td>SV222</td>
<td>8</td>
</tr>
</tbody>
</table>

**Surveying II**  
**Water Resources Engineering**  
**Introduction to Electrical Information**  
**Transportation Engineering**  
**Survey Camp II**

#### Year V

Same as full-time Year III

#### Year VI

Same as full-time Year IV

1 Any student who is unable to undertake years V and VI as a full-time student may do so over three part-time years. Such a student may be required to attend day classes in most subjects.

**NOTE:** See statement about the Bachelor of Surveying degree on page 62.

### Description of Subject Entries

The subjects offered in the Faculty of Engineering course outlines may be varied from time to time both in content and hours.

Each subject has an identification number with prefixed letters indicating the Department responsible for the subject, CE for Civil Engineering, EE for Electrical Engineering, and ME for Mechanical Engineering. The first numeral generally indicates the Year of the full-time course in which the subject is normally taken; the second numeral indicates the field of study; the third numeral for undergraduate courses indicates the level, or sequence in the field. A suffix letter J indicates that the subject is a joint offering of more than one department.

The hours shown for each subject are the total attendance hours for lectures, laboratory, design and tutorial classes. As a guide to private study and preparation, students should allow, on the average about 1½ hours for each hour of lectures and one hour for each hour of laboratory, design or tutorial. The note Arr. indicates that the unit is an elective for which the hours are fixed by arrangement.
Indicating Numerals  Field of Study

Civil Engineering Subjects

CE-0-  Service Courses
CE-1-  Structures
CE-2-  Materials
CE-3-  Fluid Mechanics
CE-4-  Water Resources
CE-5-  Civil Engineering practice
CE-6-  Surveying — Specialist courses
CE-7-  Surveying and Transportation
CE-9-  Special Topics

Surveying Subjects

SV-0-  Servicing course
SV-1-  General Surveying
SV-2-  Survey Camps
SV-3-  Survey Computations
SV-4-  Astronomy
SV-5-  Geodesy
SV-6-  Photogrammetry
SV-7-  Land Studies
SV-8-  Project and Seminars
SV-9-  Special courses

521103  CE101 Civil Engineering IS

Prerequisites  Nil

Hours  Two lecture hours and one tutorial hour per week

Examination  Progressive Assessment

Content

Statics: Force systems, equilibrium, pin-jointed frames
Properties of Materials: Behaviour of materials under static and dynamic loads.
Mechanics of Solids: Uniaxial loading, stress and strain, internal forces and stresses, deflection of beams.
Fluid Mechanics: Fluid properties, hydrostatics, fluid dynamics, continuity, energy, momentum. Flow in pipes, conduits and open channels.
Soil Mechanics: Soil properties, seepage, soil stresses, settlement, compaction, strength and failure criteria.
References

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 graphical treatment; equilibrium of three-dimensional force systems, cables.

Text
Hall, A. S. & Archer, F. Principles of Statics (University of New South Wales, Student's Union)

References
Beer & Johnston Mechanics for Engineers Statics 2nd edn (McGraw-Hill)
Meriam, J. L. Statics 2nd edn (S.I.) (Wiley 1975)

521104 CE171 Engineering Surveying I†

Prerequisites Nil

Hours 1½ lecture-hours, one ½ hour tutorial and one hour of fieldwork per week.

Examination One 3-hour paper

Content
A course of lectures, field work and a survey camp; basic measurement techniques and instruments, traversing, plane tabling, tacheometry; contours, areas, volumes, route surveys and associated calculations; hydrographic and underground surveys; introduction to photogrammetry; controlling and setting out small engineering projects.

† Part I of this subject may be taken as a one unit elective in the Department of Mechanical Engineering.
Text
Bannister, A. & Raymond, S.  *Surveying* (Pitman)

References
Barry, B. A.  *Construction Measurements* (Wiley)
Clark, D.  *Plane and Geodetic Surveying Vol. I* (Plane Surveying) (Constable)

522402 CE201 Engineering for Surveyors

Prerequisite  Engineering I

Hours  Two lecture hours and one tutorial hour per week

Examination  Progressive assessment

Content
Materials, structures and design of instruments. Aspects of hydraulics, hydrology and soil mechanics.

References

522102 CE212 Mechanics of Solids I

Prerequisites  Engineering I and Maths I

Hours  1½ lecture hours and one 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.
**Text**

Hall, A. S.  
*An Introduction to the Mechanics of Solids*  
S.I. edn (Wiley 1973)

**References**

Crandall, S. H., Dahl, N. G. & Lardner, T. J.  
*An Introduction to the Mechanics of Solids*  
2nd edn (McGraw-Hill 1972)

Shanley, F. R.  

---

**522101 CE221 Properties of Materials I**

**Prerequisites**  
Engineering I

**Hours**  
1½ lecture hours and one tutorial hour per week

**Examination**  
One 3-hour paper

**Content**  

**Suggested Preliminary Reading**  
Gordon, J. E.  

Whyatt, O. H. & Dew-Hughes, D.  
*Metals, Ceramics and Polymers* (Cambridge University Press 1974)

**References**

Davis, H. E., Troxell, G. E. & Wiskocil, C. J.  

McCintock, F. A. & Argon, A. S.  
*Mechanical Behaviour of Materials* (Addison-Wesley 1966)

Richards, C. W.  
*Engineering Material Science* (Chapman-Hall 1961)

---

**522105 CE222 Materials Technology†**

**Hours**  
1½ lecture hours and 1½ laboratory/tutorial hours per week on average.

**Examination**  
Two 3-hour papers, the first at mid-year.
Content

Metallurgy: basic structure of metals.

Brickwork, timber, ceramics, plastics: basic properties and uses.

Concrete technology: materials in concrete; concrete mix design; properties of plastic and hardened concrete; manufacturing and field control.

Texts

As for CE221 Properties of Materials plus

Design Control and Characteristics of Concrete
(Cement & Concrete Association)

(Standards Association of Australia)

SAA Code — AS1465 — Dense Natural Aggregates for Concrete (Standards Association of Australia)

References

Lea, F. M. & Desch, C. H. The Chemistry of Cement and Concrete (Arnold)

Taylor, W. H. Concrete Technology and Practice (Angus & Robertson)

† Part I of this subject may be taken as a one unit elective in the Department of Mechanical Engineering.

732900 CE223J Engineering Geology (for students in Engineering)

Hours

One lecture hour and 2 laboratory hours per week for fourteen weeks together with two days field work.

Examination

One two-hour paper

Content

Introduction to principles of geology and their application to engineering problems.

Text

Krynine & Judd Principles of Engineering Geology and Geotechnics

522202 CE231 Fluid Mechanics I

Prerequisites

Maths I and ME131 Dynamics

Hours

One lecture hour and one ½ hour of tutorials and laboratory work per week

Examination

One 3-hour paper
Content

Text
Olson, R. M., Engineering Fluid Mechanics 3rd edn (Intext 1973)

References

522203 CE241 Water Resources Engineering

Hours
Two lecture hours and one tutorial hour per week

Examination
One 3-hour paper

Content

Texts
Australian Rainfall and Runoff (Institution of Engineers. Australia, Stormwater Standards Committee)
Tebbutt, T. H. Y. Principles of Water Quality Control (Pergamon 1971)
References
Chow, V. T.  
Fair, G. M., Geyer, J. C. & Okun, D. A.
McGauchey, P. H.
Metcalf & Eddy Jr

Handbook of Applied Hydrology (McGraw-Hill)
Water and Wastewater Engineering Vol. II (John Wiley 1968)
Engineering Management of Water Quality (McGraw-Hill 1968)
Wastewater Engineering (McGraw-Hill 1972)

523304  CE303 Structural Design

Prerequisites  CE212 and ME241
Hours  Two lecture hours and one tutorial hour per week
Examination  Progressive assessment only
Content  Design of steel and reinforced concrete structures for students not following the Civil Engineering course.

Texts  As for CE313 (Design)
References

523101  CE313 Structural Analysis and Design I

Prerequisites  CE212 and CE221
Hours  Four lecture hours and two tutorial hours per week
Examination  One 3-hour paper (Analysis)

Content  Analysis of elastic statically determinate and indeterminate systems by classical methods; plastic analysis; basic design of steel and reinforced concrete structures.

Texts  Nil
Analysis
Design
B.H.P.—A.I.S.  Hot Rolled Carbon Steel Sections and Plates (B.H.P. Co. Ltd)
Bresler, B., Lin, T. Y. & Scalzi, J. B.  Design of Steel Structures (Wiley)
OR
McGuire, W.
OR
Gorenc, B. E. &
Tinyou, R.
Ferguson, P. M.

Lay, M. G.

References

Analysis
Baker & Heyman, J.
Coates, R. C.,
Coutie, M. G. &
Kong, F. K.
Horne, M. R.
Norris, C. H. &
Wilber, J. B.

Design
Bennett, E. W.
Gray, C. S.
Sachs, P.

Steel Structures (Prentice-Hall)
Steel Designer's Handbook (N.S.W. University Press)
Reinforced Concrete Fundamentals 3rd edn (Wiley)
Source Book for the Australian Steel Structures Code AS1250 (AISC)
SAA Steel Structures Code AS1250 — 1975
SAA Code for Concrete in Buildings AS1480 — 1973
SAA Loading Code AS1170 Pt I Dead and Live Load — 1971
AS 1170 Pt II Wind Loads — 1973

Plastic Design of Frames Vols 1 & 2
(Cambridge University Press)
Structural Analysis (Nelson 1972)
Plastic Theory of Structures (Nelson 1971)
Elementary Structural Analysis (McGraw-Hill 1960)
Structural Concrete Elements (Chapman Hall 1973)
Steel Designer's Manual (Lockwood)
Wind Forces in Engineering (Pergamon)
Engineering Drawing Practice — ASCA A1 — 1966 (Standards Association of Australia)
*Engineering Drawing Practice ASC 21 — 1966 (Imperial Units)
AS1100, Parts 3, 4, 5, 6, 7 & 9 (Metric Drawing Standard)
SAA Code for Higher Strength Bolts — AS1511 — 1973 (Standards Association of Australia)
SAA Code for Welding in Building AS1554
Pt. II — 1972 Automatic and Semi-automatic Welding (Standards Association of Australia)

* Due to conversion to S.I. Units, codes will be confirmed by the lecturer concerned.

523105 CE313A Structural Analysis I (Topic in Civil Engineering IIM in the Faculty of Mathematics)

Prerequisites
CE212 and Maths I

Hours
Two lecture hours and one tutorial hour per week

Examination
One 3-hour paper

Content
Analysis component of CE313
Analysis of elastic statically determinate and indeterminate systems by classical methods; plastic analysis.

Texts
As for CE313 (Analysis Component)

References

523102 CE324 Soil Mechanics†

Prerequisite
CE212

Pre- or Corequisite
CE332

Hours
Two lecture hours and one laboratory hour per week

Examination
Two 2-hour papers, the first at mid-year

Content
Index properties, classification of soils; introduction to finite element methods; permeability, capillarity, seepage and flow nets; stresses in soils; settlement and consolidation; compaction, shear strength and failure criteria; stability of retaining walls.

Text
Wu, T. H. Soil Mechanics (Allyn & Bacon 1966)
References
Lambe, T. W.  *Soil Testing for Engineers* (Wiley)
-  *Methods of Testing Soils for Engineering Purposes* ASA89 (Standards Association of Australia)

† Part 1 of this subject may be taken as a one unit elective in the Department of Mechanical Engineering.

523301  CE332 Fluid Mechanics II

**Prerequisite**
CE231

**Hours**
Two lecture-hours and one hour tutorial and laboratory per week

**Examination**
One 3-hour paper

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

**Preliminary Reading**
Rouse, H. & Ince, S.  *History of Hydraulics* (Dover 1963)

**Texts**
Henderson, F. M.  *Open Channel Flow* (Collier-Macmillan 1966)
Olson, R. M.  *Engineering Fluid Mechanics* 3rd edn (Intext 1973)

**References**
Davis, C. V. & Sorenson  *Handbook of Applied Hydraulics* 3rd edn (McGraw-Hill)
Morris, H. M.  *Applied Hydraulics in Engineering* (Ronald Press 1963)
Rouse, H.  *Engineering Hydraulics* (Wiley 1951)
Vallentine, H. R.  *Applied Hydrodynamics* (Butterworths)

523900  CE340 Surveying for Architects

**Hours**
1½ lecture hours, one ½ hour tutorial and one hour of fieldwork

**Examination**
One 3-hour paper
Content
Introduction; linear measurements and corrections; chain surveying; levelling and booking; contours; the theodolite and its use in measuring angles; traversing; plane table methods of surveying; tacheometry.

Reference
Bannister, A. & Raymond, S. Surveying (Pitman)

523202 GE350 Seminar

Hours Two seminar hours per week for 21 weeks

Content
Preparation and presentation by students of lectures and discussions on a range of topics of historical, social and technological significance.

523107 CE351 Civil Engineering Systems I

Hours One lecture hour and one half hour tutorial per week

Examination Two 1½-hour term papers and one 3-hour final paper

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

Text

References
Baumol, W. J. Economic Theory and Operations Analysis (Prentice-Hall)
de Neufville, R. & Stafford, J. H. Systems Analysis for Engineers and Managers (McGraw-Hill)
Wagner, H. M. Principles of Operations Research (Prentice-Hall)
523108  CE372 Transportation Engineering

Hours  1½ lecture hours per week

Examination  One 3-hour paper

Content

Elements of regional planning, land-use/transport interaction; transportation modes and system characteristics; transportation demand estimates, data collection, highway engineering; driver, vehicle and road characteristics, road geometrics; traffic engineering; road construction, drainage, pavements, maintenance.

Preliminary Reading

Hay, W. W.  An Introduction to Transportation Engineering (Wiley)

Texts

Oglesby, C. H. & Hewes, L. I.

Highway Engineering (Wiley)

Geometric Design of Rural Roads (NAASRA)

Traffic Engineering Practice (NAASRA)

References

Blunden, W. R.

The Land-Use/Transport System (Pergamon)

Yoder, E. J.

Principles of Pavement Design (Wiley)

524101  CE414 Structural Analysis and Design II

Prerequisites  CE313 and Mathematics IIIB

Hours  3½ lecture-hours and 2½ tutorial hours per week

Examination  One 3-hour paper

Content


Text

—  AS1481 — 1974 — SAA Prestressed Concrete Code (Standards Association of Australia)
References

Bresler, B., Lin, T. Y. & Scalzi, J. B.  
Design of Steel Structure 2nd edn (Wiley)

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

Ferguson, P. M.  
Reinforced Concrete Fundamentals 3rd edn (Wiley)

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

Lin, T. Y.  
Design of Prestressed Concrete Structures (Wiley)

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

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

Norris, C. H. & Wilbur, J. B.  
Elementary Structural Analysis 2nd edn (McGraw-Hill 1960)

524103  CE414A Structural Analysis II

Prerequisites  
CE313 or CE313A and Maths IIB

Hours  
1½ lecture-hours and 1½ tutorial hours per week

Examination  
One 3-hour paper

Content

Analysis component of CE414.

References

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

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

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

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

Norris, C. H. & Wilbur, J. B.  
Elementary Structural Analysis 2nd edn (McGraw-Hill 1960)
524104 CE414B Structural Design II

Prerequisite
CE313

Hours
1½ lecture hours and 1½ tutorial hours per week

Examination
Progressive assessment only

Content
Design component of CE414.

Text
AS1481 — 1974 — SAA Prestressed Concrete Code (Standards Association of Australia)

References
Ferguson, P. M. Reinforced Concrete Fundamentals 3rd edn (Wiley)
Lin, T. Y. Design of Prestressed Concrete Structures (Wiley)

524403 CE425 Earth and Rock Engineering

Prerequisite
CE324

Hours
One lecture hour and one ½ hour tutorial per week

Examination
Progressive assessment

Content
Site investigation, design of spread footings, strip and combined footings, raft foundations, piled foundations, design of embankments, cuttings, earth and rockfill dams, introductory rock mechanics.

Text
Peck, R. B., Hanson, W. E., & Thornburn, T. H. Foundation Engineering 2nd cdn (Wiley 1974)

References
524102  CE452 Engineering Construction

Hours  Two lecture hours and one tutorial hour per week

Examination  One 3-hour paper

Content

Management: Construction company failures and the need for efficient management; principles of management, management functions and techniques; nature and type of organisations structure.

Administration: Costing; estimating; engineering contracts; drawings and specifications; tendering.

Project Planning and Control: Planning; constructing and analysing networks; resource levelling; cost minimization; presentation of information; control.

Construction Plant: Classification, selection and use of plant; plant organization; plant costs, purchase or hire; site establishment and temporary works.

Construction Methods and Equipment: Earthmoving; drilling and blasting; tunnelling; foundation drilling; piling; bridge and building construction.

Texts

Antill, J. M.  Civil Engineering Management (Angus & Robertson 1970)


References

Carson, A. Brinton  Foundation Construction (McGraw-Hill)

McFarland, Dalton E.  Management Principles and Practices (Macmillan)

Peurifoy, R. L.  Construction, Planning, Equipment and Methods (McGraw-Hill)

524404  CE453 Project

Prerequisites  Prerequisite and corequisites will depend on nature of Topic.

Hours  No formal lectures — Personal contact with supervisor

Minimum work load of 3 hours per week

Content

Literature review, analytical and/or experimental investigation, or one or more civil engineering design problems. Presentation of seminar.

85
In all electives, the subdivision of the course into lectures, tutorials etc; the form of examination and the prescribed and reference texts unless indicated below, will be advised by the lecturer.

**Industrial Experience — Electives**
Part-time students in suitable employment may receive credit of one unit for one year's industrial experience provided approval is obtained from the Head of the Department before October 31 in the year prior to that in which credit is sought. To obtain a pass in each unit, a satisfactory report on that year's industrial experience must be submitted before October 31 of the year in question.

**524029 CE415 Elastic Continua**

*Pre(Co-)requisite*  
CE414 or CE414A

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

*Examination*  
One two hour final paper

*Content*

*References*
Desai, C. S. & Abel, J. F.  
*Introduction to the Finite Element Method*  
(Van Nostrand-Reinhold 1972)

Timoshenko, S. P. & Goodier, J. N.  

Timoshenko, S. P. & Woinowsky-Krieger, S.  
*Theory of Plates and Shells* 2nd edn (McGraw-Hill 1965)

**524030 CE416 Plastic Frame Design**

*Pre(Co-)requisite*  
CE414 or CE414A

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

*Examination*  
One two hour final paper
Content
Review of upper and lower bound theorems, beams, columns, connections, design of braced frames, column deflection curves, subassemblies, unbraced frames.

References
Lehigh University  
Plastic Design of Multi-story Frames  
(1965)

Massonet, C. E. & Save, M. A.  
Plastic Analysis and Design Vol. 1 Beams and Frames (Blaisdell 1965)

524031  CE417 Steel Beams, Columns and Frames

Pre(Co-)requisite  
CE414

Hours  
One lecture hour and one half tutorial hour per week

Examination  
One 3-hour paper

Content
Instability of beams, columns and frames, including analysis of thin-walled sections in torsion; box girder analysis.

References
Croll, J. G. A. & Walker, A. C.  
Elements of Structural Stability (Macmillan 1972)

Galambos, T. V.  
Structural Members and Frames (Prentice-Hall 1968)

—  
Combined Bending and Torsion of Beams and Girders — Publication No. 31 Pts 1 and 2 (British Constructional Steelwork Association)

524032  CE418 Brickwork and Timber Design

Pre(Co-)requisite  
CE414

Hours  
One lecture hour and one half tutorial hour per week

Examination  
Progressive assessment

Content
The properties and behaviour of brickwork and its components. The design of brickwork structures including recent developments in high rise construction. The properties and behaviour of timber. The design of timber structures.
Text
N. H. & Boyd, J. D. (Jacaranda Press)

References
— Recommended Practice for Engineered Brick Masonery (Structural Clay Products Institute, U.S.A.)
— S.A.A. Timber Engineering Code ASCA65 — 1972
— S.A.A. Brickwork Code AS1640 — 1974

524033 CE419 Engineering Seismology

Prerequisites Nil

Hours One and a half lecture hours per week

Examination Progressive assessment

Content
Causes of earthquakes, the theory of plate tectonics; introduction to classical seismology; seismicity, source mechanisms, source parameters, simple source models; wave propagation, propagation of strong ground motion; effects of local geology and topography; design earthquake estimation; statistical characterization of high-frequency ground motion, introduction to random vibration theory; tectonics and seismicity of the South-West Pacific and resulting earthquake engineering problems.

Texts
References To be advised.

524034 CE426 Advanced Materials

Prerequisites CE212 and CE221

Hours One lecture hour and one half tutorial hour per week

Examination One 3-hour paper

Content
Texts
References
To be advised.

524035 CE427 Concrete Technology

Prerequisite
CE222

Hours
1½ lecture hours per week for 20 weeks and
1½ laboratory hours per week for 8 weeks.

Examination
One 2-hour paper

Content
Characteristics of special concretes. Use of high alumina, slag, fly ash
and other special cements; gap-graded mixes; lightweight aggregate;
fibre reinforcement; small scale concrete models.

Texts
References
To be advised.

524036 CE428 Soil Mechanics

Prerequisite
CE324

Hours
One lecture hour and one half tutorial hour per
week

Examination
Progressive assessment

Content
More advanced work including recent experimental and analytical
advances in soil mechanics.

Texts
Nil

References
Scott, R. F. Principles of Soil Mechanics (Addison Wesley 1963)

524037 CE429 Foundation Engineering

Prerequisite
CE324

Hours
One lecture hour and one half tutorial hour per
week

Examination
Progressive Assessment.
Content
Course time will be divided between more advanced analytical and design methods, and exercises in practical soils engineering. Current soil mechanics projects in and about Newcastle will be followed and sites visited. Each student will undertake a small but complete foundation investigation including site investigation, laboratory testing, design recommendations and presentation of a brief written report.

Texts
Nil

References
To be advised.

524038 CE433 Theoretical Hydrodynamics

Prerequisite
CE332

Hours
One lecture hour and one half tutorial hour per week

Examination
One 3-hour paper

Content
Proof and applications of the Navier Stokes equations and the vorticity equation; irrotational flow and the use of complex variable methods to solve some of the basic engineering problems such as airfoil lift and percolation under dams.

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

Reference
Milne-Thompson, L. M. Theoretical Hydrodynamics (Macmillan)

524039 CE434 Open Channel Flow

Prerequisite
CE332

Hours
One lecture hour and one half tutorial hour per week

Examination
One 3-hour paper

Content
Further methods of plotting longitudinal profiles, and solution of more difficult problems involving channel transitions and controls. Introduction to unsteady flow; the method of characteristics, and the principles of flood routing.
524040  CE435 River and Coastal Engineering I

Prerequisite  CE332

Hours  One lecture hour and one half tutorial hour per week

Examination  One 3-hour paper

Content  

Texts
Henderson, F. M.  *Open Channel Flow* (Collier-Macmillan 1966)
Muir Wood, A. M.  *Coastal Hydraulics* (Macmillan 1969)

References
Leopold, L. B., Wolman, M. G. & Miller, J. P.  *Fluvial Processes in Geomorphology* (Freeman 1964)
Leliavsky, S.  *An Introduction to Fluvial Hydraulics* (Dover 1966)
Wiegel, R. L.  *Oceanographical Engineering* (Prentice-Hall 1964)

524041  CE442 Water Resources Engineering

Prerequisite  CE241

Hours  One lecture hour and one half tutorial hour per week

Content  
To be advised.

Texts  

524042 CE443 Water Quality Management

Prerequisite
CE241

Hours
One lecture hour and one half tutorial hour per week

Examination
One 3-hour paper

Content

Preliminary Reading
Imhoff, K., Muller, W. J. & Thistlewayte, D. K. B. Disposal of Sewage and Other Waterborne Wastes 2nd edn (Butterworths 1971)

Text

Reference

524043 CE454 Critical Path Planning

Pre(Con)-requisite
CE351

Hours
1½ lecture hours per week

Examination
Progressive assessment

Content

524044 CE455 Civil Engineering Systems II

Prerequisite
CE351

Hours
One lecture hour and one half tutorial hour per week
Examination
One 3-hour paper

Content
Mathematical programming and optimisation techniques, applications to problems in structural design, engineering management, water resource systems and transportation.

Texts
Nil

References
de Neufville, R. & Stafford, J. H.
Systems Analysis for Engineers and Managers (McGraw-Hill 1971)
Stark, R. M. & Nicholls, R. L.
Wagner, H. M.

524045 CE473 Engineering Surveying II

Prerequisite
CE171

Hours
One lecture hour and one half tutorial hour per week

Content
To be advised.

Texts

524046 CE474 Transportation Planning

Prerequisite
CE372

Hours
1½ lecture hours per week

Examination
One 2-hour paper

Content
Transportation in the national economy; sociological, environmental and economic requirements of transportation systems; demands for travel; land use/transport interaction. Transportation planning; data collection, trip generation; trip distribution; traffic assignment; modal split; economic evaluation. Recent innovations in transportation systems.

Text
Bruton, M. J.
Introduction to Transportation Planning
(Hutchinson Educational 1970)
524047  CE475 Highway Engineering

Prerequisite  CE372
Hours  1½ lecture hours per week
Content  To be advised.
Texts  

524048  CE490 Special Topic

Hours  1½ lecture hours per week

524049  CE491 Special Topic

Hours  1½ lecture hours per week

521110  SV111 Surveying I

Prerequisites  Nil

Hours  Part A: Average 1½ lecture hours, one half tutorial
        hour and 2½ fieldwork hours per week
        Part B: One lecture hour and one half tutorial
               hour per week

Examination  Two 3-hour papers

Content

Part A (Surveying)
Classes of surveys — nature, causes and classes of errors — elementary
error propagation — linear measurement with tapes, ordinary differential
levelling, angle measurement, plane table, tacheometry optical
square, Abney level, Indian clinometer, magnetic compass.
Field notes — line ranging, chain surveys — traversing and traverse
calculations — plane triangulation — contour surveys — plane table
surveying.
Route Surveys — areas and volumes — horizontal (circular and transi-
tion) and vertical curves.
History of surveying and survey instruments.

Part B (Cartography)
Cartographic drawing — plotting and plan drawing for cadastral and
engineering surveys.
Texts
Bannister, A. & Raymond, S.  
Surveying 3rd edn (Pitman 1972)

—  
Seven-Figure Mathematical Tables (W. & R. Chambers 1958)

References
Clarke, D.  
Plane & Geodetic Surveying Vol. I 6th edn (Constable 1969)

Whyte, W. S.  
Basic Metric Surveying (Butterworths 1969)

521111  SV121 Survey Camp I

Prerequisite  
CE171 Engineering Surveying (B.E. students only)

Corequisite  
SV111 Surveying I (B.Surv. students only)

Duration  
Five days

Examination  
Progressive assessment

Content
Extensive contour and detail survey, including horizontal and vertical control by traverse and differential levelling — plane tabling — stadia. A small engineering survey. Associated calculations and plans.

522404  SV212 Surveying II

Prerequisites  
SV111 Surveying I

Corequisites  
SV231 Survey Computations I

Hours

Part A: Average 1½ lecture hours, 1 tutorial hour and 2 fieldwork hours per week

Part B: One lecture hour and ½ tutorial hour per week

Examination  
Two 3-hour papers

Content
Part A (Surveying)
Precise levelling, barometric levelling, trigonometrical levelling, reciprocal levelling-hydrographic surveying — underground surveying — gyrotheodolites — plane triangulation with single second theodolites.
Part B (Optics)

Reflection and refraction at plane and curved surfaces — prisms, thin lenses and spherical mirrors — lens combinations, thick lenses, “thick” mirrors — aberrations, parabolic reflectors — optical trains in surveying instruments, optical compensators, optical plumbing-Gauss collimation techniques.

**Texts**

Bannister, A. & Raymond, S.

*Surveying* 3rd edn (Pitman 1972)

Clark, D.


Clark, D.

*Plane and Geodetic Surveying for Engineers* Vol. II 6th edn (Constable 1973)

**References**

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—


Cooper, M. A. R.

*Modern Theodolites and Levels* (Crosby Lockwood 1971)

Hodges, D. J. & Greenwood, J. B.

*Optical Distance Measurement* (Butterworths 1971)

Ingham, A. E.

*Hydrographic Surveying for the Surveyor and Engineer* (Crosby Lockwood 1974)

Smith, J. R.

*Optical Distance Measurement* (Crosby Lockwood 1970)

**522405  SV222 Survey Camp II**

**Prerequisite**

SV121 Survey Camp I

**Corequisite**

SV212 Surveying II

**Duration**

Five days

**Examination**

Progressive assessment

**Content**

Extensive engineering survey — control by plane triangulation and traversing — setting out road centreline, including transition and circular curves — calculation of grades and earthworks quantities, and associated drawings.
SV231 Survey Computations I

**Prerequisite**
SV111 Surveying I

**Hours**
Two lecture hours and 1 tutorial hour per week

**Examination**
Progressive assessment

**Content**
Use of tables — plane trigonometrical formulae — calculation of triangles, areas, roadways, subdivisions. Use of calculating machines. Traverse computations including offsets and missing data problems. Areas from co-ordinates — transformations — resections and intersections, mathematical and semi-graphic. Spherical trigonometry and applications to survey problems. Elementary computer programming.

**Texts**

- *The University of Newcastle Computing Centre Handbook* (University of Newcastle 1975)
- *The Manual of the N.S.W. Integrated Surveys Grid* (N.S.W. Government Printer)

SV313 Surveying III

**Prerequisites**
SV212 Surveying II and EE203 Introduction to Electrical Information

**Hours**
Averaging one lecture hour and ½ fieldwork hour per week

**Examination**
One 3-hour paper

**Content**
Electronic timing — frequency measurement and calibration — phase shift measurement of sinusoidal waves — propagation of electromagnetic waves — electromagnetic distance measurement — navigational aids, applications to hydrographic surveying.

**Text**
Burnside, D. C., *Electromagnetic Distance Measurement* (Crosby Lockwood 1971)
References

- Admiralty Manual of Hydrographic Surveying Vol. II (HMSO)
- Hames, G. Sound Underwater (David & Charles 1974)
- Saastamoinen, J. J. Surveyors Guide to Electromagnetic Distance Measurement (University of Toronto 1967)

523330  SV323 Survey Camp III

Prerequisite  SV222 Survey Camp II
Corequisites  SV313 Surveying III
             SV361 Photogrammetry I
Duration      Twelve days
Examination   Progressive assessment

Content
Preparation of detail and topographical map from aerial photos, including:
Horizontal control by second-order triangulation and EDM traverse — vertical control by trigonometric levelling and precise levelling; extension of control by barometric levelling.
Stellar observations for latitude, longitude and azimuth.

523326  SV332 Survey Computations II

Prerequisite  SV231 Survey Computation I
Hours        ½ lecture hour and one ½ tutorial hour per week
Examination  One 3-hour paper

Content
Revision and extension of error theory — adjustment by least squares — error ellipse calculations.

Text        Nil

References

- Rainsford, H. F. Survey Adjustments and Least Squares (Constable 1957)
- Richardus, P. Project Surveying (North Holland 1966)
523327  SV341 Astronomy I

**Prerequisite**  
SV231 Survey Computations I

**Hours**  
Average two lecture hours and 1 fieldwork hour per week

**Examination**  
One 3-hour paper

**Content**  
The celestial sphere and astronomic triangle — definitions, conventions and time — latitude by circum-meridian methods; longitude by ex-meridian methods; best position, balancing — azimuth by circum-elongation, circumpolar and sun observations — optimum position, balancing — position line methods.

**Text**  
To be advised

**References**

Biddle, C. A.  
*Text Book of Field Astronomy*  
(London, HMSO 1958)

Roelofs, R.  
*Astronomy Applied to Land Surveying*  
(Amsterdam, Ahrend 1970)

523328  SV351 Geodesy I

**Prerequisite**  
SV231 Survey Computations I  
SV212 Surveying II

**Hours**  
Average two lecture hours and one fieldwork hour per week

**Examination**  
One 3-hour paper

**Content**  
Historical development of geodesy — differential geometry — the spheroid — Legendre's Theorem — computation of geographical coordinates — geodetic surveying (horizontal control) — map projections — the Australian Map Grid and the N.S.W. Integrated Survey Grid.

**Texts**

Clark, D.  
*Plane and Geodetic Surveying for Engineers*  
Vol. II 6th edn (Constable 1973)

—  
*The Australian Map Grid Technical Manual*  

—  
*The Manual of the N.S.W. Integrated Survey Grid* (N.S.W. Govt. Printer)

—  
*Integrated Survey Grid Tables* (N.S.W. Govt. Printer 1972)
Reference
Bomford, G. Geodesy 3rd edn (Oxford 1971)

523329 SV361 Photogrammetry I

Prerequisite Nil

Hours Average 1½ lecture hours and 1½ laboratory hours per week

Examination One 3-hour paper

Content
Stereoscopic vision — geometry of single aerial photograph — stereoscopic pairs — fundamental mathematical relationships — radial triangulation. Inner, relative and absolute orientation with respect to direct optical projection. Cameras, physical properties of photographs.

Text
Wolf, P. R. Elements of Photogrammetry (McGraw-Hill 1974)

Reference — The Manual of Photogrammetry Vols. I & II (Amer. Soc. of Photogrammetry)

524125 SV414 Surveying IV

Prerequisites SV313 Surveying III

Corequisites SV332 Survey Computations II
Property and Survey Law

Hours Two lecture hours and one tutorial hour per week

Examination One 3-hour paper

Content
Map reproduction — methods of preparation and reproduction of line maps — other map products.

Cadastral surveys in N.S.W. — survey practice law; professional ethics; surveyors' rights, powers and duties — Torrens and Common Law title surveys; searches — identification surveys, field records and plans — integrated surveys.

Tape standardisation, laboratory testing of instruments, error analysis in survey methods.
**Text**

Hallmann, F. M. *Legal Aspects of Boundary Surveying as Apply in New South Wales* (Inst. of Surveyors, Aust. 1973)

**References**

Lawrence, G. R. P. *Cartographic Methods* (Methuen 1971)

Richardus, P. *Project Surveying* (North Holland 1966)

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**524126  SV415 Surveying V (Elective)**

**Prerequisite**

SV313 Surveying III

**Corequisites**

SV414 Surveying IV

SV332 Survey Computations II

**Hours**

One lecture hour and ½ tutorial hour per week

**Examination**

One 3-hour paper

**Content**

Measurement of deflection and settlement of structures — survey methods in industry — relocation of lost marks — special surveying problems.

**Text**

To be advised.

**References**

To be advised.

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**524127  SV442 Astronomy II (Elective)**

**Prerequisite**

SV341 Astronomy I

**Hours**

Average two lecture hours and one fieldwork hour per week

**Examination**

One 3-hour paper

**Content**

A study of topics selected from:—

Corrections to observations and calculations

Star co-ordinates

Meridian methods

Equal altitude methods

Precise timing

**Text**

To be advised.

**References**

To be advised.
524128 SV452 Geodesy II

Prerequisite
SV351 Geodesy I

Corequisite
SV332 Survey Computations II

Hours
Average one lecture hour and \( \frac{1}{2} \) tutorial hour per week

Examination
One 3-hour paper

Content
Least squares adjustment of control surveys — variance/covariance matrix, variance factor and weight coefficient matrix — elementary statistical testing of observations and adjusted values — precise levelling.

Relationship between geoid and ellipsoid — astro-geodetic levelling — ellipsoidal elevations — mean sea level and the geoid-gravity and its use in geodesy — methods for establishing a world geodetic system.

Text
Clark, D. *Plane and Geodetic Surveying* Vol. II 6th edn (Constable 1973)

References
Bomford, G. *Geodesy* 3rd edn (Oxford 1971)
Richardus, P. *Project Surveying* (North Holland 1966)

524129 SV453 Geodesy III (Elective)

Corequisite
SV452 Geodesy II

Hours
Average one lecture hour and \( \frac{1}{2} \) tutorial hour per week

Examination
One 3-hour paper

Content
Calculations on the ellipsoid — conformal projection of an ellipsoid — atmospheric refraction and its effect on survey measurements — adjustment of control surveys, precision of adjusted measurements, error ellipses of adjusted co-ordinates. The permanence of geodetic position — long range goals of geodesy.

Text
To be advised.

References

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524130  SV462 Photogrammetry II

Prerequisite  SV361 Photogrammetry I

Hours  Average 1/2 lecture hour and 1/2 laboratory hour per week

Examination  One 3-hour paper

Content
Photogrammetric orientation. Design principles and practical application of exact and approximate restitution instruments. Flight and project planning— aerial mapping — aerial triangulation of strips.

Text
Wolf, P. R.  Elements of Photogrammetry (McGraw-Hill 1974)

Reference
—  Manual of Photogrammetry Vols. I & II (Amer. Soc. of Photogrammetry)

524131  SV463 Photogrammetry III (Elective)

Corequisites  SV462 Photogrammetry II
SV332 Survey Computations II

Hours  Average 1/2 lecture hours and 1/2 laboratory hours per week

Examination  One 3-hour paper

Content

Text
References  To be advised.

524132  SV471 Land Valuation

Prerequisite  Nil

Hours  1 1/2 lecture hours per week

Examination  One 3-hour paper
Content

General principles of urban and rural land valuation — unimproved and improved capital values — valuation of leasehold and freehold land — subdivisional value of land — valuation of buildings — relevant Acts and Regulations — N.S.W. Land and Valuation Court proceedings and decisions.

Text

To be advised.

References

524133 SV481 Project

Prerequisite

Prerequisites and corequisites will depend on the nature of the topic.

Hours

No formal lectures — personal contact with supervisor as required. Minimum work load of three hours per week.

Examination

Assessment

Content

EITHER

A minor research project involving a literature review and/or analytical and/or experimental investigation

OR

A land studies project, involving selection of a site suitable for a specified purpose, investigation of title, zoning, site survey, environmental impact study, design for development.

524134 SV482 Professional/Project Seminar

Corequisite

SV414 Surveying IV

Hours

1½ hours per week

Examination

Assessment

Content

A weekly seminar series during which each final year student gives a seminar on his project. Other seminars in the series will be led by members of the surveying, or an allied, profession, on selected topics.
DEPARTMENT OF ELECTRICAL ENGINEERING

Electrical Engineering is a rapidly expanding branch of engineering. It includes such fields as computer and information science, switching theory, the theory and design of automatic control systems, electronics, and the study of electrical power generation and distribution.

In preparation for a career in any branch of Electrical Engineering, the student must acquire a knowledge of the basic sciences of Mathematics and Physics. Electrical Engineering, perhaps more than most other branches of engineering, is closely linked with the pure sciences and requires a scientific outlook and approach for the proper understanding of the problems involved.

During the early stages of the undergraduate courses, students concentrate on acquiring a knowledge of the basic science subjects of mathematics, physics and chemistry, together with an introduction to engineering. Then students are introduced to the basic electrical engineering subjects, including electric circuit theory, electric power engineering and electronics. Advanced students study specialised subjects on power, control, computers, electronics or communication in their final year. Final year students may also broaden their knowledge by taking courses such as Industrial Law, Production Control, Economics or Accounting.

Towards the end of his final year, the full-time undergraduate prepares a report covering some aspect of a supervised project, and delivers a seminar paper on a selected topic.

Postgraduate students are prepared for the degrees of Master of Engineering, Master of Engineering Science and Doctor of Philosophy. Their work includes formal lecture courses, seminars and research in both practical and theoretical aspects of their specialisations.

Preparation of Programme

Each student will be assigned an academic advisor from among the teaching staff. The student is expected to arrange his own programme subject to the requirements stated below and the approval of his advisor. Minor variations from the stated requirements will be considered upon application to the Head of the Department, provided the application has received support of the advisor. Any such variations will have to receive the approval of the Dean of the Faculty.

All choices in the various degree programmes are to be made according to prerequisite and corequisite requirements and timetable restrictions. Complete lists of pre- and corequisites appear in the description of individual subjects. Subjects offered in the first half year are indicated by *, in the second half year by **, and for the full year by ***.
Definition of Units
Individual subjects are given a quantitative rating by defining 1 unit to be 42 attendance hours. Thus topics which meet 3 hours a week for half a year are rated at 1 unit and those which meet 3 hours a week for a full year are rated at 2 units.

SCHEDULE 1.3

BACHELOR OF ENGINEERING IN ELECTRICAL ENGINEERING

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<th>Subject</th>
<th>Units</th>
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<td>Mathematics I</td>
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<td>Engineering I</td>
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<td>2 Workshop Practice</td>
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<td>3 Mathematics IIB (Topics C, D, E, &amp; H)</td>
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<tr>
<td>PH221</td>
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<tr>
<td>Chemistry IS</td>
<td>2***</td>
</tr>
<tr>
<td>1 Electives</td>
<td>4***</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>15</td>
</tr>
<tr>
<td><strong>Year III</strong></td>
<td></td>
</tr>
<tr>
<td>EE311</td>
<td>Electrical Machinery</td>
</tr>
<tr>
<td>EE3215</td>
<td>Electronics</td>
</tr>
<tr>
<td>EE331</td>
<td>Circuits</td>
</tr>
<tr>
<td>EE341</td>
<td>Automatic Control</td>
</tr>
<tr>
<td>EE361</td>
<td>Computer Structure: Machine &amp; Assembly Languages</td>
</tr>
<tr>
<td>Five of EE300 or EE400</td>
<td>5***</td>
</tr>
<tr>
<td>1 Electives</td>
<td>4***</td>
</tr>
<tr>
<td>GE350</td>
<td>Seminar</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>15</td>
</tr>
</tbody>
</table>
During the course each full-time student should complete periods of practical experience acceptable to the Faculty Board totalling 20 weeks before 31st January in the year in which the degree is to be awarded. Each student should hand in a report concerning his practical experience to the department secretary during the first term but not later than the last week of the term.

* First half year
** Second half year
*** Full year

1 See Elective Requirements — Appendix A.
2 The completion of this unit may be delayed to second year if desired.
3 Mathematics IIB may be taken in two parts each of three terms duration.
4 See Year I course details on page 34.
5 Due to proposed course changes EE321 will be the same as EE221 in 1976.
### Schedule 3.3

**Bachelor of Science (Engineering) in Electrical Engineering**

*Stages 1-3 will not be offered after 1975*

#### Stage 4

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>GE350 Seminar</td>
<td>1***</td>
</tr>
<tr>
<td>EE311 Electrical Machinery</td>
<td>1*</td>
</tr>
<tr>
<td>EE331 Circuits</td>
<td>1*</td>
</tr>
<tr>
<td>One of EE300 or EE400</td>
<td>1**</td>
</tr>
<tr>
<td>1Elective</td>
<td>5***</td>
</tr>
<tr>
<td>Elective (Industrial experience)</td>
<td>1***</td>
</tr>
</tbody>
</table>

#### Stage 5

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE321 Electronics</td>
<td>1*</td>
</tr>
<tr>
<td>EE341 Automatic Control</td>
<td>1*</td>
</tr>
<tr>
<td>EE361 Computer Structure: Machine &amp; Assembly Languages</td>
<td>1*</td>
</tr>
<tr>
<td>Five of EE300 or EE400</td>
<td>5***</td>
</tr>
<tr>
<td>Elective (Industrial experience)</td>
<td>1***</td>
</tr>
</tbody>
</table>

#### Year VI Full Time²

- Six of EE300 or EE400 6***
- 1Elective 6***
- EE480/491 Project/Seminar 4***

---

*  First half year
** Second half year
*** Full year

1 See Elective Requirements—Appendix A.
2 The timetable for Year VI is prepared on the basis that the student will attend the course full time. Any student who is unable to complete Year VI as a full time student may do so over two part time years.
3 Mathematics IIB may be taken in two parts each of three terms duration.
4 ME121 Workshop practice must be taken in Stage 1 or 2.
5 Due to proposed course changes EE321 will be the same as EE221 in 1976.
Subject & Units

Stage 5

EE311 Electrical Machines 1*
EE341 Automatic Control 1*
Two of EE300 2
1 Electives 4***
---
8

Stage 6

GE350 Seminar 1****
Four of EE400 or EE500 4***
1 Electives 4***
---
9

During the course each part-time student should complete periods of practical experience acceptable to the Faculty Board totalling three years before 31st January in the year in which the degree is to be awarded.

* First half year
** Second half year
*** Full year
1 See Elective Requirements — Appendix A.
2 Due to proposed course changes EE321 will be the same as EE221 in 1976.

**SCHEDULE 1.7**

**BACHELOR OF ENGINEERING IN COMPUTER ENGINEERING**

**Year I**

Engineering I 4***
Mathematics I 4***
Physics IA 4***
1 Electives 4***
ME121 Workshop Practice 1***
---
17

**Year II**

EE211 Energy Conversion 1**
EE221 Semi-conductor Devices 1*
EE231 Electrical Circuits 1***
2 Mathematics IIB (Topics C, D, E & H) 4***
PH221 Electromagnetics & Quantum Mechanics 2***
Chemistry IS 2***
1 Electives 4***
---
15
<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year III</strong></td>
<td></td>
</tr>
<tr>
<td>EE321³ Electronics</td>
<td>1*</td>
</tr>
<tr>
<td>EE331 Circuits</td>
<td>1*</td>
</tr>
<tr>
<td>EE341 Automatic Control (inc. Analog computers)</td>
<td>1*</td>
</tr>
<tr>
<td>EE361 Computer Structure: Machine &amp; Assembly Languages</td>
<td>1*</td>
</tr>
<tr>
<td>EE322 Electronics</td>
<td>1**</td>
</tr>
<tr>
<td>EE323L Electronics Laboratory</td>
<td>1**</td>
</tr>
<tr>
<td>EE362 Logical Design &amp; Switching Theory</td>
<td>1**</td>
</tr>
<tr>
<td>EM2F Numerical Analysis &amp; Computing</td>
<td>1***</td>
</tr>
<tr>
<td>Programming &amp; Algorithms</td>
<td>1*</td>
</tr>
<tr>
<td>Data Structures &amp; Programming</td>
<td>1**</td>
</tr>
<tr>
<td>GE350 Seminar</td>
<td>1***</td>
</tr>
<tr>
<td>¹Electives</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td><strong>15</strong></td>
</tr>
<tr>
<td><strong>Year IV</strong></td>
<td></td>
</tr>
<tr>
<td>EE463 Computer Operating Systems</td>
<td>1*</td>
</tr>
<tr>
<td>EE464 Compilers, Assemblers &amp; Interpreters</td>
<td>1**</td>
</tr>
<tr>
<td>EE425 Digital Electronics</td>
<td>1**</td>
</tr>
<tr>
<td>Four subjects from List 1</td>
<td>4</td>
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<tr>
<td>EE480/491 Project/Seminar</td>
<td>4***</td>
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<tr>
<td>¹Electives</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>

During the course each full time student should complete period of practical experience acceptable to the Faculty Board totalling 20 weeks before 31st January in the year in which the degree is to be awarded. Each student should hand in a report concerning his practical experience to the departmental secretary during the first term but not later than the last week of the term.

* First half year
** Second half year
*** Full year

1 See Elective Requirements — Appendix A.
2 Mathematics IIb may be taken in two parts each of three terms duration.
3 Due to proposed course changes EE321 will be the same as EE221 in 1976.
**LIST 1: FOURTH YEAR SUBJECTS FOR COMPUTER ENGINEERING**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE421</td>
<td>Electronics</td>
</tr>
<tr>
<td>EE423L</td>
<td>Electronics Laboratory</td>
</tr>
<tr>
<td>EE441</td>
<td>Modern Control</td>
</tr>
<tr>
<td>EE442</td>
<td>Modern Control</td>
</tr>
<tr>
<td>EE443</td>
<td>Optimization Techniques</td>
</tr>
<tr>
<td>EE444</td>
<td>Communication Systems</td>
</tr>
<tr>
<td>EE447</td>
<td>Digital Communications</td>
</tr>
<tr>
<td>EE565</td>
<td>Pattern Recognition</td>
</tr>
<tr>
<td>EE566</td>
<td>Automata and Computing Machines</td>
</tr>
<tr>
<td>EE567</td>
<td>Computer Process Control</td>
</tr>
<tr>
<td>ME301</td>
<td>Engineering Computations</td>
</tr>
<tr>
<td>ME401</td>
<td>Systems Analysis</td>
</tr>
<tr>
<td>ME402</td>
<td>Systems Planning, Organization, and Control</td>
</tr>
<tr>
<td>ME404</td>
<td>Mathematical Programming</td>
</tr>
<tr>
<td>ME487</td>
<td>Operations Research: Deterministic Models</td>
</tr>
<tr>
<td>ME488</td>
<td>Operations Research: Probabilistic Models</td>
</tr>
<tr>
<td>ME489</td>
<td>Operations Research: Applications in Industry</td>
</tr>
<tr>
<td>ME581G</td>
<td>Mathematical Programming</td>
</tr>
<tr>
<td>Commerce</td>
<td>Commercial Programming</td>
</tr>
</tbody>
</table>

**Mathematics III**
- Operations Research (Topic U)
- Mathematical Logic (Topic O)
- Numerical Analysis (Topic Z)
- Topics in Finite Mathematics

**Mathematics IV**
- Combinational Designs
- Graph Theory

**BACHELOR OF ARTS/BACHELOR OF ENGINEERING IN ELECTRICAL ENGINEERING**

In addition to the requirements for the B.E. with the relevant elective requirements selections as shown in Appendix A, the combined degree student is required to undertake one year in the relevant non engineering faculty. This year may be taken after completion of the third or the fourth year of a B.E. programme. For some, there may be advantages for taking this year after completing the four year B.E. requirements but before taking out a B.E. degree.

**Additional year for B.A./B.E. (16 units)**

Arts subject Part III
Arts subject Part I or II or III
Arts Part II
BACHELOR OF SCIENCE/BACHELOR OF ENGINEERING IN ELECTRICAL ENGINEERING

The candidate shall complete all requirements for the degrees of Bachelor of Science and Bachelor of Engineering in Electrical Engineering by completing a combined course approved by the Faculty Boards of the Faculties of Engineering and Science, provided that the Deans of both Faculties certify that the work in the combined degree is no less in quantity and quality than if the two degrees were taken separately.

Admission to the 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.

BACHELOR OF COMMERCE/BACHELOR OF ENGINEERING IN ELECTRICAL ENGINEERING

The course followed must meet the Requirements for the degrees of Bachelor of Engineering and Bachelor of Commerce. The following programme has been approved by the two Faculty Boards:

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td><strong>Year I</strong></td>
<td></td>
</tr>
<tr>
<td>Mathematics I</td>
<td>4</td>
</tr>
<tr>
<td>Engineering I</td>
<td>4</td>
</tr>
<tr>
<td>Physics IA</td>
<td>4</td>
</tr>
<tr>
<td>ME121 Workshop Practice</td>
<td>1</td>
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<tr>
<td>Microeconomics</td>
<td>2</td>
</tr>
<tr>
<td>Economic History I</td>
<td></td>
</tr>
<tr>
<td>Legal Studies I</td>
<td>2</td>
</tr>
<tr>
<td>Economic Statistics I</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>17</td>
</tr>
</tbody>
</table>

<p>| <strong>Year II</strong>                     |       |
| EE211 Energy Conversion         | <strong>1</strong> |
| EE221 Semi-conductor Devices    | 1     |
| EE231 Electrical Circuits       |     <strong>1</strong> |
| Mathematics IIIB               | 4     |
| PH221 Electromagnetics &amp; Quantum Mechanics | 2 |
| Macroeconomics                  | 4     |
| Accounting I                    | 4     |
| <strong>Total</strong>                       | 17    |</p>
<table>
<thead>
<tr>
<th>Year</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>GE350 Seminar</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>EE311 Electrical Machines</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>EE321 Electronics</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>EE331 Circuits</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>EE341 Automatic Control</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>EE361 Computer Structure: Machine &amp; Assembly Languages</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Two of EE300 or EE400</td>
<td>2</td>
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<td></td>
<td>Chemistry IS</td>
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<tr>
<td></td>
<td>Two Economics &amp; Commerce subjects</td>
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<tr>
<td>IV</td>
<td>Five of EE300 or EE400 or EE500</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>2 Electives</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Two Economics &amp; Commerce subjects</td>
<td>4^1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18</td>
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<tr>
<td>V</td>
<td>EE480/491 Project/Seminar</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Five of EE300 or EE400 or EE500</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>2 Electives</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>One Economics &amp; Commerce subject</td>
<td>4^1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>17</td>
</tr>
</tbody>
</table>

* First half year

** Second half year

1 The subjects which count towards the B.Com. degree are those marked 1 plus six Engineering units chosen from subjects normally taken in 3rd or 4th year of the full-time Engineering programme which may be counted as one Group C subject.

2 The eight elective units must be taken in the Faculty of Engineering; at least two must be from outside the Department of Electrical Engineering and at least two must be from within the Department of Electrical Engineering.

3 Due to proposed course changes EE321 will be the same as EE221 in 1976.
### Prerequisites and Corequisites

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisite/S</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE203</td>
<td>Introduction to Electrical Information</td>
<td>Maths I, Physics IA or IB</td>
<td></td>
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<tr>
<td>EE204</td>
<td>Introduction to Electrical Energy</td>
<td>EE203</td>
<td></td>
</tr>
<tr>
<td>EE211</td>
<td>Energy Conversion</td>
<td>EE101</td>
<td></td>
</tr>
<tr>
<td>EE221</td>
<td>Semi-conductor Devices</td>
<td>Physics IA or IB, EE101</td>
<td></td>
</tr>
<tr>
<td>EE231</td>
<td>Electrical Circuits</td>
<td>EE101</td>
<td></td>
</tr>
<tr>
<td>EE311</td>
<td>Electrical Machinery</td>
<td>EE211</td>
<td></td>
</tr>
</tbody>
</table>
| EE312       | Electrical Machinery                             | EE311 or EE313 recommended but not mandatory |*
| EE313       | Power Systems                                    | EE211 & EE231  |                                            |
| EE321       | Electronics                                      | EE101          |                                            |
| EE322       | Electronics                                      | EE221          |                                            |
| EE323L      | Electronics Laboratory                           | EE221 or EE322 | Corequisite EE322                          |
| EE331       | Circuits                                         | EE231          |                                            |
| EE332       | Circuits                                         | EE231          |                                            |
| EE341       | Automatic Control                                | Maths IIB      |                                            |
| EE342       | Automatic Control                                | EE341          |                                            |
| EE361       | Computer Structure: Machine & Assembly Languages | Maths I        |                                            |
|             | Logical Design & Switching Theory               | EE361 recommended but not mandatory |                                             |
| EE411       | Electrical Machines                              | EE312          |                                            |
| EE412       | Advanced Topics in Heavy Current Electrical     | EE411          |                                            |
|             | Engineering                                      |                |                                            |
| EE413       | Electrical Machines                              | EE411          |                                            |
| EE415       | Power Systems                                    | EE312 & EE332  |                                            |
| EE421       | Electronics                                      | EE322          |                                            |
| EE423L      | Electronics Laboratory                           | EE323L or EE421 | Corequisite EE421                        |
| EE425       | Digital Electronics                              | EE421 or EE423L & EE332 |                                      |
| EE441       | Modern Control                                   | EE342          |                                            |
| EE442       | Modern Control                                   | EE342          |                                            |
| EE443       | Optimization Techniques                          | Maths II Topics C, D, E |                                      |
| EE444       | Communication Systems                            | EE331          |                                            |
| EE445       | Communication Systems                            | EE342          |                                            |
| EE451       | Field Theory                                     | Maths II Topics C, D, E & Ph 221 |                                      |
| EE452       | Microwave Measurements                           | EE451 or Physics III or consent of instructor |                                          |
| EE463       | Computer Operating Systems                       | EE361          |                                            |
| EE464       | Compilers, Assemblers and Interpreters           | EE361          |                                            |

*Due to proposed course changes EE321 will be the same as EE221 in 1976.*
DESCRIPTION OF SUBJECT ENTRIES

Subjects offered by the Department are listed below. All are 1 unit (42 hours) unless otherwise stated. The contents and units may be varied from time to time without prior notification. Topics given in the first half of the year are indicated by *, in the second half by **, and for the full year by ***.

One unit is defined as 42 hours of attendance in lecture, laboratory, design, and tutorial classes. As a guide to private study and preparation, a student should allow approximately 1½ hours of outside work for each hour of lecture, and one hour for each hour of laboratory, design or tutorial attendance.

Each topic has an identifying number whose middle digit indicates the field of study, according to the following code:

<table>
<thead>
<tr>
<th>Indicating Numerals</th>
<th>Field of Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE-0-</td>
<td>General Electrical Engineering</td>
</tr>
<tr>
<td>EE-1-</td>
<td>Electrical Machines or Power Systems</td>
</tr>
<tr>
<td>EE-2-</td>
<td>Electronics</td>
</tr>
<tr>
<td>EE-3-</td>
<td>Electrical Circuit Theory or Measurements</td>
</tr>
<tr>
<td>EE-4-</td>
<td>Control or Communication Systems</td>
</tr>
<tr>
<td>EE-5-</td>
<td>Field Theory</td>
</tr>
<tr>
<td>EE-6-</td>
<td>Computer Science or Automata Theory</td>
</tr>
<tr>
<td>EE-8-</td>
<td>Project/Directed Reading</td>
</tr>
<tr>
<td>EE-9-</td>
<td>Seminar</td>
</tr>
</tbody>
</table>

531202 EE101 Circuit Fundamentals***

Prerequisites Nil

Hours 1½ hours of lectures, tutorials and laboratory work per week

Examination Progressive assessment and final examination

Content


Text

Baldwin, C. T. Electrical Measurements 2nd edn (Harrap)
Williams, G. An Introduction to Electrical Circuit Theory (Macmillan)
References
Balabanian, N.  
Fundamentals of Circuit Theory (Allyn & Bacon)
Hayt & Kemmerly  
Engineering Circuit Analysis (McGraw-Hill)

532103 EE203 Introduction to Electrical Information*

Prerequisites  
Maths I & Physics IA or IB

Hours  
3 hours of lectures, tutorial and laboratory work per week

Examination  
Progressive assessment and final examination

Content
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.

Texts  
To be advised

References
Fitzgerald,  
Higginbotham & Grabel  
Basic Electrical Engineering
Hammond & Gehmlich  
Electrical Engineering 2nd edn
Lockwood & Dunstan  
Electrical Engineering Principles
McKenzie, Smith & Hose  
Basic Electrical Engineering Science

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**532104 EE204 Introduction to Electrical Energy**

**Prerequisite:** EE203

**Hours**
3 hours of lectures, tutorials and laboratory work per week

**Examination**
Progressive assessment and final examination

**Content**


**Texts**
Nil

**References**
As for EE203

---

**532106 EE211 Energy Conversion**

**Prerequisite**
EE101

**Hours**
3 hours of lectures and laboratory work per week

**Examination**
Progressive assessment and final examination

**Content**

Concept of flux linkage and inductance; self, mutual and leakage inductance of coupled circuits, voltage equations for coupled circuits, the air core transformer; the practical iron cored transformer, equivalent circuits, phasor diagrams. Transformer testing.

Electro-mechanical energy conversion; electro-mechanical transducers, law of conservation of energy and its application to singly-excited and doubly-excited systems.
Text
Gourishanke, V.  *Electromagnetic Energy Conversion*
(International Text Book Co.)

Reference
Smith  *Circuits, Devices and Systems* (Wiley)

532107  EE221  Semiconductor Devices*  

**Prerequisites**
EE101 and Physics I  

**Hours**
3 hours of lectures and laboratory work per week  

**Examination**
Progressive assessment and final examination.  

**Content**

**Text**
Millman & Halkias  *Integrated Electronics* (McGraw-Hill)  

**References**
Angelo, J.  *Electronics BJT’s, FET’s and Microcircuits* (McGraw-Hill)  
Gray & Searle  *Electronic Principles* (Wiley)  

532105  EE231  Electrical Circuits***

**Prerequisite**
EE101  

**Hours**
3 hours of lectures, tutorials and laboratory work per week  

**Examination**
Progressive assessment and final examination  

**Content**
Text
Gourishanke, V. Electromagnetic Energy Conversion (International Text Book Co.)

Reference
Smith Circuits, Devices and Systems (Wiley)

532107 EE221 Semi-conductor Devices*

Prerequisites EE101 and Physics I
Hours 3 hours of lectures and laboratory work per week
Examination Progressive assessment and final examination
Content

Text
Millman & Halkias Integrated Electronics (McGraw-Hill)

References
Angelo, J. Electronics BJT's, FET's and Microcircuits (McGraw-Hill)
Gray & Searle Electronic Principles (Wiley)

532105 EE231 Electrical Circuits***

Prerequisite EE101
Hours 3 hours of lectures, tutorials and laboratory work per week
Examination Progressive assessment and final examination
Content
533104 EE311 Electrical Machinery*

**Prerequisite**
EE204

**Hours**
3 hours of lectures, tutorials and laboratory work per week

**Examination**
Progressive assessment and final examination

**Content**

**Text**
O'Kelly & Simmons *Introduction to Generalized Electrical Machine Theory* (McGraw-Hill)

**References**
Say *The Performance and Design of Alternating Current Machines* (Pitman)
Thaler & Wilcox *Electric Machines* (Wiley)

533209 EE312 Electrical Machinery**

**Prerequisite**
EE311

**Corequisite**
EE313 recommended but not mandatory

**Hours**
3 hours of lectures, tutorials and laboratory work per week

**Examination**
Progressive assessment and final examination
Content

Text
Thaler & Wilcox  Electric Machines (Wiley)

Reference
O'Kelly & Simmons  Introduction to Generalized Electric Machine Theory (McGraw-Hill)

533201 EE313 Power Systems**

Prerequisites
EE204 & EE231

Corequisite
EE312 recommended but not mandatory

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

Examination
Progressive assessment and final examination

Content

Text
Stevenson  Elements of Power System Analysis 2nd edn (McGraw-Hill)

References
—  Westinghouse Transmission and Distribution Reference Book

Freeman  Electrical Power Transmission & Distribution (George G. Harrap & Co. Ltd.)

—  J. & P. Switchgear Book

533102 EE321 Electronics* (Physical electronics)
Same as EE221 in 1976 (not to be offered from 1977 onwards)

533202 EE322 Electronics**

Prerequisite
EE221

Hours
3 hours of lectures and tutorials per week

Examination
Progressive assessment and final examination

Content
BJT and FET—amplifiers. Analysis and design of transistor amplifiers, biasing and A.C. characteristics including high frequency performance. Application of feedback, negative and positive. Oscillator circuits.

Text
Millman & Halkias Integrated Electronics (McGraw-Hill)

Reference
Gray & Searle Electronic Principles (Wiley)
G. E. Transistor Manual

533207 EE323L Electronics Laboratory**

Prerequisite
EE221

Corequisite
EE322

Hours
3 hours of laboratory work per week

Examination
No final examination

Content
An essentially practical course, complementing EE322. Laboratory exercises requiring the application of Active Circuits theory to the solution of specific problems.

Texts
As for EE321 & EE322

533105 EE331 Circuits*

Prerequisite
EE231

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

Examination
Progressive assessment and final examination
Content

Text
To be advised

References
Desoer & Kuth *Basic Circuit Theory* (McGraw-Hill)
Kuo, B. C. *Linear Networks and Systems* (McGraw-Hill)
Roe, P. H. *Networks and Systems* (Addison & Wesley)

533203 EE332 Circuits**

Prerequisites
EE204 & EE231

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

Examination
Progressive assessment and final examination

Content
Terminated two-port networks; matching, attenuators and equalizers; constant-k filters.
Transmission lines: transient travelling waves; steady-state analysis of lossless and lossy transmission lines; radio-frequency and power-frequency line; impedance charts and matching with stubs.

Text
Potter & Fich *Theory of Networks and Lines* (Prentice-Hall)

References
Moore, R. K. *Travelling Wave Engineering* (McGraw-Hill)
Johnson, W. C. *Transmission Lines and Networks* (McGraw-Hill)
Ware & Reed *Communication Circuits* (Wiley)
Content

Basic computer elements and peripherals, representation and organization of information, number systems and arithmetic, logical operations. Hardware components, processor structure, addressing modes and instruction set, machine-language programming, subroutines, traps and interrupts, use of the stack. Assembly: pseudo-ops, macros, recursion and re-entrancy, relocation, linking and loading. System software: assemblers, linkers, loaders, dumpers, interpreters, simulators, compilers.

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

Texts


*Processor Handbook* (PDP 11/20) (DEC)

References

Chu *Computer Organization and Micro Programming* (McGraw-Hill)

Donovan *Systems Programming* (McGraw-Hill)

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

533212  EE362 Logical Design and Switching Theory**

Prerequisite

Maths I

Hours

3 hours of lectures, tutorials and practical work per week

Examination

Progressive assessment and final examination

Content

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

Text

Friedman *Logical Design of Digital Systems* (Computer Science Press)
References

Hill & Peterson  *Introduction to Switching Theory and Logical Design* (Wiley)

Kohavi  *Switching and Finite Automata Theory* (McGraw-Hill)

Lewin  *Theory and Design of Digital Computers* (Nelson)

Mano  *Computer Logic Design* (Prentice-Hall)

Prather  *Introduction to Switching Theory: A Mathematical Approach* (Allyn & Bacon)

533208  EE380 Project/Directed Reading

**Prerequisite**  Nil

**Hours**  By arrangement

**Examination**  To be advised

**Content**

Private work of laboratory, literature search or theoretical nature requiring the preparation of a report. Taken under the direction of a supervisor with whom the topic should be negotiated.

534120  EE411 Electrical Machines*

**Prerequisite**  EE312

**Hours**  3 hours of lectures, tutorials and laboratory work per week

**Examination**  Progressive assessment and final examination

**Content**


**Text**

Thaler & Wilcox  *Electric Machines* (Wiley)

**Reference**

Say  *The Performance and Design of Alternating Current Machines* 3rd edn (Pitman)
534105  EE412 Advanced Topics in Heavy Current Electrical Engineering**

Prerequisite  

EE311

Hours  

3 hours of lectures, tutorials and laboratory work per week

Examination  

Progressive assessment and final examination

Content  


Text To be advised

Reference

Pally  

Thyristor Phase Controlled Converters and Cycloconverters

534121  EE413 Electrical Machines** (Not offered in 1976)

534107  EE415 Power Systems*

Prerequisites  

EE312 & EE332

Hours  

3 hours of lectures, tutorials and laboratory work per week

Examination  

Progressive assessment and final examination

Content  


Text

Stevenson  

Elements of Power System Analysis 2nd edn (McGraw-Hill)
References

J. & P. Switchgear Book
Westinghouse Transmission and Distribution Reference Book

Waddicor
Principles of Electrical Power Transmission
5th edn (Chapman & Hall)

534108 EE421 Electronics*

Prerequisite
EE322

Hours
3 hours of lectures and tutorial work taken in conjunction with EE423L

Examination
Progressive assessment and final examination

Content
D.C. amplifiers, operational amplifiers, power amplifiers, stability of feedback amplifiers, noise. Microelectronics, power supplies. High frequency amplifiers.

Text
Nil

References
G.E. SCR Manual
Electronic Circuits (McGraw-Hill)
Integrated Electronics (McGraw-Hill)

534126 EE423L Electronics Laboratory*

Prerequisite
EE323L

Corequisite
EE421

Hours
3 hours of practical work per week

Examination
Progressive assessment

Content
Complements EE421. Circuit development projects individually assigned.
534113 EE425 Digital Electronics**

**Prerequisites**
EE421 — EE423L & EE332

**Hours**
3 hours of lectures, tutorial and laboratory work per week

**Examination**
Progressive assessment and final examination

**Content**

**Texts**
Nil

**References**
Kohonen
Digital Circuits and Devices (Prentice-Hall)

Malmstadt & Enke
Digital Electronics for Scientists (New York: Benjamin inc.)

Mano
Computer Logic Designs (Prentice-Hall)

Sifferlen & Vartanian
Digital Electronics with Engineering Applications (Prentice-Hall)

534119 EE441 Modern Control (Digital Signal Processing)*

**Prerequisite**
EE342

**Hours**
3 hours of lectures, tutorial and laboratory work per week

**Examination**
Progressive assessment and final examination

**Content**
Digital filtering and digital control systems, z-transforms, state variable techniques, sampling and reconstruction, fast fourier transforms.

**Text**
Oppenheim & Schafe
Digital Signal Processing (Prentice-Hall 1999)

**References**
Cadzow, J. A. & Hartens, H. R.

Gold & Rader
Digital Signal Processing (McGraw-Hill 1971)

Kuo, B. C.
Discrete-Data Control Systems (Prentice-Hall Inc. 1970)
534115 EE442 Modern Control** (not offered in 1976)

534132 EE443 Optimization Techniques

Prerequisites Maths II, Topics C, D, E.

Hours 3 hours per week

Content Mathematical background to optimization. Comparison of optimization methods; engineering applications — such as to problems of identification, control, pattern recognition and resource allocation.

Texts
Luenberger, D. G. *Introduction to Linear and Non-Linear Programming* (Addison-Wesley 1973)

Fundamentals and Applications of Nonlinear Programming

Reference
Luenberger, D. G. *Optimization via Vector Space Methods* (Wiley 1969)

534116 EE444 Communication Systems*

Prerequisite EE331

Hours 3 hours per week

Examination Progressive assessment and final examination

Content Introduction to the common forms of analog modulation, as well as pulse modulation systems including pulse code modulation. Performance in the presence of noise is considered.

Text

Reference
534128 EE445 Communication Systems

Prerequisite EE342

Content
Stochastic processes including stationary gaussian processes from a time-domain viewpoint. Kalman filtering and application to AM and FM demodulation.

Text

534133 EE446 Advanced Topics in Control (not offered in 1976)

534134 EE447 Digital Communications

Prerequisite Consent of Instructor

Hours 3 hours of lectures and tutorials per week

Examination Progressive assessment and final examination

Content
1. Noisy Memoryless M-ary channels
   Orthogonal signalling on noisy memoryless channels. Optimum receivers, the matched filters, the correlation receiver. Shannons channel capacity theorem. Introduction to coding techniques; block, algebraic and convolution codes.

2. Noisy channels with memory

Text To be advised

References
Lucky, Galz & Weldon Principles of Data Communication (McGraw-Hill)

Wozercraft & Jacobs The Principles of Communication Engineering (Wiley)

534129 EE451 Field Theory (not offered in 1976)
**534130 EE452 Microwave Measurements**

**Prerequisites**
EE451 or Physics III or consent of Instructor

**Content**
Generation and modulation of microwave frequencies. Analysis of wave propagation in unguided and guided configurations. Analysis and design of passive microwave components for impedance matching, etc. Measurement of frequency, wavelength, power, attenuation and complex impedance.

**Text**
Nil

**References**
Adams, S. F. *Microwave Theory and Application* (Hewlett Packard Co.)
Barlow, H. M. & Cullen, A. L. *Microwave Measurements* (Constable 1950)
Ginzton, E. L. *Microwave Measurements* (McGraw-Hill)
Ramo, S., Whinnery, J. R. & Van Duzer, T. *Fields and Waves in Communication Electronics* (Wiley)

**534124 EE463 Computer Operating Systems**

**Prerequisite**
EE361

**Hours**
3 hours per week

**Examination**
Progressive assessment and final examination

**Content**

**Text**
Madnick & Donovan *Operating Systems* (McGraw-Hill)

**References**
Coffman & Denning *Operating Systems Theory* (Prentice-Hall)
Donovan *Systems Programming* (McGraw-Hill)
Hansen *Operating System Principles* (Prentice-Hall)
534125  EE464 Compilers, Assemblers and Interpreters**

**Prerequisite**  EE361

**Hours**  3 hours per week

**Examination**  Progressive assessment and final examination

**Content**

**Text**
Gries  *Compiler Construction for Digital Computers*  (Wiley)

**References**
Donovan  *Systems Programming*  (McGraw-Hill)

534102  EE480 Project/Directed Reading***

**Content**
Topics to be arranged with a staff member in the field of interest during first term. Full time students are normally required to undertake a project.

534101  EE491 Seminar***

**Content**
Talks on various topics of general interest in engineering. EE480 and EE491 are taken together and counted as four units.
DEPARTMENT OF MECHANICAL ENGINEERING

Essentially the Mechanical Engineer is concerned with the creative use of materials, motion and energy. He is usually associated with some aspect of the design, production and use of machinery. The courses in Mechanical Engineering develop from basic subjects, through those of an applied nature to reach a professional level in such areas as analysis, synthesis and design, thermodynamics, fluid mechanics, automatic control and engineering management.

Course work is organised into lectures and tutorial classes, together with laboratory work in order to introduce students to the practical problems of equipment usage.

The Bachelor of Engineering degrees in Mechanical and Industrial Engineering comprise four years of full-time study or their equivalent in part-time study or a combination of full- and part-time attendance.

Courses of study currently available in the Department are:

(i) **Bachelor of Engineering degree course in Mechanical Engineering**

This course is designed to give a basic training in the activities followed by professional mechanical engineers. It is oriented towards design, plant operation and control, manufacturing methods, material usage and energy conversion and utilisation.

(ii) **Bachelor of Engineering degree course in Industrial Engineering**

Years I and II of this course are similar to the full-time degree course in Mechanical Engineering.

In the later years the course is oriented towards the study of production techniques and their control and the application of scientific principles to administration and industrial management. The course is thus designed for those engineers who wish to make their career in the planning, supervision and administration of industrial undertakings.

(iii) **Bachelor of Engineering degree course in Naval Architecture**

Years I and II of the course are identical with the full-time Bachelor of Engineering courses in Mechanical and Industrial Engineering.

**Note**

The last two years of the Naval Architecture course will be discontinued as those students who enrolled prior to 1975 complete the course. Students enrolling for the Naval Architecture course for the first time in 1975 or later years will have to transfer to the University of New South Wales after completing the first two years of the course.

Students proceeding by **full-time study** in (i), (ii) and (iii) above are **required to gain as much industrial experience as possible by working in industry during long vacations.**
(iv) Bachelor of Arts/Bachelor of Engineering degree course in Mechanical Engineering

and

(v) Bachelor of Arts/Bachelor of Engineering degree course in Industrial Engineering

comprising five years of full-time study in the Faculties of Arts and Engineering.

These courses (iv & v) have been designed for those engineers who require a broader base to their education and training programme. This broader base is considered important in the areas of planning, organisation and management.

(vi) Bachelor of Science/Bachelor of Engineering degree course in Mechanical Engineering

and

(vii) Bachelor of Science/Bachelor of Engineering degree course in Industrial Engineering

comprising five years of full-time study in the Faculties of Science and Engineering.

(viii) Bachelor of Commerce/Bachelor of Engineering degree course in Mechanical Engineering

and

(ix) Bachelor of Commerce/Bachelor of Engineering degree course in Industrial Engineering

comprising five years of full-time study in the Faculties of Economics and Commerce and Engineering

Students are required to gain as much industrial experience as possible by working in Industry during long vacations.

(x) Diploma in Industrial Engineering

This is a two-year part-time course for graduates in any branch of Engineering or Applied Science with appropriate experience or for persons otherwise acceptably qualified. The successful completion of the course leads to the award of a diploma in Industrial Engineering. Those wishing to enrol in this course should write to the Head of the Department of Mechanical Engineering for further details.

The course may, with the permission of the Faculty Board, be completed in one full-time year.

Note

The Bachelor of Science (Engineering) degrees are being phased out. No student is permitted to enrol or re-enrol in these courses unless he was enrolled in the course prior to 1st January, 1974.

A student is permitted to continue in the course for as long as he has passed sufficient subjects in the course to enable him to complete all requirements for admission to the degree before the end of the 1979 academic year.
### SCHEDULE 1.5

**BACHELOR OF ENGINEERING IN MECHANICAL ENGINEERING**

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<td>Quality Engineering</td>
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<td>ME413</td>
<td>Design of Crankshafts, Flywheels and other Rotating Members</td>
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<td>ME414</td>
<td>Design of Hydraulic and Pneumatic Power Systems</td>
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<td>ME449</td>
<td>Reliability Analysis of Mechanical Systems</td>
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<td>ME487</td>
<td>Operations Research — Deterministic Models</td>
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**One unit selected from**

- Design of Crankshafts, Flywheels and other Rotating Members
- Design of Hydraulic and Pneumatic Power Systems
- Reliability Analysis of Mechanical Systems
- Operations Research — Deterministic Models
- Engineering Administration
- Engineering Economics
- Project/Seminar

* First half year

**Second half year**

1. With approval of Head of Department, Chemistry I (4 units) may be taken in lieu of Chemistry IS, Met151 and ME122.
2. Mathematics IIB may be taken in two parts each of three terms duration.
3. With the approval of Head of Department, CE313 Structural Analysis and Design I (4 units) may be taken in lieu of CE303 (2 units) and 2 units of the Year III Elective.
4. See Elective Requirements — Appendix A.

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**Recommended Programme for the Bachelor of Engineering in Mechanical Engineering By Part-time Study**

### Stage 1

- Engineering I 4
- Mathematics I 4
- ME121 Workshop Practice 1

### Stage 2

- Chemistry IS 2
- Physics IA 4
- ME092 Industrial Experience 1
- ME122 Process Technology 1
- Met151 Microstructure of Materials 1

Total: 13 units
### Stage 3

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* First half year
** Second half year

### Stage 5

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<td>Engineering Economics</td>
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<td>ME496</td>
<td>Project/Seminar</td>
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One unit selected from:

- ME381 Methods Engineering
- ME383 Quality Engineering
- ME413 Design of Crankshafts, Flywheels and other Rotating Members
- ME414 Design of Hydraulic and Pneumatic Power Systems
- ME449 Reliability Analysis of Mechanical Systems
- ME487 Operations Research — Deterministic Models

2 Electives: 6

16

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1 Any student who is unable to complete Year VI as a full time student may do so in two part time years and may include ME096 in the programme if not previously taken.

2 See Elective Requirements — Appendix A.
**SCHEDULE 3.5**

**BACHELOR OF SCIENCE (ENGINEERING) IN MECHANICAL ENGINEERING**

Stages 1-3 not offered after 1975.

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<td>ME482 Engineering Economics</td>
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One unit selected from:

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<td>ME381 Methods Engineering</td>
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<td>ME383 Quality Engineering</td>
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<tr>
<td>ME413 Design of Crankshafts, Flywheels and other Rotating Members</td>
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<td>ME414 Design of Hydraulic and Pneumatic Power Systems</td>
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<td>ME449 Reliability Analysis of Mechanical Systems</td>
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<td>ME487 Operations Research — Deterministic Models</td>
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* First half year
** Second half year

139
# SCHEDULE 1.4

**BACHELOR OF ENGINEERING IN INDUSTRIAL ENGINEERING**

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<td>ME213</td>
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* First half year
** Second half year

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<td>ME361</td>
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<tr>
<td>ME381</td>
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<td>Operations Research — Deterministic Models</td>
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140
**Year IV**

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1 With approval of the Head of Department, Chemistry I (4 units) may be taken in lieu of Chemistry IS, Met151 and ME122.

2 Maths IIB may be taken in two parts each of three terms duration.

3 See Elective Requirements — Appendix A.

---

**RECOMMENDED PROGRAMME FOR THE BACHELOR OF ENGINEERING IN INDUSTRIAL ENGINEERING BY PART-TIME STUDY**

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<td><strong>Stage 4</strong></td>
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<td>EE 204 **Introduction to Electrical Energy</td>
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<tr>
<td>ME094 Industrial Experience</td>
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<td>ME201 Laboratory Measurements</td>
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*Note: * and ** indicate mandatory courses.*
### Subject Units

#### Stage 5

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#### Year VI Full time

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<td>ME385</td>
<td>Accounting and Financial Studies</td>
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<td>2Electives</td>
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</table>

* First half year

** Second half year

1 Any student who is unable to complete Year VI as a full time student may do so in two part time years and may include ME096 in the programme if not previously taken.

2 See Elective Requirements — Appendix A.
## SCHEDULE 1.6

**BACHELOR OF ENGINEERING IN NAVAL ARCHITECTURE**

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<td>ME222</td>
<td>Process Technology</td>
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<td>ME241</td>
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<td>ME271</td>
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Subject | Units
---|---
**Year IV**
GE350 Seminar | 1
ME481 Engineering Administration | 1
ME482 Engineering Economics | 1
NA481 Shipyard Production and Management | 1
ME453 Fluid Mechanics | 1
NA402 Special Purpose Ships | 1
NA431 Ships Machinery | 1
NA452 Theoretical Naval Architecture | 1
NA496 Project/Seminar | 4
1 Electives | 3

| * First half year |
| ** Second half year |
| 1 See Elective Requirements — Appendix A. |
| 2 Mathematics IIB may be taken in two parts each of three terms duration. |
| 3 See Year I course details on page 34. |
| 4 See note on Page 133. |

**RECOMMENDED PROGRAMME FOR THE BACHELOR OF ENGINEERING IN NAVAL ARCHITECTURE BY PART-TIME STUDY**

**Stage 1**

| Engineering I | 4 |
| Mathematics I | 4 |
| ME121 Workshop Practice | 1 |
| **| **|
| ** | 9 |

**Stage 2**

| Chemistry IS | 2 |
| Physics IA | 4 |
| ME092 Industrial Experience | 1 |
| 1 Electives | 2 |
| **| **|
| ** | 9 |

**Stage 3**

<p>| Mathematics IIB | 4 |
| ME093 Industrial Experience | 1 |
| ME222 Process Technology | 1 |
| ME241 Properties of Materials | 1½ |
| CE212 Mechanics of Solids I | 1½ |
| **| **|
| ** | 9 |</p>
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* First half year
** Second half year

1 A maximum of three Industrial Experience units may be claimed in this course.
2 See Elective Requirements — Appendix A.
3 Any student who is unable to complete Year VI as a full-time student may do so over two part-time years.
4 See note on Page 133.

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**BACHELOR OF SCIENCE (ENGINEERING) IN NAVAL ARCHITECTURE**

Stages 1 and 2 will not be offered after 1974.

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* First half year
** Second half year

1 See Elective Requirements — Appendix A.
2 Mathematics IIB may be taken in two parts each of three terms duration.
BACHELOR OF ARTS/BACHELOR OF ENGINEERING IN
MECHANICAL ENGINEERING

The course followed must comply with Section 19 of the Requirements for the Degrees of Bachelor of Engineering and Bachelor of Science (Engineering). The following programme is recommended:

<table>
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<tr>
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<tr>
<td>Met151 Microstructure of Materials</td>
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<td><strong>Total</strong></td>
<td>17</td>
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</table>

With approval of Head of Department, Chemistry I (4 units) may be taken in lieu of Chemistry IS, and Met151 and ME122.

| **Year II**                                |       |
| 2Arts subjects Part I                      | 4     |
| ME201 Laboratory Measurements             | 1     |
| ME202 Dynamics of Engineering Systems     | 1     |
| ME214 Mechanics of Solids I               | 1     |
| ME223 Mechanical Technology               | 1     |
| ME232 Dynamics of Machines                | 1     |
| ME241 Properties of Materials             | 1     |
| ME251 Fluid Mechanics                     | 1     |
| ME271 Thermodynamics                      | 1     |
| 3Mathematics IIB                           | 4     |
| **Total**                                   | 16    |

<p>| <strong>Year III</strong>                               |       |
| 2Arts subject Part II                      | 5     |
| 2Arts subject Part I or Part II            | 4½    |
| EE 203 *Introduction to Electrical Information | 1  |
| EE 204 **Introduction to Electrical Energy | 1  |
| ME212 Engineering Design                   | 1     |
| ME213 Engineering Design                   | 1     |
| ME301 Engineering Computations             | 1     |
| ME342 Properties of Materials              | 1     |
| ME343 Mechanics of Solids I                | 1     |
| ME361 Automatic Control                    | 1     |
| <strong>Total</strong>                                   | 17½   |</p>
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<td>2Arts subject Part II or Part III</td>
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<td>ME372 Heat Transfer</td>
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<tr>
<td>ME373 Thermodynamics</td>
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<tr>
<td><strong>Year V</strong></td>
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<tr>
<td>CE303 Structural Design</td>
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<tr>
<td>ME313 Engineering Design</td>
<td>1</td>
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<tr>
<td>ME333 Dynamics of Machines</td>
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<tr>
<td>ME481 Engineering Administration</td>
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<td>ME482 Engineering Economics</td>
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<td>ME381 Methods Engineering</td>
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<tr>
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<tr>
<td>ME413 Design of Crankshafts, Flywheels and other Rotating Members</td>
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<tr>
<td>ME414 Design of Hydraulic &amp; Pneumatic Power Systems</td>
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<tr>
<td>ME449 Reliability Analysis of Mechanical Systems</td>
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<tr>
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<tr>
<td><strong>Electives</strong></td>
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</table>

* First half year

** Second half year

1 Must be selected from departmental technical electives.

2 Approximate hours only. Refer to Arts Faculty Handbook for subject details.

3 Mathematics IIB may be taken in two parts each of three terms duration.

---

**BACHELOR OF SCIENCE/BACHELOR OF ENGINEERING IN MECHANICAL ENGINEERING**

The course followed must comply with Section 19 of the Requirements for the degrees of Bachelor of Engineering and Bachelor of Science (Engineering). The following programme is recommended:

**Year I**

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<td>1</td>
</tr>
<tr>
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<td>1</td>
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<tr>
<td>Met151 Microstructure of Materials</td>
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With approval of Head of Department, Chemistry I (4 units) may be taken in lieu of Chemistry IS, Met151 and ME122.
<table>
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<td>Physics II</td>
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<td>ME251 Fluid Mechanics</td>
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<tr>
<td>ME241 Properties of Materials</td>
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<tr>
<td>EE203 *Introduction to Electrical Information</td>
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<td>EE204 **Introduction to Electrical Energy</td>
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<td>ME301 Engineering Computations</td>
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<td>ME372 Heat Transfer</td>
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<td>ME373 Thermodynamics</td>
<td>1</td>
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<td>ME481 Engineering Administration</td>
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<td>ME482 Engineering Economics</td>
<td>1</td>
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<tr>
<td>One unit selected from —</td>
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</tr>
<tr>
<td>ME381 Methods Engineering</td>
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<tr>
<td>ME383 Quality Engineering</td>
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<tr>
<td>ME413 Design of Crankshafts, Flywheels and other Rotating Members</td>
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150
Subject

Year V

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* First half year
** Second half year
1 See Elective Requirements — Appendix A.

**BACHELOR OF ARTS/BACHELOR OF ENGINEERING IN INDUSTRIAL ENGINEERING**

The course followed must comply with Section 19 of the Requirements for the Degrees of Bachelor of Engineering and Bachelor of Science (Engineering). The following programme is recommended:

**Year I**

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<th>Subject</th>
<th>Units</th>
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<td>ME122</td>
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<tr>
<td><strong>Total</strong></td>
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With approval of Head of Department, Chemistry I (4 units) may be taken in lieu of Chemistry IS, Met 151 and ME122.

**Year II**

1 Arts subject Part I

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<td>ME214</td>
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<td>ME271</td>
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<td>Subject</td>
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<td>EE204</td>
<td>**Introduction to Electrical Energy</td>
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<td>1Arts subject Part II or Part III</td>
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<tr>
<td>ME384</td>
<td>Design for Production</td>
</tr>
<tr>
<td>ME487</td>
<td>Operations Research — Deterministic Models</td>
</tr>
<tr>
<td>ME488</td>
<td>Operations Research — Probabilistic Models</td>
</tr>
<tr>
<td><strong>Year V</strong></td>
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<td>Engineering Design</td>
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<tr>
<td>ME333</td>
<td>Dynamics of Machines</td>
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<tr>
<td>ME361</td>
<td>Automatic Control</td>
</tr>
<tr>
<td>ME385</td>
<td>Accounting &amp; Financial Studies</td>
</tr>
<tr>
<td>ME496</td>
<td>Project/Seminar</td>
</tr>
<tr>
<td>ME681</td>
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<tr>
<td><strong>Second half year</strong></td>
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</tbody>
</table>

* Approximate unit values. Refer to Arts Faculty Handbook for subject details.

2 See Elective Requirements — Appendix A.

3 Mathematics IIIB may be taken in two parts each of three terms duration.
BACHELOR OF SCIENCE/BACHELOR OF ENGINEERING IN INDUSTRIAL ENGINEERING

The course followed must comply with Section 19 of the Requirements for the degrees of Bachelor of Engineering and Bachelor of Science (Engineering). The following programme is recommended:

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<th>Subject</th>
<th>Units</th>
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<tbody>
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<tr>
<td>ME122 Process Technology</td>
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</tr>
<tr>
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<td><strong>Total</strong></td>
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</tr>
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With approval of Head of Department, Chemistry I (4 units) may be taken in lieu of Chemistry IS, Met 151 and ME122.

<table>
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<td>EE204 **Introduction to Electrical Energy</td>
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<td>ME361 Automatic Control</td>
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<tr>
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* First half year

** Second half year

1 See Elective Requirements — Appendix A.

**BACHELOR OF COMMERCE/BACHELOR OF ENGINEERING IN MECHANICAL ENGINEERING**

The course followed must comply with Section 19 of the Requirements for the degrees of Bachelor of Engineering and Bachelor of Science (Engineering). The following programme has been approved by the two Faculty Boards:

**Year I**

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With approval of Head of Department Chemistry I (4 units) may be taken in lieu of Chemistry IS, Met151 and ME122.

154
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<td>2Economics &amp; Commerce</td>
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<td>2Economics &amp; Commerce</td>
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<td><strong>Year IV</strong></td>
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<tr>
<td>GE350</td>
<td>Seminar</td>
</tr>
<tr>
<td>ME301</td>
<td>Engineering Computations</td>
</tr>
<tr>
<td>ME313</td>
<td>Engineering Design</td>
</tr>
<tr>
<td>ME333</td>
<td>Dynamics of Machines</td>
</tr>
<tr>
<td>ME342</td>
<td>Properties of Materials</td>
</tr>
<tr>
<td>ME343</td>
<td>Mechanics of Solids</td>
</tr>
<tr>
<td>ME352</td>
<td>Fluid Mechanics</td>
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<td>ME361</td>
<td>Automatic Control</td>
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<td>Heat Transfer</td>
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<tr>
<td>ME373</td>
<td>Thermodynamics</td>
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</table>
Subject Units

Year V

CE303 Structural Design 2
     one unit of —
ME381 Methods Engineering
ME383 Quality Engineering
ME413 Design of Crankshafts, Flywheels and other
     Rotating Members
ME414 Design of Hydraulic & Pneumatic
     Power Systems
ME449 Reliability Analysis of Mechanical Systems
ME487 Operations Research — Deterministic Models
ME496 Project/Seminar 4
Electives 5
Economics & Commerce 4

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* First half year
** Second half year

1 Three elective units must be chosen from the list of Departmental Electives.
2 The subjects which count towards the B.Com. degree are those marked 2 plus six
     Engineering units chosen from subjects normally taken in Year III or Year IV of
     the full time Engineering programme which may be counted as one Group C subject.

BACHELOR COMMERCE/BACHELOR OF ENGINEERING IN
INDUSTRIAL ENGINEERING

The course followed must comply with Section 19 of the Requirements for
the degrees of Bachelor of Engineering and Bachelor of Science (Engineering). The following programme has been approved by the two Faculty
Boards:

Year I

Engineering I 4
Mathematics I 4
Physics IA 4
Chemistry IS 2
ME121 Workshop Practice 1
ME122 Process Technology 1
Met151 Microstructure of Materials 1

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With approval of Head of Department, Chemistry I (4 units) may be taken in lieu of
Chemistry IS, Met151 and ME122.
<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subject Units</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Year II</strong></td>
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</tr>
<tr>
<td>EE203 *Introduction to Electrical Information</td>
<td>1</td>
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<tr>
<td>EE204 **Introduction to Electrical Machines</td>
<td>1</td>
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<tr>
<td>ME202 Dynamics of Engineering Systems</td>
<td>1</td>
</tr>
<tr>
<td>ME214 Mechanics of Solids I</td>
<td>1</td>
</tr>
<tr>
<td>ME223 Mechanical Technology</td>
<td>1</td>
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<tr>
<td>ME241 Properties of Materials</td>
<td>1</td>
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<tr>
<td>2Microeconomics</td>
<td>2</td>
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<tr>
<td>2Accounting I</td>
<td>4</td>
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<td>2Mathematics IIB</td>
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<tr>
<td>one of —</td>
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<tr>
<td>2Economic History I</td>
<td>2</td>
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<tr>
<td>Economic Statistics I</td>
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<td>Legal Studies I</td>
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<td><strong>Year III</strong></td>
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<tr>
<td>ME201 Laboratory Measurements</td>
<td>1</td>
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<tr>
<td>ME212 Engineering Design</td>
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<tr>
<td>ME213 Engineering Design</td>
<td>1</td>
</tr>
<tr>
<td>ME232 Dynamics of Machines</td>
<td>1</td>
</tr>
<tr>
<td>ME251 Fluid Mechanics</td>
<td>1</td>
</tr>
<tr>
<td>ME271 Thermodynamics</td>
<td>1</td>
</tr>
<tr>
<td>2Macroeconomics</td>
<td>4</td>
</tr>
<tr>
<td>2Economics &amp; Commerce</td>
<td>4</td>
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<tr>
<td>2Economics &amp; Commerce</td>
<td>4</td>
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<tr>
<td><strong>Year IV</strong></td>
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<tr>
<td>GE350 Seminar</td>
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<tr>
<td>ME301 Engineering Computations</td>
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<td>ME313 Engineering Design</td>
<td>1</td>
</tr>
<tr>
<td>ME333 Dynamics of Machines</td>
<td>1</td>
</tr>
<tr>
<td>ME342 Properties of Materials</td>
<td>1</td>
</tr>
<tr>
<td>ME343 Mechanics of Solids</td>
<td>1</td>
</tr>
<tr>
<td>ME361 Automatic Control</td>
<td>1</td>
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<tr>
<td>ME381 Methods Engineering</td>
<td>1</td>
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<tr>
<td>ME383 Quality Engineering</td>
<td>1</td>
</tr>
<tr>
<td>ME384 Design for Production</td>
<td>1</td>
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<tr>
<td>ME487 Operations Research — Deterministic Models</td>
<td>1</td>
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<tr>
<td>ME488 Operations Research — Probabilistic Models</td>
<td>1</td>
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<td>2Economics &amp; Commerce</td>
<td>4</td>
</tr>
<tr>
<td></td>
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</tr>
</tbody>
</table>
Subject Units

Year V

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME496 Project/Seminar</td>
<td>4</td>
</tr>
<tr>
<td>ME681 Industrial Law</td>
<td>2</td>
</tr>
<tr>
<td>2Economics &amp; Commerce</td>
<td>4</td>
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<tr>
<td>1Electives</td>
<td>5</td>
</tr>
</tbody>
</table>

* First half year

** Second half year

1 Three elective units must be chosen from the list of Departmental Electives.
2 The subjects which count towards the B.Com. degree are those marked 2 plus six Engineering units chosen from subjects normally taken in Year III or Year IV of the full-time Engineering programme which may be counted as one Group C subject.

Conditions as to Selection of Electives

1. At least 2 units of 4-unit elective in Year III must be taken outside the Faculty.
2. Not more than 6 units may be taken outside the Faculty.
3. At least 3 of the 6 elective units taken in Year IV must be selected from the departmental list of technical electives.
4. For students in full employment proceeding as part-time students, each year of appropriate employment that is supervised and approved by the Head of Department is credited as 1 unit of elective. A maximum of 5 such units is allowed, described as:
   - ME092 Industrial Experience 1 unit
   - ME093 Industrial Experience 1 unit
   - ME094 Industrial Experience 1 unit
   - ME095 Industrial Experience 1 unit
   - ME096 Industrial Experience 1 unit
   These elective units may be used to meet any elective requirements in Clauses 1 and 2 above, except the departmental technical elective requirement in Clause 3.
5. Three elective units in the B.A./B.E. courses and in the B.Sc./B.E. courses must be selected from the list of Departmental Technical Electives on page 160.
# List of Prerequisites

## Mechanical and Industrial Engineering

<table>
<thead>
<tr>
<th>Subject Unit</th>
<th>Prerequisite</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME201 Laboratory Measurements</td>
<td>*Maths I, *Physics IA or IB</td>
</tr>
<tr>
<td>ME202 Dynamics of Engineering Systems</td>
<td>Maths I, *ME131, *CE111,</td>
</tr>
<tr>
<td>ME212 Engineering Design</td>
<td>*ME121, ME111/2, CE111,</td>
</tr>
<tr>
<td>ME212</td>
<td>*Maths I, *ME214</td>
</tr>
<tr>
<td>ME213 Engineering Design</td>
<td>ME212</td>
</tr>
<tr>
<td>ME214 Mechanics of Solids</td>
<td>ME111/2, ME131, CE111, Maths I</td>
</tr>
<tr>
<td>ME221 Workshop Practice</td>
<td>*ME121</td>
</tr>
<tr>
<td>ME223 Mechanical Technology</td>
<td>*ME121</td>
</tr>
<tr>
<td>ME232 Dynamics of Machines</td>
<td>Maths I, ME131, ME111/2, CE111</td>
</tr>
<tr>
<td>ME241 Properties of Materials</td>
<td>Maths I, ME111/2, CE111</td>
</tr>
<tr>
<td>ME251 Fluid Mechanics</td>
<td>Maths I, ME131</td>
</tr>
<tr>
<td>ME271 Thermodynamics</td>
<td>Maths I, Physics IA or IB</td>
</tr>
<tr>
<td>ME301 Engineering Computations</td>
<td>Maths I</td>
</tr>
<tr>
<td>ME313 Engineering Design</td>
<td>ME213, ME232, Maths I</td>
</tr>
<tr>
<td>ME333 Dynamics of Machines</td>
<td>Maths IIB</td>
</tr>
<tr>
<td>ME342 Properties of Materials</td>
<td>ME241</td>
</tr>
<tr>
<td>ME343 Mechanics of Solids</td>
<td>ME214 or CE212</td>
</tr>
<tr>
<td>ME352 Fluid Mechanics</td>
<td>ME251</td>
</tr>
<tr>
<td>ME361 Automatic Control</td>
<td>Maths IIB</td>
</tr>
<tr>
<td>ME372 Heat Transfer</td>
<td>*Maths IIB</td>
</tr>
<tr>
<td>ME373 Thermodynamics</td>
<td>ME271</td>
</tr>
<tr>
<td>ME381 Methods Engineering</td>
<td>Maths I, ME122, ME223</td>
</tr>
<tr>
<td>ME383 Quality Engineering</td>
<td>Maths IIB, ME122, ME223</td>
</tr>
<tr>
<td>ME384 Design for Production</td>
<td>ME213, ME122, ME223</td>
</tr>
<tr>
<td>ME385 Accounting &amp; Financial Studies</td>
<td>Maths I</td>
</tr>
<tr>
<td>ME401 Systems Analysis</td>
<td>Maths IIB, ME361</td>
</tr>
<tr>
<td>ME402 Systems Planning, Organization &amp; Control</td>
<td>Maths IIB, ME361</td>
</tr>
<tr>
<td>ME403 Resources Planning &amp; Allocation</td>
<td>Maths IIB, ME361</td>
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<tr>
<td>ME404 Mathematical Programming</td>
<td>Maths IIB</td>
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<tr>
<td>ME405 Advanced Engineering Computations</td>
<td>ME301</td>
</tr>
<tr>
<td>ME407 Environmental Engineering</td>
<td>Completed Year II of Course</td>
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<tr>
<td>ME408 Industrial Safety Engineering</td>
<td>Maths IIB</td>
</tr>
<tr>
<td>ME413 Design of Crankshafts, Flywheel &amp; other Rotating Members</td>
<td>*ME313, *ME333</td>
</tr>
<tr>
<td>ME414 Design of Hydraulic &amp; Pneumatic Power Systems</td>
<td>ME251, *ME352</td>
</tr>
<tr>
<td>ME415 Design of Cranes &amp; Hoist Equipment</td>
<td>*CE303, ME213, ME232</td>
</tr>
<tr>
<td>ME416 Design of Pressure Vessels, High Pressure Pipelines, Plates &amp; Shells</td>
<td>ME313, ME342/3</td>
</tr>
<tr>
<td>ME417 Design of Worm &amp; Special Purpose Gear Reduction Units</td>
<td>ME213, ME232</td>
</tr>
<tr>
<td>ME418</td>
<td>ME313, ME372</td>
</tr>
<tr>
<td>ME419 Design of Conveyors &amp; Materials Handling Equipment</td>
<td>*ME313, ME232</td>
</tr>
<tr>
<td>ME434 Advanced Kinematics &amp; Dynamics of Machines</td>
<td>ME333</td>
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<tr>
<td>ME444 Properties of Materials</td>
<td>ME342</td>
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<tr>
<td>ME445 Mechanics of Solids</td>
<td>ME343</td>
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<tr>
<td>ME446 An Introduction to Plastic Analysis</td>
<td>ME342/3</td>
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<tr>
<td>ME447 An Introduction to Experimental Analysis</td>
<td>ME342/3</td>
</tr>
<tr>
<td>ME448 An Introduction to Photomechanics</td>
<td>ME342/3</td>
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</tbody>
</table>
### Subject Unit

<table>
<thead>
<tr>
<th>Subject Unit</th>
<th>Prerequisite</th>
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<tbody>
<tr>
<td>ME449 Reliability Analysis of Mechanical Systems</td>
<td>ME313, Maths IIB</td>
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<tr>
<td>ME453 Fluid Mechanics</td>
<td>*ME352</td>
</tr>
<tr>
<td>ME454 Turbomachinery</td>
<td>*ME352</td>
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<tr>
<td>ME473 Thermodynamics</td>
<td>ME271</td>
</tr>
<tr>
<td>ME474 Heat Transfer</td>
<td>ME372</td>
</tr>
<tr>
<td>ME476 Developments in the Use of Solar Energy</td>
<td>ME271, ME372</td>
</tr>
<tr>
<td>ME481 Engineering Administration</td>
<td>Maths I</td>
</tr>
<tr>
<td>ME482 Engineering Economics</td>
<td>Maths I</td>
</tr>
<tr>
<td>ME483 Production Engineering</td>
<td>Maths I, ME122, ME223</td>
</tr>
<tr>
<td>ME485 Tool Design</td>
<td>ME384</td>
</tr>
<tr>
<td>ME486 Industrial Design</td>
<td>ME313</td>
</tr>
<tr>
<td>ME487 Operations Research — Deterministic Models</td>
<td>Maths IIB</td>
</tr>
<tr>
<td>ME488 Operations Research — Probabilistic Models</td>
<td>Maths IIB</td>
</tr>
<tr>
<td>ME489 Operations Research — Applications in Industry</td>
<td>Maths IIB</td>
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### Naval Architecture

<table>
<thead>
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<th>Subject Unit</th>
<th>Prerequisite</th>
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</thead>
<tbody>
<tr>
<td>NA201 Theoretical Naval Architecture</td>
<td>*Maths I, ME111/2, ME131, CE111</td>
</tr>
<tr>
<td>NA221 Naval Architecture Technology</td>
<td>*Maths I, ME111/2, CE111</td>
</tr>
<tr>
<td>NA241 Applied Naval Architecture</td>
<td>ME111/2</td>
</tr>
<tr>
<td>NA311 Ship Design &amp; Construction</td>
<td>NA201, NA221, NA241</td>
</tr>
<tr>
<td>NA342 Applied Naval Architecture</td>
<td>ME251, NA201, NA221, NA241</td>
</tr>
<tr>
<td>NA351 Resistance &amp; Propulsion of Ships</td>
<td>ME251, NA201, NA221, NA241</td>
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<tr>
<td>NA402 Special Purpose Ships</td>
<td>NA311, NA351</td>
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<tr>
<td>NA431 Ships' Machinery</td>
<td>NA311, NA351</td>
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<tr>
<td>NA452 Theoretical Naval Architecture</td>
<td>NA311, NA351</td>
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<tr>
<td>NA481 Shipyard Production &amp; Management</td>
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</tbody>
</table>

* Prerequisites thus indicated may, with the consent of the Head of the Department, be read concurrently with the subject unit named.

### Departmental Technical Electives

Each Elective is to consist of three subject units chosen from the following list.

1. **SUBJECT UNITS (42 hrs/unit)**

<table>
<thead>
<tr>
<th>Subject Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME401 Systems Analysis</td>
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<tr>
<td>ME402 Systems Planning, Organization &amp; Control</td>
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<tr>
<td>ME403 Resources Planning &amp; Allocation</td>
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<td>ME404 Mathematical Programming</td>
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<td>ME405 Advanced Engineering Computations</td>
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<td>ME407 Environmental Engineering</td>
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<tr>
<td>ME408 Industrial Safety Engineering</td>
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<tr>
<td>ME413 Design of Crankshafts, Flywheels &amp; other Rotating Members</td>
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<tr>
<td>ME414 Design of Hydraulic &amp; Pneumatic Power Systems</td>
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<tr>
<td>ME415 Design of Crane &amp; Hoist Equipment</td>
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<td>ME416 Design of Pressure Vessels, High Pressure Pipelines, Plates &amp; Shells</td>
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<tr>
<td>ME417 Design of Worm &amp; Special Purpose Gear Reduction Units</td>
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</tbody>
</table>

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ME418  Design of Thermal Unit Components
ME419  Design of Conveyors & Materials Handling Equipment
ME434  Advanced Kinematics & Dynamics of Machines
ME444  Properties of Materials
ME445  Mechanics of Solids
ME446  An Introduction to Plastic Analysis
ME447  An Introduction to Experimental Analysis
ME448  An Introduction to Photomechanics
ME449  Reliability Analysis for Mechanical Systems
ME453  Fluid Mechanics
ME454  Turbomachinery
ME473  Thermodynamics
ME474  Heat Transfer
ME476  Developments in the Use of Solar Energy
ME483  Production Engineering
ME485  Tool Design
ME486  Industrial Design
ME487  Operations Research — Deterministic Models
ME488  Operations Research — Probabilistic Models
ME489  Operations Research — Applications in Industry

Should other departments or faculties select three or more of the subject units to form a subject, the subject so formed shall be called *Mechanical Engineering III*.

Elective programmes must be approved by the Head of Department.

1 Availability of individual subject units will depend on student demand.
DESCRIPTION OF SUBJECT ENTRIES

Indicating Numerals for Mechanical Engineering

ME-0- General courses
ME-1- Analysis and Design
ME-2- Mechanical Engineering Practice
ME-3- Machines
ME-4- Materials
ME-5- Fluid Mechanics
ME-6- Automatic Control
ME-7- Thermodynamics
ME-8- Industrial Engineering
ME-9- Project & Seminar

Naval Architecture

NA-0- General courses
NA-1- Analysis and Design
NA-2- Shipbuilding practice
NA-3- Machines
NA-4- Applications
NA-5- Resistance & Propulsion
NA-6- 
NA-7- 
NA-8- Industrial Engineering
NA-9- Project & Seminar

ME092 to ME096 Industrial Experience Units  See page 206.

Examination  Progressive assessment

541101 ME111 Graphics

Prerequisites  Nil
Hours  42
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.
Text
Levens, A. S.  Graphics (Wiley 1968)
Or
Luzadder, W. J.  Basic Graphics (Prentice-Hall 1968)

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

541102  ME112 Engineering Drawing and Elementary Design

Prerequisites  Nil
Hours  42
Examination  Progressive assessment

Content

Text
Australian Standard Engineering Drawing Practice ASCZI — 1973 (Institution of Engineers, Australia)

References
Earle, J. H.  Design Drafting (Addison Wesley 1972)
Levens, A. S.  Graphics (Wiley 1968)
Or
Luzadder, W. J.  Basic Graphics (Prentice-Hall 1968)

541201  ME121 Workshop Practice

Prerequisites  Nil
Hours  48
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, welding processes, boilermaking and steel fabrication, and the engineering inventory of materials and components.

Text
Tech Education  Trade Technology Notes

References
DeGarmo, E. P.  Materials and Processes in Manufacturing (Macmillan)
Doyle, L. E. et al  Manufacturing Processes and Materials for Engineers (Prentice-Hall)
H. Ford Trade School  Shop Theory (McGraw-Hill)
—  Trade Catalogues

541202  ME122 Process Technology

Prerequisite  Nil
Hours  42

Examination  Progressive assessment

Content

Text
DeGarmo, E. P.  Materials and Processing in Manufacturing (Macmillan)
OR
Doyle, L. E. et al  Manufacturing Processes and Materials for Engineers (Prentice-Hall)

References
Campbell, J. S.  Processes and Materials in Manufacturing (McGraw-Hill)
Datsko, I.  Materials, Properties and Manufacturing Processes (Wiley)
541103 ME131 Dynamics

**Prerequisites**
Nil

**Hours**
42

**Examination**
One 3-hour paper

**Content**
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**
Meriam, J. L. *Dynamics* 2nd edn S.I. Version (Wiley International edn 1975)

**Reference**

542201 ME201 Laboratory Measurements

**Prerequisites**
*Maths I & *Physics IA or IB

**Hours**
42

**Examination**
Progressive assessment

**Content**
Fundamental units and quantities are discussed as well as the means by which they are measured. Variability in measured data is described and an introduction to error analysis is given. The importance of a correct interpretation of experimental data is emphasised, and simple examples of regression analysis are explained.

Basic methods using mechanical, optical or electrical systems or some combination of these, which are used for the measurement of length, strain, area, pressure, temperature, force, torque, fluid flow, vibration, acceleration and other physical properties, are described. Selected laboratory experiments are also provided.
Text
Holman, J. P.  
*Experimental Methods for Engineers* (McGraw-Hill 1966)

References
Beckwith, T. G. & Buck, W. L.  
*Mechanical Measurements* (Addison-Wesley)
Brinkworth, B. J.  
*An Introduction to Experimentation* (EUP)
Volk, W.  
*Applied Statistics for Engineers* (McGraw-Hill)

542104 ME202 Dynamics of Engineering Systems

Prerequisites  
Maths I, *ME131, *CE111

Hours  
42

Examination  
Progressive assessment

Content
System Classification — Lumped parameter and distributed systems; discrete systems. Examples commonly occurring in engineering problems.
Linear Graph Analysis and Network Analysis; Block diagrams.
Circuit diagrams for mechanical systems—“through” and “across” variables; equilibrium and compatibility analysis; system modelling; system function.
Concept of “state”; free and forced response; stability.
Classical time domain analysis; frequency domain analysis of linear lumped and continuous systems.

Text
Cannon, R. H.  
*Dynamics of Physical Systems* (McGraw-Hill)

References
Haberman, C. M.  
*Engineering Systems Analysis* (Merril)
Raven, F. H.  

542302 ME212 Engineering Design

Prerequisites  
*ME121, ME111/2, *ME214 or CE212
CE111, *Maths I

Hours  
42

Examination  
Progressive assessment
Content

Design procedures for mechanical components. Load estimation. Typical allowable stress and factor of safety values. Stress calculations. Detail considerations of the design of shafts, bearings, couplings, bolted joints, welded connections, wall brackets, eccentric connections, levers, flat and vee belts, drives and springs. Horsepower, calculations for straight and helical spur gear reductions.

Text

Hall, A. S.  

References


Faires, V. M. *Design of Machine Elements* (Macmillan)

Kent, W. *Mechanical Engineers' Handbook Design and Production* (Wiley)

Phelan, R. M. *Fundamentals of Mechanical Design* (McGraw-Hill)

Shigley, J. E. *Mechanical Engineering Design* (McGraw-Hill)

— *Machine Cut Gears Helical & Straight Spur* A.S.B. 61 — 1941

542303 ME213 Engineering Design

Prerequisite  
*ME212

Hours  
42

Examination  
One 3½-hour paper

Content

The design of brakes, clutches, gear box reduction units and power screws for industrial applications. Modern developments in this area will be discussed.

Text

References

Black, P. H. & Adams, A. F.  
Doughty, V. L. & Vallance, A.  
Faires, V. M.  
Hall, A. S.  
Holowenko, A. E. & Laughlin, B. G.  
Phelan, R. M.  
Shigley, J. E.  
Siegal, W. J., Maleev, V. L. & Hartmann, J. B.

Machine Design (McGraw-Hill)
Design of Machine Members (McGraw-Hill)
Design of Machine Elements (Macmillan)
Theory and Problems of Machine Design (Schaum Publishing Co.)
Fundamentals of Mechanical Design (McGraw-Hill)
Mechanical Engineering Design International Student edn (McGraw-Hill)
Mechanical Design of Machines (International Textbook Co.)

542105 ME214 Mechanics of Solids

Prerequisites Maths I, ME111/112, ME131, CE111
Hours 42
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.

Text
Hall, A. S.  An Introduction to the Mechanics of Solids  
International Student edn (Wiley 1973)

References
2nd edn (McGraw-Hill 1972)
Higdon, A. et al  Mechanics of Materials (Wiley)
Popov, E. P.  Introduction to Mechanics of Solids  
(Prentice-Hall 1968)

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### ME223 Mechanical Technology

**Prerequisite**  
*ME121

**Hours**  
42

**Examination**  
Progressive assessment

**Content**

**Texts**
- Campbell, J. S.  
  *Processes and Materials in Manufacturing*  
  (John Wiley)
- DeGarmo, E. P.  
  *Materials Processes in Manufacturing*  
  (Macmillan)

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

### ME232 Dynamics of Machines

**Prerequisites**  
Maths I, ME131, ME111/2, CE111

**Hours**  
42

**Examination**  
One 3-hour paper

**Content**
Kinematics and dynamics of simple mechanisms, cams and toothed gearing.

**Text**
- Hirschhorn, J.  
  *Kinematics and Dynamics of Plane Mechanisms*  
  (McGraw-Hill)

**References**
- Holowenko, A. R. C.  
  *Dynamics of Machinery*  
  (Wiley)
- Kepler, H. B.  
  *Basic Graphical Kinematics*  
  (McGraw-Hill)
- Rothbart, H. A.  
  *Cam Design, and Accuracy*  
  (Wiley)
- Shigley, J. E.  
  *Theory of Machines*  
  (McGraw-Hill)
542102 ME241 Properties of Materials

Prerequisites
Maths I, ME111/2, CE111

Hours
42

Examination
One 3-hour paper

Content
An introductory subject on materials science, structure and properties of materials, strength and failure criteria for materials, material characterisation. The use and selection of materials for durability, static and dynamic loading conditions, electrical applications, and severe environmental conditions. The particular merits of metals, and of ceramic and organic materials are emphasised.

Texts
Nil

References
McClintock & Argon  Mechanical Behaviour of Materials (Addison-Wesley)
Richards, C. W.  Engineering Materials Science (Wadsworth)
Van Vlack, L. H.  Elements of Materials Science (Addison-Wesley)

542202 ME251 Fluid Mechanics

Prerequisites
Maths I, ME131

Hours
42

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
References
Dougherty, R. L. & Franzini, J. B.  
"Fluid Mechanics with Engineering Applications"  
(McGraw-Hill)
Streeter, V. L.  
"Fluid Mechanics 5th edn"  
(McGraw-Hill)

542203  ME271 Thermodynamics

Prerequisites  
Maths I, Physics IA or IB

Hours  
42

Examination  
Progressive assessment

Content
Calculation of property changes and energy flows for non-flow, steady flow and unsteady flow processes using various working substances.
Examination of various energy conversion systems as examples of the above calculations — Carnot cycle, Rankine cycle, reheat cycle, regenerative feed heating, Otto cycle, Diesel and mixed cycles, Stirling and Ericsson cycles, gas turbine cycles, refrigeration cycles.
Introduction to combustion processes.

Texts
Haywood, R. W.  
"Thermodynamic Tables in SI (Metric) Units"  
(Cambridge University Press 1972)
Rogers, G. F. C., & Mahew, R.  
"Engineering Thermodynamics Work and Heat Transfer, SI Units"  
(Longmans 1972)

References
Cole, E. H.  
"Engineering Thermodynamics"  
(Edward Arnold 1973)
Wallace, F. J. & Linning, W. A.  
"Basic Engineering Thermodynamics (SI Units)"  
(Pitman 1970)

543101 ME301 Engineering Computations

Prerequisite  
Maths I

Hours  
42

Examination  
Progressive assessment
Content

Texts
— Fortran (Dataset Pty. Ltd. 1973)

References
Forsythe, G. & Moler, C. B. Computer Solution of Linear Algebraic Systems (Prentice-Hall 1967)
Ralston, A. A First Course in Numerical Analysis (I.S.E. McGraw-Hill 1965)

543302 ME313 Engineering Design

Prerequisites ME213, ME214, ME232, Maths I, *ME343
Hours 42
Examination Progressive assessment

Content
The design of power unit cylinders, reciprocating power elements, cylinder closures, dynamic struts and dynamic levers using work or indicator diagrams as developed from thermodynamics, fluid mechanics or machine tool theory as the basis of horsepower, load and stress calculation. Effects of inertia, dead weight and centrifugal force on piston loads. Inertia bending of struts and bending induced by bearing friction. Stress summation and factor of safety criteria. Special reference to reciprocating engine, compressor and power press units. Manufacturing techniques and material compatibility. Introduction to optimisation techniques and formalised decision making in design.

Text
Siegel, W. J. Mechanical Design of Machines (International Textbook Co.)
Malev, V. L. & Hartmann, J. B.
References
Howarth, M. H. Design of High Speed Diesel Engines
Lipson & Juvinall Handbook of Stress and Strength (Macmillan)
Matousek, R. Engineering Design (Blackie)
Purday Diesel Engine Design (Constable)
Seely & Smith Advanced Mechanics of Materials (Wiley)
Shigley, J. E. Mechanical Engineering Design (McGraw-Hill)
Walshaw Diesel Engine Design (Newnes)

543301 ME333 Dynamics of Machines

Prerequisite Maths IIIB
Hours 42
Examination Progressive assessment

Content

Text
Church, A. H. Mechanical Vibrations (John Wiley)
Or
Phelan, R. M. Dynamics of Machinery (McGraw-Hill)

References
Anderson, R. A. Fundamentals of Vibrations (Macmillan)
Seto, W. W. Mechanical Vibrations (Schaum)
Timoshenko, S. & Young, D. H. Vibration Problems in Engineering (Van Nostrand)
Yu Chen Vibrations—Theoretical Methods (Addison-Wesley)

543302 ME342 Properties of Materials

Prerequisite ME241
Hours 42
Examination One 3-hour paper

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Content


Text

Polakowski, N. H. & Ripling, E. M.  
Strength and Structure of Engineering Materials (Prentice-Hall)

References

D'Isa, F.  
Mechanics of Metals (Addison-Wesley)

Fung, Y. C.  
A First Course in Continuum Mechanics (Prentice-Hall)

Gordon, J. E.  
The New Science of Strong Materials (Pelican)

McClintock & Argon  
Mechanical Behaviour of Materials (Addison-Wesley)

Richards, C. W.  
Engineering Materials Science (Wadsworth)

543103 ME343 Mechanics of Solids

Prerequisites  
CE212 or ME214

Hours  
42

Examination  
Progressive assessment

Content


Texts  
Nil
References
Dahl, N. G. & Lardner, T. J.

D'Isa, F. A. Mechanics of Metals (Addison-Wesley)

Juvinall, R. C. Stress, Strain and Strength (McGraw-Hill)
Long, R. R. Mechanics of Solids and Fluids (Prentice-Hall)
McClintock, F. A. & Argon, A. S. Mechanical Behaviour of Materials (Addison-Wesley)
Seely, F. B. & Smith, A. M. Advanced Mechanics of Materials (Wiley)

543201 ME352 Fluid Mechanics

Prerequisite ME251
Hours 42
Examination Progressive assessment

Content
Basic equations for interactions between fluids and moving vanes. Applications to radial flow pumps and fans, and the development of similarity relationships and descriptions of performance. Similar applications to axial flow pumps and fans, turbo-compressors, water turbines, steam turbines, and gas turbines. Study of cavitation as it affects machines handling liquids.

Texts Nil

References
Cscanady Theory of Turbomachines (McGraw-Hill)
Kovats, A. & Desmur, G. Pumps, Fans and Compressors (Blackie)

543204 ME361 Automatic Control

Prerequisite Maths IIB
Hours 42
Examination Progressive assessment

175
Content


Texts

Nil

References

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

Gupta & Hasdorff  
Fundamentals of Automatic Control (Wiley)

Melsa & Schultz  
Linear Control Systems (McGraw-Hill)

Raven, F. H.  
Automatic Control Engineering (McGraw-Hill)

543202 ME371 Heat Transfer

Prerequisite  
*Maths IIB

Hours  
42

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

Bayley, F. J.,  
Heat Transfer (Thomas Nelson 1972)

Owen, J. M. & Turner, A. B.

References

Jakob, M.  
Heat Transfer Vols. 1 & 2 (Wiley)

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

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543505  ME373 Thermodynamics

Prerequisite
ME271

Hours
42

Examination
Progressive assessment

Content
General thermodynamic relations, equations of state, compressibility factor.
Non-reactive gaseous mixtures, gas and vapour mixtures, psychrometry.
First and second law analysis of energy systems including power plants, gas turbines, transportation prime movers, air compressors, refrigeration and air conditioning.
Reactive mixtures, enthalpy and internal energy of reaction, equilibrium constant.
Thermodynamics of irreversible processes, entropy production.
Introduction to statistical thermodynamics, entropy and probability, the energy partition function, use in determining thermodynamic properties.
Introduction to direct energy conversion systems such as thermoelectric devices, fuel cells, thermionic devices, magnetohydrodynamic power.

Text
Wood, B. D.  Applications of Thermodynamics (Addison-Wesley 1969)

543501  ME381 Methods Engineering

Prerequisites
Maths I, ME222/3

Hours
42

Examination
Progressive assessment

Content

Text
Niebel, B. W.  Methods Engineering (Wiley)
543505 ME373 Thermodynamics

Prerequisite

ME271

Hours

42

Examination

Progressive assessment

Content

General thermodynamic relations, equations of state, compressibility factor.
Non-reactive gaseous mixtures, gas and vapour mixtures, psychrometry.
First and second law analysis of energy systems including power plants, gas turbines, transportation prime movers, air compressors, refrigeration and air conditioning.
Reactive mixtures, enthalpy and internal energy of reaction, equilibrium constant.
Thermodynamics of irreversible processes, entropy production.
Introduction to statistical thermodynamics, entropy and probability, the energy partition function, use in determining thermodynamic properties.
Introduction to direct energy conversion systems such as thermoelectric devices, fuel cells, thermionic devices, magnetohydrodynamic power.

Text

Wood, B. D. Applications of Thermodynamics (Addison-Wesley 1969)

543501 ME381 Methods Engineering

Prerequisites

Maths I, ME222/3

Hours

42

Examination

Progressive assessment

Content


Text

Niebel, B. W. Methods Engineering (Wiley)
References
Barnes, R. M.  Motion and Time Study (Wiley)
Krick, E. V.  Motion and Time Study (Irwin)

543502 ME383 Quality Engineering

Prerequisites  Maths IIB, ME222/3
Hours  42
Examination  Progressive assessment
Content

References
—  Handbook of Industrial Metrology Amer. Soc. Tool & Mfg. Engs (Prentice-Hall)
Duncan, A. J.  Quality Control and Industrial Statistics (Irwin)
Grant, E. L.  Statistical Quality Control (McGraw-Hill)
Juran, J. M. & Gryna, F. M.  Quality Planning and Analysis (McGraw-Hill)
Kirkpatrick, E. G.  Quality Control for Managers and Engineers (Wiley)

543503 ME384 Design for Production

Prerequisites  ME213, ME222/3
Hours  42
Examination  Progressive assessment

178
Content
The application of economics, methods engineering, ergonomics and mechanical engineering to the development and design of a product. Its production (particularly in quantity), distribution and marketing. Operation methods; metrology, tools; jigs and fixtures, assembly and inspection procedures. Plant facilities.

Texts
Nil

References
— Fundamentals of Tool Design Amer. Soc. of Tool & Mfg. Engs. (Prentice-Hall)
— Value Engineering in Manufacturing Amer. Soc. of Tool & Mfg. Engs. (Prentice-Hall)
Kempster, M. H. A. Principles of Jig and Tool Design (E.U.P.)
Niebel, B. W. & Baldwin, E. N. Designing for Production (Irwin)

416105 ME385 Accounting and Financial Studies

Content
For subject entry see page 307.

544451 ME401 Systems Analysis

Prerequisites Maths II B, ME361
Hours 42
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)

Machol, R.  
*Systems Engineering Handbook* (McGraw-Hill)

McMillan, C. & Gonzalez, R. F.  

544452  **ME402 Systems Planning, Organization and Control**

**Prerequisites**  
Maths IIB, ME361

**Hours**  
42

**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 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)

Machol, R.  

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

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

Wayne-Weymore, A.  
*A Mathematical Theory of Systems Engineering*  
(Wiley 1967)
544421 ME403 Resources Planning and Allocation

Prerequisites  
Maths IIB, ME361

Hours  
42

Examination  
Progressive assessment

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

Texts  
Nil

References  
Ackoff, R. L.  
_A Concept of Corporate Planning_ (Wiley—Interscience 1970)

Firey, K.  
_Man, Mind and Land_ (New York, Free Press 1960)

Fisher, J. L. & Potter, N.  
_World Prospects for Natural Resources_  

McDevitt, J.  
_Minerals and Men_ (Baltimore, John Hopkins Press 1968)

Zimmerman, E. W.  
_World Resources and Industries_ (New York, Harper 1951)

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544417 ME404 Mathematical Programming

Prerequisite  
Mathematics IIB

Hours  
42

Examination  
Progressive assessment
Content
Introduction to the solution of static optimisation problems. Dynamic programming; computational refinements of the basic algorithm.
Linear programming; the Simplex algorithm and its revised form; duality theory; sensitivity analysis; decomposition algorithms. Transportation and assignment problems.

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

References
Kunzi, H. P. Non-Linear Programming (Blaisdell 1966)
Krelle, W. & Oettli, W.
McMillan, C. Mathematical Programming (Wiley 1970)
Taha, H. A. Operations Research (Macmillan 1971)

544462 ME405 Advanced Engineering Computations

Prerequisite
ME301

Hours
42

Examination
Progressive assessment

Content
Advanced FORTRAN programming
Variable formats, relational and logical expressions, complex algebra, multiple entry and return points for subroutine and function segments, use of disc and magnetic tape files, compounding of programs from segments stored in separate files, direct access files and backing stores, dump and overlay programs for large jobs, use of library subroutines for a number of problems, e.g. matrice manipulations.

Some advanced computing techniques. For example:
(a) The Nachtsheim-Swigert iteration scheme for solving end value differential equations.
(b) Use of “out-of-core” solver of large sets of banded equations using Gauss elimination.

Introduction to the solution of heat, mass and momentum transfer problems using:
(a) The marker-and-cell finite difference technique.
(b) Finite element techniques.

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Text

References

Alder, B., Fernbach S. & Rotenberg (eds) Various articles from—

- Methods of Computational Physics (N.Y., Academic Press 1964)
- Mathematics of Computations
- International Journal for Numerical Methods in Engineering

544453 ME407 Environmental Engineering

Prerequisite Completed Year II of Course
Hours 42
Examination Progressive assessment

Content
The role of the engineering in environmental pollution and control is examined through interaction of man with air, water, and land masses which comprise the environment in which he lives. Effects of air and noise pollution on man, vegetation, and other materials will be considered. Methods of reducing pollution to acceptable levels will be studied through consideration of physical diffusion models and the examination of existing quality standards, control legislation and various forms of measuring and control hardware.

Texts
Perkin, Henry C. Air Pollution (McGraw-Hill)
Taylor, Rupert Noise (Penguin Books)

References
Batton, L. J. The Unclean Sky (Anchor)
Beranek, L. L. Air Pollution Vols I II & III (Academic Press)
Lund, H. F. Industrial Pollution Control Handbook (McGraw-Hill)
Stern, A. C. Noise Reduction (McGraw-Hill)
Treshow, M. Fresh Air (University of Utah Press)
544422 ME408 Industrial Safety Engineering

Prerequisite Mathematics IIB

Hours 42

Examination To be advised

Content
A course dealing with both theoretical and practical aspects of engineering safety. The course will include:
Concepts, principles and techniques in the application of various analytical approaches for engineering system safety and reliability. Applications of statistical analysis to engineering system safety evaluation and design. The fault-free analysis technique and its application to hazard evaluation and to the design of safe systems.
Human factors and environmental considerations. Particular industrial situations — hazards due to such factors as fire, machinery, electrical components.
Health hazards due to noise pollution, toxic gases, dangerous chemicals and radio activity.

References
Beranek, L. L. Noise Reduction (McGraw-Hill)
Guyot & Cole, R. A. An Introduction to Industrial Safety (West Publishing Corp.)
S.A.A. Guide to Safety Standards
Simonds, R. H. & Grimaldi, J. V. Safety Management (Irwin)

544404 ME413 Design of Crankshafts, Flywheels and other Rotating Members

Prerequisites *ME313, *ME333

Hours 42

Examination Progressive assessment
Content

The design of single and multi-throw crankshafts, flywheels cam and eccentric mechanisms for engines, turbines, compressor, pump or machine tool applications, using hypothetical work or indicator diagrams developed from thermodynamics or machine tool theory as the basis of load, turning moment and stress calculations. Inertia, centrifugal force vibration and balancing criteria, stress summation and multi-factor of safety criteria. Material selection and process compatibility. Manufacturing methods.

Texts
Nil

References

Howarth, M. H.  Design of High Speed Diesel Engines  (Constable)
Lipson & Juvinall  Handbook of Stress and Strength  (Macmillan)
Purday  Diesel Engine Design  (Constable)
Seely & Smith  Advanced Mechanics of Materials  (Wiley)
Shigley, J. E.  Mechanical Engineering Design  (McGraw-Hill)
Siegel, W. J.  Mechanical Design of Machines  (International Textbook Co.)
Maleev, V. I. & Hartmann, J. B.
Walshaw  Diesel Engine Design  (Newnes)

544403 ME414 Design of Hydraulic and Pneumatic Power Systems

Prerequisites  ME251, *ME352
Hours  42
Examination  Progressive assessment

Content

The design of hydraulic, pneumatic and vacuum power units for the provision of power and/or control mechanisms for machine tools, materials handling equipment, etc. Interrelation of load, velocity, acceleration and capacity diagrams in circuit design. Circuit component characteristics. Safety features. Fluid characteristics, fluid flow rates and fluid pressure ratings.

Texts  Nil
References
Kay, F. X.  Pneumatics (Machinery Reference Series)
Molloy, E.  Hydraulic Machinery (Newnes)
Morris, H. M.  Applied Hydraulics in Engineering (The Ronald Peers Co.)
War, W. G.  Hydraulics in Mechanical Handling (Trade & Technical Press Ltd)
—  Hydraulic Handling (Trade & Technical Press Ltd)
—  Principles of Hydraulics (Trade & Technical Press Ltd)

544405  ME415 Design of Crane and Hoist Equipment

Prerequisites  *CE303, ME213, ME232
Hours  42
Examination  Progressive assessment

Content
The designs of the mechanical components for various types of cranes, hoists and associated equipment with special reference to The Australian Standard Crane and Hoist Code, and N.S.W. Department of Labour and Industry requirements. Mechanical Hydraulic and Pneumatic systems. Hydraulic Circuits and Control aspects. Safety and test requirements.

Texts  Nil

References
Broughton, H. H.  Electric Cranes (Spon)
—  S.A.A. CB2 Crane and Hoist Code

544406  ME416 Design of Pressure Vessels, High Pressure Pipelines, Plates and Shells

Prerequisites  *ME313, ME342/3
Hours  42
Examination  Progressive assessment
Content


Texts

Nil

References

Harvey, J. F.  Pressure Vessel Design (Van Nostrand)
Littleton, C. T.  Industrial Piping (McGraw-Hill)
Marton, W. L.  Handbook of Industrial Pipework (Pitman & Sons)
Timoshenko, S.  Theory of Plates and Shells (McGraw-Hill)
—  Flanges and Bolting for Pipes, Valves and Shells A.S.B. 52-1971
—  S.A.A. Boiler Code AS 1200—1972 Standards Assn of Australia
—  Unfired Pressure Vessels AS 1210—1972 Standards Assn of Australia
—  Water Tube Boilers AS 1228—1972 Standards Assn of Australia
—  S.A.A. Pressure Piping Code CB 18 Standards Assn of Australia

544407 ME417 Design of Worm and Special Purpose Gear Reduction Units

Prerequisites  ME213, ME232

Hours  42

Examination  Progresive assessment

Content

The design of gear reduction units for industrial requirements with special reference to Australian Standard Code and N.S.W. Department of Labour and Industry requirements. Special reference to vehicle transmission and coupling systems.

Texts  Nil

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References
Buckingham, E. & Ryffel, H. H.  
Design of Worm and Spiral Gears (The Industrial Press Machinery Publishing Co.)

Houghton, P. S.  
Gears Spur, Helical Bevel and Worm (The Technical Press Ltd)

—  
Machine Cut Gears — Helical and Straight Spur A.S.B. 61 — 1941

—  
Bevel gears (Machine cut) A.S.B. 62 — 1965

—  
Worm Gearing A.S.B. 66 — 1969

544408  ME418 Design of Thermal Unit Components

Prerequisites  ME313, ME372

Hours  42

Examination  Progressive assessment

Content


Text

References

Lorenzi, D.  Combustion Engineering (Combustion Engineering & Superheater Inc.)


—  Steam — its generation and uses The Babcock & Wilcox Co.

—  S.A.A. Boiler Code AS 1200 — 1972 Standards Assn of Australia

—  S.A.A. Pressure Piping Code CB 18 Standards Assn of Australia
544409 ME419 Design of Conveyors and Materials Handling Equipment

Prerequisites  *ME313, ME232
Hours  42
Examination  Progressive assessment

Content
Types of conveyors and materials handling equipment. The design of their mechanical components with special reference to belt, link, screw, vibrating and overhead type conveyors. A review of operational requirements. Loading and unloading devices. Hydraulic power circuits and control aspects. Brief discussion of pneumatic and hydraulic conveying systems.

Texts  Nil

References
Atherton, W. H.  *Conveying Machinery* (Technical Press Ltd)
Pneumatic Handling of Powdered Materials
The Engineers' Equipment Association (Constable)

Hudson, E. G.  *Conveyors* (John Wiley—Chapman & Hall)

Rudenko, N.  *Materials Handling Equipment* (Peace Publishers, Moscow)

Spivakovsky & Dyackov  *Conveyors and Related Equipment* (Peace Publishers, Moscow)

Stocker, H. E.  *Materials Handling* (Prentice-Hall)

S.A.A. Crane and Hoist Code C.B. 2

A.S.B. 3/6/238/255 *Conveyor and Elevator Belting*

544419 ME434 Advanced Kinematics and Dynamics of Machines

Prerequisite  ME333
Hours  42
Examination  Progressive assessment
Content
Dynamic Motion Analysis; energy distribution method, equivalent mass-and-force method, the rate-of-exchange-of-energy method.
Advanced Kinematics of the Plane Motion; the inflection circle, Euler-Savary equation, Bobillier's construction, Hartmann's construction.
Introduction to synthesis; graphical and analytical methods.

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

References
Hall, A. S. *Kinematics and Linkage Design* (Prentice-Hall 1960)
Holowenko, A. R. *Dynamics of Machines* (Wiley)

544401 ME444 Properties of Materials

Prerequisite ME342

Hours 42

Examination Progressive assessment

Content
Dislocation mechanics and fracture mechanics.
Use of composite materials.
Development of filament and whisker reinforcement techniques.
Influence of residual stresses in design. Dynamics, thermal, electrical, magnetic and radiation effects.

Texts Nil

References
Broutman & Krock *Modern Composite Materials* (Addison-Wesley)
Holister, G. S. & Thomas, C. *Fibre Reinforced Materials* (Elsevier)
McClintock & Argon *Mechanical Behaviour of Materials* (Addison-Wesley)
Richards *Engineering Materials Science* (Wadsworth)
544402 ME445 Mechanics of Solids

Prerequisite ME343

Hours 42

Examination Progressive assessment

Content
An introduction to the theory of plates and shells with extensions to thick pressure vessels and creep effects. Application of numerical (approximate) methods.

Texts Nil

References
Timoshenko & Wainowsky-Krieger Theory of Plates and Shells (McGraw-Hill)
Zienkiewcz & Holister Stress Analysis (Wiley)

544414 ME446 Introduction to Plastic Analysis

Prerequisites ME342/3

Hours 42

Examination Progressive assessment

Content
(i) No elastic-plastic interface;
(ii) An elastic-plastic interface.


Texts Nil

References
Ford, H. Advanced Mechanics of Materials 1st edn (Longmans 1963)
Hill, R. Plasticity (Oxford 1950)
Prager, W. Introduction to Plasticity (Addison-Wesley 1959)
544415  ME447 An Introduction to Experimental Analysis

Prerequisites  ME342/3

Hours  42

Examination  Progressive assessment

Content

The subject presents a systematic approach to the analysis and design of experiments and the interpretation of experimental results. Particular emphasis is placed on data processing and analysis. Selected experiments involving both physical and computer solutions will be undertaken.

Text


References

Cook, N. H. & Rubinowicz  Physical Measurements and Analysis (Addison-Wesley 1963)
Dally, J. W. & Riley, W. F.  Experimental Stress Analysis (International Student edn, McGraw-Hill 1965)
Neville, A. M. & Kennedy, J. B.  Basic Statistical Methods for Engineers and Scientists (International Textbook Co. 1964)

544416  ME448 An Introduction to Photomechanics

Prerequisites  ME342/3

Hours  42

Examination  Progressive assessment

Content


Texts  Nil
References

Dally, J. W. & Riley, W. F. "Experimental Stress Analysis" (McGraw-Hill 1965)

Durelli, A. J. & Riley, W. F. "Introduction to Photomechanics" (Prentice-Hall 1965)

Frocht, M. M. "Photoelasticity" Vol. 1 1st edn, Vol. 2 1st edn (Wiley)

544418 ME449 Reliability Analysis for Mechanical Systems

Prerequisites
ME313, Mathematics IIB

Hours
42

Examination
Progressive assessment

Content


Reliability Case Studies. Automobile suspension ignition systems. Measuring system.

Text

References

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


544411 ME453 Fluid Mechanics

Prerequisite
*ME352

Hours
42

Examination
Progressive assessment
Lectures and laboratory work dealing with a selection from the following topics:—

Application of hydrodynamics
Hydraulic transients
Fractional analysis applications
Cavitation studies
Topics in turbomachinery
One-dimensional compressible flow.

References
Brown, J. H. *Hydro-electric Engineering Practice Vol. 2* (Blackie)
Vallentine, H. R. *Applied Hydrodynamics* (Butterworths)

**544461 ME454 Turbomachinery**

Prerequisite *ME352*

Hours 42

Examination Progressive assessment

Content


References

Horlock *Axial Flow Turbines, Fluid Mechanics and Thermodynamics* (Bullivants)
Kovats, A. & Desmur, G. *Pumps, Fans and Compressors* (Blackie)
544412 ME473 Thermodynamics

**Prerequisite** ME271

**Hours** 42

**Examination** Progressive assessment

**Content**

Thermodynamic relations; the Maxwell relations; general equations for enthalpy, internal energy and entropy, compressibility factor, equations of state, generalised charts for enthalpy and entropy. Irreversibility and availability: reversible work and irreversibilities, availability concepts and applications.

Mixtures: of ideal gases, gas and vapour mixtures. Refrigeration and air conditioning; simple and multi-stage vapour-compression cycles, calculation of refrigeration and air conditioning loads, physical aspects of equipment.

**Texts** Nil

**References**


Jennings, B. H. & Lewis, S. R. *Air Conditioning and Refrigeration* (International Text Book)

Threlkelo, J. L. *Thermal Environmental Engineering* (Prentice-Hall)


— *Guide and Data Book ASHRAE*

544413 ME474 Heat Transfer

**Prerequisite** ME372

**Hours** 42

**Examination** Progressive assessment

**Content**

Development of the general form of the continuity, momentum and energy equations. Application and solution for various physical situations. Turbulent flow heat transfer. Some advanced conduction and radiation heat transfer studies.
544423 ME476 Development in the Use of Solar Energy

Prerequisites ME271, ME372

Examination Progressive assessment

Content
The flat-plate and concentrating solar energy collectors.
Solar engines, refrigeration and air-conditioning.
Solar stills, water heaters and furnaces.
Solar batteries. Solar architecture.
Solar energy and photosynthesis.

Texts Nil

References
Threlkeld, J. L. Thermal Environmental Engineering (Prentice-Hall 1970)
— Journal of the Solar Energy Society

544101 ME481 Engineering Administration

Prerequisite Mathematics I

Hours 42

Examination One 2-hour paper
Content

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

References
Bethel, L. L. et al  
Industrial Organization and Management (McGraw-Hill)
Bynt, W. J.  
People and Organization (McGraw-Hill)
Dale, E.  
Management Theory and Practice (McGraw-Hill)
Haynes, W. W. & Massie, J. L.  
Management Analysis, Concepts and Cases (Prentice-Hall)

544102 ME482 Engineering Economics

Prerequisite  Mathematics I

Hours  42

Examination  One 3-hour paper

Content
The time value of money, economic criteria for engineering decision making, purchase and replacement economics, cost/benefit analysis. Critical evaluation of cost data for decision making.
Introduction to demand, supply, price and the policy of the firm in various market situations.
Introduction to decision making theory, Bayesian statistics and operations research.

Text
Riggs, J. L.  
Economic Decision Models (McGraw-Hill)
Or
Smith, G. W.  
Engineering Economy: Analysis of Capital Expenditures (Iowa State University Press)
References
Baker, K. R.  
Introduction to Sequencing and Scheduling  
(Wiley)
Bowman, E. H. & Fetter, R. B.  
Analysis for Production & Operations Management  
(Irwin)
Box, G. E. & Jenkins, G. M.  
Time, Series Analysis, Forecasting and Control  
(Holden Day)
Braddock, G. R. & Archbold, D. A.  
The Elements of Economic Analysis  
(McGraw-Hill)
Buffa, E. S.  
Production — Inventory Systems  
(Irwin)
DeGarmo, E. P. & Canada, J. R.  
Engineering Economy  
(Collier-Macmillan)
Forrester, J.  
Industrial Dynamics  
(MLT)
Theusen, H. G., Fabrycky, W. J. & Theusen, G. J.  
Engineering Economy  
(Prentice-Hall)

544463 ME483 Production Engineering

Prerequisites  
Mathematics I, ME122, ME223
Hours  
42
Examination  
Progressive assessment

Content
Production planning, Inventory functions, Forecasting; Scheduling and control of production. Design of a production control system. Quality and quantity control. Production inventory systems.

Text
Riggs, J. L.  
Production Systems  
(Wiley)

References
Alford, L. P. & Bangs, J. R.  
Production Handbook  
(Ronald)
Brown, R. G.  
Management Decision for Production Operations  
(Holt, Rinehart & Winston)
Buffa, E. S.  
Modern Production Management  
(Wiley)
Magee, J. & Boodman, D. H.  
Production Planning and Inventory Control  
(E.U.P.)
Martin, F. F.  
Computer Modelling & Simulation  
(Wiley)
Maynard, H. B. (ed)  
Industrial Engineering Handbook  
(McGraw-Hill)

198
544431  ME485 Tool Design

Prerequisite  ME384
Hours  42
Examination  Progressive assessment

Content
The design of tools, jigs and fixtures for various material forming and machining processes. The relative economics of jigs, fixtures and special tooling.

Texts  Nil

References
Colvin, R. H. & Hass, I. L.  Jigs and Fixtures (McGraw-Hill)
Fundamentals of Tool Design Amer. Soc. of Tool & Mfg. Engs. (Prentice-Hall)

544432  ME486 Industrial Design

Prerequisite  ME313
Hours  42
Examination  Progressive assessment

Content
The creative process and the factors influencing it — detailed study of the problems associated with product design. The integration of analysis, synthesis and evaluation of product design. Studio assignment associated with the design.

Texts  Nil

References
Baldwin, E. N. & Niebel, B. W.  Designing for Production (Irwin)
Edel, D. H. (ed)  Introduction to Creative Design (Prentice-Hall)
Mayle, W. R.  Machines and Perception in Industrial Design (Studio Vista)
Pye, D.  The Nature of Design (Studio Vista)
Read, H.  Art and Industry (Faber & Feba)
Schanfer, H.  The Roots of Modern Design (Studio Vista)
Van Doren, H.  Industrial Design (McGraw-Hill)
544841  ME487 Operations Research — Deterministic Models

Prerequisite  Mathematics IIB
Hours  42
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 Operations 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)

544842  ME488 Operations Research — Probabilistic Models

Prerequisite  Mathematics IIB
Hours  42
Examination  Progressive assessment

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

Text
Saaty, T. L.  Elements of Queueing Theory (Prentice-Hall)
References
Brown, R. G.  
Hadley, G. & Whitin, T. M.  
Taha, H. A.

Smoothing, Forecasting and Prediction of Time Series (Prentice-Hall)
Management Decision Making under Uncertainty (Macmillan)
Analysis for Inventory Systems (Prentice-Hall)
Operations Research (Macmillan)

544843 ME489 Operations Research — Applications in Industry

Prerequisite  Mathematics IIB
Hours  42
Examination  Progressive assessment

Content
The case study approach to industrial cases. The application of operations research to industrial problems.

Texts  Nil

References
Dooley, A. R. et al  
Duckworth, E.  
Eilon, S., Hall, R. I. & King, J. R.  
McKenny, J. L. & Rosenbloom, R. S.

Casebooks in Production Management (Wiley 1968)
A Guide to Operation Research (Methuen 1965)
Exercises in Industrial Management (Macmillan 1966)
Cases in Operations Management

Rivett, B.H.P., & Ackoff, R. L.
Schnelle, K. E.

A Manager's Guide to Operational Research (Wiley 1963)
Case Analysis and Business Problem Solving (McGraw-Hill 1967)

544103 ME491 Technical Seminar

Hours  42
Examination  Progressive assessment
544203 ME496 Project/Seminar

Hours 126
Examination Progressive assessment

542501 NA201 Theoretical Naval Architecture

Prerequisites *Mathematics I, ME111/2, ME131, CE111
Hours 42
Examination One 3-hour paper
Content
Hydrostatics, trim and stability, dynamic stability, free surface effects, inclining experiment, launching calculations, use of computers, loading and discharging.

Texts Nil
Reference Robb, A. M. Theory of Naval Architecture (Charles Griffin & Co.)

542502 NA221 Naval Architecture Technology

Prerequisites *Mathematics I, ME111/2, CE111
Hours 42
Examination One 3-hour paper
Content
Ships’ construction and production methods, framing systems, lofting.
Texts Nil
Reference Walton & Baxter Know Your Own Ship (Charles Griffin & Co.)

542503 NA241 Applied Naval Architecture

Prerequisites ME111/2
Hours 84
Examination Progressive assessment
Content
Drawing exercises, lines plan, structural drawing, hydrostatic calculations.

543602 NA311 Ship Design and Construction

Prerequisites NA201, NA221, NA241
Hours 42
Examination One 3-hour paper

Content
Design criteria, tonnage, safety requirements, hull form, general arrangements, propulsion machinery, auxiliary machinery, ships' services. Structural analysis, structural design to the requirements of a classification society.

Texts
Harrington, R. L. (ed) *Marine Engineering* (The Society of Naval Architects)
— *Rules and Regulations for the Construction and Classification of Steel Ships* (Lloyds Register of Shipping)

References
Muckle, W. *Strength of Ships' Structures* (Edward Arnold)
— *Principles of Naval Architecture* (The Society of Naval Architects & Marine Engineers)

543603 NA342 Applied Naval Architecture

Prerequisites ME251, NA201, NA221, NA241
Hours 84
Examination Progressive assessment

Content
Design and drawing practice relating to ship design and construction and resistance and propulsion of ships.

Texts Nil

Reference
— *Principles of Naval Architecture* (The Society of Naval Architects & Marine Engineers)
543601 NA351 Resistance and Propulsion of Ships

Prerequisites  ME251, NA201, NA221, NA241
Hours  42
Examination  One 3-hour paper

Content

References
Robb, A. M.  Theory of Naval Architecture (Charles Griffin & Co.)
Taylor, D. W.  The Speed and Power of Ships (U.S. Maritime Administration, Washing, D.C.)

544602 NA402 Special Purpose Ships

Prerequisites  NA311, NA351
Hours  42
Examination  One 3-hour paper

Content
Ships for special cargoes, dredges, tugs, submersibles, offshore structures, supply tenders etc. Design criteria.

Text
Brahtz, J. F. (ed)  Ocean Engineering (John Wiley)

544604 NA341 Ship's Machinery

Prerequisites  NA311, NA351
Hours  42
Examination  One 3-hour paper

Content
Propulsion machinery, auxilliary machinery, deck machinery, rigging, navigational aids.
Text
Harrington, R. L. (ed.) *Marine Engineering* (The Society of Naval Architects)

544601  NA452 Theoretical Naval Architecture

**Prerequisites**
NA311, NA351

**Hours**
42

**Examination**
One 3-hour paper

**Content**
Wave theory, ships dynamics, stabilisers. Sea-going qualities, dynamic positioning.

**Texts**
Nil

**References**
Robb, A. M. *Theory of Naval Architecture* (Charles Griffin & Co.)
— *Principles of Naval Architecture* (The Society of Naval Architects & Marine Engineers)

544801  NA481 Shipyards Production and Management

**Prerequisites**
Nil

**Hours**
42

**Examination**
One 3-hour paper

**Content**
Pre-fabrication techniques, standardisation, yard lay-out, production planning, contract law, launching arrangements.

544504  NA496 Project/Seminar

**Hours**
126

**Examination**
Progressive assessment
ME092 to ME096 Industrial Experience Units

Examination

Progressive assessment

Content

These subject units are designed to formalise the periods of Industrial Experience which may be studied in lieu of elective units by part-time students. Each of the Industrial Experience units is equivalent to one elective unit of 42 hours. Students who wish to study any or all of the Industrial Experience units ME092-096 in lieu of elective units will be required to attend some 10 lecture and tutorial periods which will deal with working and professional environments, essentials of communication and report writing. In addition, each student will be required to present a seminar relating to aspects of his experience and to report to his industrial experience tutor twice per term. Some assignments relating to employment and experience will be set. Students will also be required to present a report giving a connected account and critical evaluation of his engineering activities and experience during the year. Such units may be used by part-time students in lieu of the elective requirements of Clauses 2 and 3, page 21, or vice-versa.
504101 GE471 Energy*

Prerequisites  Physics IA or IB, Mathematics IIB  

Hours  3 hours per week  

Examinations  Progressive assessment  

Content  
History, distribution and forecasts of energy usage.  
Overview of problems in energy management.  
Basics of energy transformations and the applicability of the laws of thermodynamics in energy conversion.  
Energy release from fundamental processes. Energy units and their use related to nuclear, solar, chemical, thermal, electrical and mechanical forms of energy.  
Environmental aspects of energy usage and control of thermal, audio, gas and other forms of pollution.  

Texts  To be advised  

504102 GE472 Energy**

Prerequisites  Physics IA or IB, Mathematics IIB  

Hours  3 hours per week  

Examinations  Progressive assessment  

Content  
Energy conversion technology:—  
Conversion efficiencies and technical and economic constraints.  
Current technology—steam plants, combustion engines and turbines, nuclear reactors, hydro-electric plants etc.  
Possible future technology—solar power, m h d, fusion, fuel cells, the hydrogen economy, total energy etc.  
Energy management:—  
Planning of systems, increase in efficiency of usage, choice of energy sources and energy conservation.  

Texts  To be advised  

*First half year  
**Second half year
DEPARTMENT OF METALLURGY

Two degrees at Bachelor level in Metallurgy are available in the Faculty of Engineering.

The B.Sc. (Met.) is a three year course for candidates with an approved level of industrial experience. This industrial experience may be attained concurrently with the course which then usually takes six years.

The B.Met. is a four year course which may be awarded with honours. Candidates for the B.Met. degree are required to complete a minimum of four months approved industrial experience before completion of their course.

Facilities exist for studies and/or research leading to the degrees of M.Eng.Sc., M.Sc., M.E. and PhD.

SCHEDULE 2.1

BACHELOR OF METALLURGY
AND
BACHELOR OF SCIENCE (METALLURGY)

<table>
<thead>
<tr>
<th>Subject</th>
<th>Year I</th>
<th>Units</th>
</tr>
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<tbody>
<tr>
<td>Mathematics I</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Physics IA</td>
<td>4</td>
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</tr>
<tr>
<td>ME121 Workshop Practice</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ChE101 Industrial Process Principles</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Met141 Mechanical Properties of Materials</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Met151 Microstructure of Materials</td>
<td>1</td>
<td></td>
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<tr>
<td>Met181 Atomic Structure of Materials</td>
<td>1</td>
<td></td>
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<tr>
<td>Met182 Electronic Structure of Materials</td>
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<tr>
<td>Met121 Chemical Stability of Materials</td>
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<td>and two of</td>
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<tr>
<td>ME131 Dynamics</td>
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<tr>
<td>ME111 Graphics</td>
<td>2</td>
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<tr>
<td>ME112 Engineering Drawing &amp; Elementary Design</td>
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**Subject**

**Year II**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
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<tbody>
<tr>
<td>Met211 Metallurgical Computations (Maths Topics A, C, F &amp; G)</td>
<td>4</td>
</tr>
<tr>
<td>Met221 Metallurgical Thermodynamics</td>
<td>1</td>
</tr>
<tr>
<td>Met212 Metallurgical Stoichiometry</td>
<td>1</td>
</tr>
<tr>
<td>Met213 Applied Statistics</td>
<td>1</td>
</tr>
<tr>
<td>Met231 Rate Processes</td>
<td>1</td>
</tr>
<tr>
<td>*Met252 Metallography</td>
<td>1</td>
</tr>
<tr>
<td>**Met241 Microplasticity</td>
<td>1</td>
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<tr>
<td>*Met261 Extraction Metallurgy</td>
<td>1</td>
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<tr>
<td>**Met271 Fabrication Metallurgy</td>
<td>1</td>
</tr>
<tr>
<td>1Elective I</td>
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</table>

**Year III**

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<tr>
<th>Subject</th>
<th>Units</th>
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<tr>
<td>**Met301 Communication Skills</td>
<td>4</td>
</tr>
<tr>
<td>Met361 Pyro-Extraction Metallurgy</td>
<td>1</td>
</tr>
<tr>
<td>*ChE331 Process Economics</td>
<td>4</td>
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<tr>
<td>3six of Met300 subjects</td>
<td>6</td>
</tr>
<tr>
<td>1Elective II</td>
<td>6</td>
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<tr>
<td>Met391 Physical Metallurgy Laboratory</td>
<td>2</td>
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<tr>
<td>Or</td>
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<tr>
<td>Met392 Chemical Metallurgy Laboratory</td>
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</table>

**Year IV**

<table>
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<tr>
<th>Subject</th>
<th>Units</th>
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<tbody>
<tr>
<td>Met401 Metallurgy Project</td>
<td>8</td>
</tr>
<tr>
<td>Met402 Metallurgy III</td>
<td>8</td>
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</tbody>
</table>

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**B.Sc.(Met.)**

To qualify for admission to the Bachelor of Science (Metallurgy) the candidate must satisfy the requirements for the first three years of the course and the industrial experience requirements prescribed by the Faculty Board (see page 30).

**B.Met.**

To qualify for admission to the Bachelor of Metallurgy the candidate must satisfy all the requirements of Schedule 2.1 and the industrial experience requirements prescribed by the Faculty Board.

* First half year
** Second half year

1 See Elective Requirements—Appendix A.
2 See description of subjects on page 230.
3 The optional Met300 subjects to be offered subject to sufficient enrolment and staff availability are:

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Subject | Units
---|---
Met311 | Applied Statistics 1
Met312 | Optimisation & Control 1
Met321 | Metallurgical Thermodynamics 1
Met322 | Electrochemistry & Corrosion 1
Met331 | Transport Processes in Metallurgical Systems 1
Met332 | Fluid Mechanics of Metallurgical Processes 1
*Met341 | Fracture & Failure Analysis 1
Met351 | Metallography 1
Met352 | Physical Metallurgy 1
Met353 | Solidification Processes 1
Met354 | X-ray & Electron Metallography 1
Met362 | Hydro- & Electro-Extraction Metallurgy 1
Met363 | Metallurgical Reactor Analysis 1
Met364 | Refractories 1
*Met371 | Materials Selection 1
Met372 | Fabrication Processes 1
Met373 | Polymer Technology 1
*Met374 | Welding & Non-Destructive Testing 1
Met381 | Metal Physics 1

* First half year

BACHELOR OF MATHEMATICS/
BACHELOR OF METALLURGY

The details of the combined course in Mathematics and Metallurgy follow simply from the requirements for each degree. The combined degree should contain Mathematics I, Mathematics IIA, Mathematics IIC, Mathematics IIIA, Mathematics IIIB or a Part III subject from Schedule B of the Schedule of Subjects approved for the degree of Bachelor of Mathematics, and all the subjects satisfying the Requirements for the degree of Bachelor of Metallurgy, except that

(a) Mathematics I shall be replaced by Chemistry I or Geology I or any other subject approved by the Deans;

(b) Metallurgical Computations shall be replaced by Mathematics IIB, which may be taken in two parts, each of three terms duration;

(c) No Mathematics subjects may be taken as electives.

The course could be pursued in the following manner:

**Year I**
Mathematics I, Physics IA, ME121, ChE101, Met141, Met151, Met 181, Met 182, Met 121, and two of ME131, ME111 and ME112

**Year II**
Mathematics IIA, Mathematics IIB Part I, Met221, Met212, Met213, Met231, Met252, Met241, Met261, Met271 and one of Chemistry I, Geology I or any other subject approved by the Deans

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Year III  Mathematics IIC, Mathematics IIB Part II, Met301, Met361, ChE331, six of Met300 subjects, Elective I and two units of Elective II

Year IV  Mathematics IIIA and either Mathematics IIIB, or a Schedule B Part III subject from the Requirements for the degree of Bachelor of Mathematics and four units of Elective II

Year V  Met401, Met402 and two units of Elective II

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

2 No Mathematics subject may be taken as an elective.

ELECTIVE I

The four elective units in the second year programme must be chosen from:

- Physics II (4)
- Maths II Topics (1 each)
- Electronics & Instrumentation (4)

EE203  Introduction to Electrical Information (1)
ME251  Fluid Mechanics (1)  or
CE231  Fluid Mechanics (1)  or
ChE211  Fluid Statics and Dynamics
ME372  Heat Transfer (1)  or
ChE212  Heat Transfer (1)  or
ME223  Mechanical Technology (1)
ME131  Dynamics (1)
ME111/112 Graphics/Engineering Drawing & Elementary Design (2)
CE111  Statics (1)
CE221  Properties of Materials (1)  or
ME241  Properties of Materials (1)  or
ME202  Dynamics of Engineering Systems (1)

or other appropriate subjects approved by the Head of Department.

ELECTIVE II

The six elective units in the third year programme may be selected from:

(a) Any third or fourth year subjects offered by other Engineering Departments or the Faculty of Mathematics or the Faculty of Science subject to the approval of Head of Department.

(b) Up to two units selected from the list of second year electives not already taken.

(c) Any other appropriate subject approved by the Head of Department.
DESCRIPTION OF SUBJECT ENTRIES

**Indicating Numerals**  
**Field of Study**

Met-0- General  
Met-1- Computations  
Met-2- Physical Chemistry  
Met-3- Transport  
Met-4- Mechanical  
Met-5- Physical Metallurgy & Metallography  
Met-6- Extraction  
Met-7- Fabrication & Materials  
Met-8- Structure & Metal Physics  
Met-9- Laboratory

**111121 Met121 Chemical Stability of Materials**  
*1 unit*

**Prerequisites**  
Nil

**Hours**  
About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

**Examination**  
1½ hour paper

**Content**

Introduction to chemical thermodynamics and the rates of homogeneous and heterogeneous chemical reactions. Extension to electrochemical and photochemical reactions, thermodynamics and kinetics of chemical change illustrated by reference to the environmental degradation of materials. Wet and dry corrosion of metals. Chemical attack on refractories, ceramics and cement. Photochemical breakdown of polymers, Stress corrosion of metals and plastics. Internal chemical breakdown of materials.

**Text**  
To be advised

**References**

Guy, A. G.  
*Introduction to Materials Science*

**111141 Met141 Mechanical Behaviour of Materials**  
*1 unit*

**Prerequisites**  
Nil

**Hours**  
About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

**Examination**  
1½ hour paper

212
Content


Text


References

Dieter, G. Mechanical Metallurgy
Polacowski & Ripling Strength and Structure of Engineering Materials
Wyatt, O. H. & Dew-Hughes Metals, Ceramics and Polymers

111151 Met151 Microstructure of Materials 1 unit

Prerequisites Nil

Hours About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination 1½ hour paper

Content

The generation of microstructure and its relationship with material properties. States of matter, bonding in solids, crystal structure, phases, surfaces, grain boundaries and interfaces, atom movement. Phase rule and microstructures in binary systems for equilibrium conditions and for near equilibrium transformations including: isomorphous, eutectic, peritectic and eutectoid types, the lever rule. Microstructures of ceramics and polymers. Technically important systems including iron-carbon, copper-zinc, aluminium-silicon, aluminium-copper. Modification of eutectics, normalizing and annealing. Non-equilibrium microstructures, quenching, Martensite and bainite, TTT diagrams. Age hardening and tempering.

Texts

References
Rhines, F. N. Phase diagrams in Metallurgy
Rollason, E. C. Metallurgy for Engineers
Van Vlack, L. H. Elements of Materials Science
Wyatt, O. H. & Metals, Ceramics and Polymers
Dew-Hughes, D.

111181 Met181 Atomic Structure of Materials 1 unit

Prerequisites Nil

Hours About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination 1½ hour paper

Content

Text

References
Cracknell, A. P. Crystals and their Structures
Van Vlack, L. H. Elements of Materials Science

111182 Met182 Electronic Structure of Materials 1 unit

Prerequisites Nil

Hours About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination 1½ hour paper
Content
Atomic bonding and electron mobility. Electrons in a potential box, free electron model of a metal, effects of the lattice, alkali, noble and transition metals, insulators and semi conductors.
Specific heat and thermal conductivity of electrons and lattices. Thermal and Electronic properties of metals, insulators and semi conductors.
Magnetic properties of metals and insulators.
Optical properties of metals, insulators and semi conductors.

Text

References
To be advised

112212 Met212 Metallurgical Stoichiometry 1 unit

Prerequisites
Nil

Hours
About 21 hours of lectures and about 21 hours of tutorials

Examination
1½ hour paper

Content
The stoichiometry of metallurgical processes. Algebraic stoichiometry after Aris.
Mass and Energy balances in industrial metallurgical processes and plants.
Interactive computing techniques for industrial stoichiometry. Stoichiometric models for graphical and computer manipulation.

Text
To be advised

References

112213 Met213 Applied Statistics 1 unit

Prerequisites
Nil

Hours
About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination
1½ hour paper
Content

Text
Davis, F. A. & Mansfield, M. W.

References
To be advised

112221 Met221 Metallurgical Thermodynamics 1 unit

Prerequisite
Met121

Hours
About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination
1½ hour paper

Content

Text
Oates, W. A. Introduction to Chemical Thermodynamics for Metallurgy Students

Reference
Gaskell, D. Introduction to Metallurgical Thermodynamics

112231 Met231 Rate Processes 1 unit

Prerequisite
Met121

Hours
About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination
1½ hour paper
Content

Introduction to chemical kinetics and transport processes in gases, solids and liquids.

Text

To be advised

References

Burke, J. *Kinetics of Phase Transformations*
Churchill, S. W. *The Rate Concept*

**112241 Met241 Microplasticity**

*Prerequisites* Met141, Met151, Met181
*Hours* About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes
*Examination* 1½ hour paper

Content

Metallography of the plastic deformation of single crystals, slip, twinning and clearage, stress strain curves of metal crystals. Dislocation theory, cross slip, climb, dissociation into partials, sessile dislocations, jogs.
Theories of work hardening, deformation bands, kink bands, dislocation interactions with solutes and particles. Deformation and annealing of polycrystalline metals.

Text

Honeycombe, R. W. K. *The Plastic Deformation of Metals*

Reference

Tegart, W. J. McG. *Elements of mechanical metallurgy*

**112252 Met252 Metallography**

*Prerequisites* Met121, Met151, Met181
*Hours* About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes
*Examination* 1½ hour paper

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Content

Text
Reed-Hill, R.  
or  
Azaroff, L. V.  
Cullity, B. D.

References
Cottrell, A. H.  
Gifkins, R. C.  
de Hoff & Rhines  
Kehl, G. H.  
Samuels, L. H.  
Taylor, A.

112261 Met261 Extraction Metallurgy  

Prerequisites  
Nil

Hours  
About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination  
1½ hour paper

Content

Text
Rosenqvist, T.  

Reference
Pehlke, R. D.
112271 Met271 Fabrication Metallurgy 1 unit

Prerequisites Met141, Met 151, Met181
Hours About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes
Examination 1½ hour paper

Content
An introduction to and a study of the common metal-working techniques. Rolling, forging, deep drawing, wire and tube drawing, casting, extrusion and powder metallurgy.

Text
Dieter, G. E. Mechanical Metallurgy
Reference Flinn, R. A. Fundamentals of Metal Casting

113301 Met301 Communication Skills ½ unit

Prerequisites Nil
Hours About 21 hours of lectures and student seminar
Examination 1½ hour paper

Content
Preparation of written and oral reports.

Text
Mitchell, J. How to write reports
Reference To be advised

113311 Met311 Applied Statistics 1 unit

Prerequisite Met213
Hours About 21 hours of lectures and about 21 hours of tutorial classes
Examination 1½ hour paper
Content

Text
To be advised

References

113312 Met312 Optimization and Control

Prerequisites
Met212, Met213

Hours
About 26 hours of lectures and about 16 hours tutorial classes

Examination
1½ hour paper

Content
Modelling: Construction of models, distributed and lumped parameter systems, spline functions, use of models in prediction, identification and simulation, validity of models.
Optimization: Method formulation, single variable techniques, multivariable techniques, linear and non linear least squares, constrained problems, confidence regions.
Control: Computer control systems, system components, advantages and justification of computer systems.

Texts
To be advised

Reference

113321 Met321 Metallurgical Thermodynamics

Hours
About 21 hours of lectures and about 21 hours of tutorial classes

Examination
1½ hour paper

Content
### 113322 Met322 Electrochemistry and Corrosion

**1 unit**

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<td>About 21 hours of lectures and about 21 hours of tutorial demonstration and practical classes</td>
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<tr>
<td><strong>Examination</strong></td>
<td>1½ hour paper</td>
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<tr>
<td><strong>Text References</strong></td>
<td>To be advised</td>
</tr>
<tr>
<td><strong>References</strong></td>
<td>Denaro, A. R. <em>Elementary Electrochemistry</em> (Butterworth 1965)</td>
</tr>
<tr>
<td></td>
<td>Fontana, M. G. &amp; Greene, N. D. <em>Corrosion Engineering</em> (McGraw Hill 1967)</td>
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<tr>
<td></td>
<td>Uhlig, H. H. <em>Corrosion and Corrosion Control</em> 2nd edn (Wiley 1971)</td>
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<tr>
<td></td>
<td>West, J. M. <em>Electrodeposition and Corrosion Processes</em> 2nd edn (Van Nostrand 1971)</td>
</tr>
</tbody>
</table>

### 113331 Met331 Transport Processes in Metallurgical Systems

**1 unit**

| **Prerequisites** | Nil |
| **Hours**         | About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes |
| **Examination**   | 1½ hour paper |
113322 Met322 Electrochemistry and Corrosion 1 unit

Prerequisite

Met221

Hours

About 21 hours of lectures and about 21 hours of tutorial demonstration and practical classes

Examination

1½ hour paper

Content


Text

To be advised

References

Denaro, A. R.  Elementary Electrochemistry (Butterworth 1965)
Fontana, M. G. & Greene, N. D.  Corrosion Engineering (McGraw Hill 1967)
West, J. M.  Electrodeposition and Corrosion Processes 2nd edn (Van Nostrand 1971)

113331 Met331 Transport Processes in Metallurgical Systems 1 unit

Prerequisites

Nil

Hours

About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination

1½ hour paper
Content
Viscosity and viscous flow with liquid metals and slags. Heat transfer with phase change.
Mass transfer in heterogeneous metallurgical systems. Simultaneous transfer processes, coupled transport phenomena. Single particle reaction systems.

Text
References

To be advised

113332 Met332 Fluid Mechanics of Metallurgical Processes 1 unit

Prerequisites Nil

Hours About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination 1½ hour paper

Content
Flow systems in pyro metallurgical processes.
Slag-metal flow.
Gas-metal flow in vacuum processes.
Melting packed bed flow.
Jet flow in metallurgical reactors.
Gas bubble flow in pyrometallurgy.
Flow in ingots and castings.
Flow at solidification interfaces.

Text
References

To be advised

113341 Met341 Fracture and Failure Analysis 1 unit

Prerequisite Met241

Hours About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination 1½ hour paper
The unique features of various modes of failure are described and explained from a metallurgical and metallographic viewpoint. The stress-strain situation at a stationary crack tip is explored and the Griffith's criterion developed.

Failure analysis and case histories.

Text
Nil

Reference
I.S.I. Publication
Fracture Toughness
No. 121 (1969)

113351 Met351 Metallography

Prerequisite
Met252

Hours
About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination
1½ hour paper

Content
A practically oriented course of modern metallographic methods. Theory of operation, application and quantitative treatment of data from modern metallographic equipment. Transmission electron microscopy; scanning electron microscopy, Field ion microscopy, Quantimet, classimat. Element and compound identification and analysis from X-ray spectroscopy, microprobe analysis and X-ray diffraction methods. Particle size and texture analysis.

Text
Smallman, R. E. & Ashbee, K. H. G.  
Azaroff, L. V.  
or  
Cullity, B. D.  

Modern Metallography
Elements of X-ray crystallography
Elements of X-ray diffraction

References
Andrews, K. W.  
Bell & Davies  
Brandon, D. G.  
Taylor, A.  
Thomas, G.  

Physical metallurgy. Techniques and application
Electron microscopy and microanalysis of metals
Modern techniques in metallography
X-ray metallography
Transmission electron microscopy of metals

223
113352 Met352 Physical Metallurgy

**Prerequisites**
Met241, Met252

**Hours**
About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

**Examination**
1½ hour paper

**Content**
Physical metallurgy of alloy steels, effect of alloying elements, hardenability of alloy steels. Tempering and temper brittleness.
Further topics in dislocation theory, yield point phenomena, fracture, age hardening, creep.

**Texts**
Bain, E. C. & Paxton, H. W. *Alloying Elements in Steel*
Honeycombe *Plastic Deformation of Metals*

**References**
Cottrell, A. H. *Dislocations and Plastic Flow in Crystal*
Smallman, R. E. *Modern Physical Metallurgy*
Wyatt & Dew-Hughes *Metals, Ceramics and Polymers*

113353 Met353 Solidification Processes

**Prerequisites**
Met151, Met181

**Hours**
About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

**Examination**
1½ hour paper

**Content**
The structure of liquid metals and the solid-liquid interface.
Effect of cast structures and inclusions on mechanical properties.

**Text**
Flemings, M. C. *Solidification Processing*

**References**
Chadwick, G. A. *Metallography of Phase Transformations*
Davies, G. J. *Solidification and Casting*
113354  Met354 X-ray and Electron Metallography  1 unit

Prerequisites  Met241, Met252

Hours  About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination  1½ hour paper

Content

Texts
Azadroff, L. V.  Elements of X-ray crystallography
Thomas, G.  Transmission electron microscopy in metals

References
Thomas & Washburn  Electron microscopy and the strength of crystals

113361  Met361 Pyro extraction Metallurgy

Prerequisite  Met261

Hours  About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination  1½ hour paper

Content
Review of current technology in the pyro metallurgy of ferrous and non ferrous processes.

Text  

References  To be advised
113362 Met362 Hydro- and Electro- Extraction Metallurgy 1 unit

Prerequisite Met261

Hours About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination 1½ hour paper

Content
Review of current technology in the hydro- and electro- metallurgy of ferrous and non-ferrous processes.

Text To be advised

References

113363 Met363 Metallurgical Reactor Analysis 1 unit

Prerequisite Met261

Hours About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination 1½ hour paper

Content
Mixing theory applied to batch and semi-continuous pyrometallurgical reactors.
Models of continuous steelmaking processes.
Computer simulation of pyrometallurgical processes.
Analysis of experimental residence time data.

Texts To be advised

References

113364 Met364 Refractories 1 unit

Prerequisite Met231

Hours About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes
Content
Techniques for the investigation and testing of refractories. Phase equilibria and rates of reaction in complex oxide systems. The clay-water system and alumino-silicate refractories. The structure, properties and industrial applications of silica, magnesite, dolomite, chrome, alumina and carbon refractories. Special refractories, including insulating materials.

Text
Nil

References
Grimshaw, R. W. The Chemistry and Physics of Clays 4th edn (Benn 1971)

113371 Met371 Materials Selection 1 unit

Prerequisites
Met241, Met252

Hours
About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination
1½ hour paper

Content
Discussion of the important properties of common commercial metals and polymers and the relation of these to their structures and microstructures. The application of criteria to aid in the selection of the correct material for a specific application.

Text
Rollason, E. C. Metallurgy for Engineers 4th edn

Reference
A.S.M. Metals Handbook Vol. 1 8th edn

113372 Met372 Fabrication Processes 1 unit

Prerequisite
Met271

Hours
About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination
1½ hour paper
Content
Detailed examination of selected metal working processes from a fundamental and from a practical viewpoint.

Texts
Nil

Reference
To be advised

113373 Met373 Polymer Technology

1 unit

Prerequisites
Met141, Met151

Hours
About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination
1½ hour paper

Content
A description and analysis of the techniques for the production and forming of commercially important polymers.

Texts
To be advised

Reference
To be advised

113374 Met374 Welding and Non Destructive Testing

1 unit

Prerequisites
Met141 and Met151 or Engineering I

Hours
About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination
1½ hour paper

Content
The basic principles and the techniques are introduced for the modern joining methods of: fusion welding brazing and soldering. The metallurgical changes which accompany these joining processes are discussed. However the main emphasis is on the arc welding of steels. Non destructive testing techniques and their applications are introduced.

Text
Lancaster, J. F.

The Metallurgy of welding, brazing and soldering

References
Jackson, M. D.
A.S.M.

Welding methods and metallurgy
Metals Handbook Vol. 6 8th edn

228
113381 Met381 Metal Physics  1 unit

Prerequisite  Met182

Hours  About 21 hours of electives and about 21 hours of tutorial, demonstration and practical classes

Examination  1½ hour paper

Content
The topic will be introduced by consideration of the Brillouin zone theory and the reciprocal space representation of lattice and electron waves.

The course will be completed by considering such topics as: Stability of metallic phases, electrical properties of materials, Magnetism, Magnetic properties of materials, Semiconductors.

Text  To be advised

References
Altmann  Bland Theory of Metals
Elliott, R. J. & Gibson, A. E.  An introduction to Solid State Physics and its Applications
Kittel  Introduction to Solid State Physics

113391 Met391 Physical Metallurgy Laboratory  4 units

Prerequisites  Nil

Hours  Part a- 3 hours per week, part b- 3 hours per week

Examination  3 hour paper for each part

Content
Part a and part b. The practices of optical, X-ray and electron metallography and the mechanical and physical testing of metals.

Texts  To be advised

References

113392 Met392 Chemical Metallurgy Laboratory  2 units

Prerequisites  Nil

Hours  3 hours per week

Examination  3 hour paper
Content
Experimental work in chemical and electrochemical equilibria and kinetics. Transport processes. Pyrometallurgical and hydrometallurgical experiments.

114402  Met402 Metallurgy III
Will consist of eight units selected from the following list. The subjects will be offered subject to sufficient enrolment and staff availability and not all subjects will be offered in any one year.

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<th>Subject</th>
<th>Unit</th>
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<td>Met404 Metallurgy Seminar</td>
<td>1</td>
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<tr>
<td>Met411 Metallurgy Project/Computations</td>
<td>1</td>
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<tr>
<td>Met421 Metallurgical Thermodynamics</td>
<td>1</td>
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<tr>
<td>Met431 Heat Transfer</td>
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<tr>
<td>Met432 Fluid Mechanics</td>
<td>1</td>
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<td>Met433 Metallurgical Rate Processes</td>
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<td>**Met441 Fracture Mechanics</td>
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<td>Met451 Electron Metallography</td>
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<tr>
<td>Met452 Physical Metallurgy</td>
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<td>Met453 Metallography</td>
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<td>Met461 Extraction Metallurgy</td>
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<tr>
<td>Met462 Reactor Analysis</td>
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<td>**Met471 Materials Selection</td>
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<td>**Met472 Welding &amp; Non-Destructive Testing</td>
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<td>Met481 Dislocation Theory</td>
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<td>Met482 Metal Physics</td>
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</table>

or any other subject approved by the Head of Department.

** Second half year

114403  Met403 Metallurgy Project/Directed Reading  
1 unit

Prerequisites  Nil

Hours  About 42 hours

Examination  By written report and seminar

Content
Topics to be arranged with members of staff at the beginning of the academic year.

Text  

References  
Nil

230
114421 Met421 Metallurgical Thermodynamics  1 unit

Prerequisite  Met321

Hours  About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination  1½ hour paper

Content  Introduction to statistical thermodynamics. Configurational models of alloys and slags. Vibrational, electronic and magnetic contributions to the partition function. Towards an understanding of phase equilibria.

Text  To be advised

References  
Richardson, F. D.  *The Physical Chemistry of Melts in Metallurgy*  Vols I & II
Wagner, C.  *Thermodynamics of Alloys*

114431 Met431 Heat Transfer  1 unit

Prerequisite  Met331

Hours  About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination  1½ hour paper

Content  Heat transfer modelling in casting and solidification, welding, pyrometallurgical reaction systems, heat treatment and fabrication systems.

Text  To be advised

Reference  

114432 Met432 Fluid Mechanics  1 unit

Prerequisite  Met332

Hours  About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination  1½ hour paper
Content

Topics treated will include:
The teeming system geometry for continuous or batch ingot production.
The solidifying interface with various morphologies.
The impinging jet geometry in gas-liquid metal contacting in pyrometallurgy.
Melting packed beds.

Text

References

To be advised

114433 Met433 Metallurgical Rate Processes

1 unit

Prerequisite

Met231

Hours

About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination

1½ hour paper

Content

Single particle reaction systems in pyrometallurgy.
Heterogeneous reaction kinetics, Fe-C-O reaction in a steelmaking environment.

Text

References

To be advised

114441 Met441 Fracture Mechanics

1 unit

Prerequisite

Met341

Hours

About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination

1½ hour paper
Content

Text
Knott, J. F.  
Fundamentals of Fracture Mechanics

References
To be advised

114451  Met451 Electron Metallography
1 unit

Prerequisites
Met351, Met352, Met354

Hours
About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination
1¼ hour paper

Content
The interaction of electrons with crystalline materials and the development of image contrast. Characterization of structural defects.

Texts
To be advised

References
Hawkes, P. W.  
Electron Optics and Electron Microscopy
Heidenreich, R. D.  
Fundamentals of Transmission electron microscopy
Muir, L. E.  
Electron optical applications in Materials Science

114452  Met452 Physical Metallurgy
1 unit

Prerequisites
Met351, Met352, Met353

Hours
About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination
1¼ hour paper

Content
Topics on the relation between mechanical properties and microstructure. Strengthening mechanisms. Internal friction in metals.
Text
To be advised

References
Cahn, R. W.  *Physical Metallurgy*
Kelly, A.  *Strong Solids*
Kelly, A. & Nicholson, K. B.  *Strengthening Mechanisms in Crystals*
Nowick, A. S. & Berry, B. S.  *Anelastic Relaxation in Crystalline Solids*

114453  Met453  Metallography  1 unit

Prerequisites  Met351, Met352, Met353
Hours  About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes
Examination  1½ hour paper

Content
Metallography of phase transformations in metals. Recrystallization, grain boundaries and interfaces.

Text
To be advised

References
Christian, J. W.  *The Theory of Phase Transformations in Metals and Alloys*
A.S.M.  *Phase Transformations*
(Manchester Conference "The Mechanism of Phase Transformations in Crystalline Solids")

114461  Met461  Extraction Metallurgy  1 unit

Prerequisites  Met361, Met362
Hours  About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes
Examination  1½ hour paper

Content
Study in depth of selected topics in the current technology of extraction metallurgy from the field of: hydrometallurgy, pyrometallurgy and electrometallurgy.

235
114462 Met462 Reactor Analysis  

Prerequisite: Met363  

Hours: About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes  

Examination: 1½ hour paper  

Content: Modelling and analysis of processes in extraction pyro-, hydro- and electro-metallurgy. Reactor kinetics of industrial reactors.

Text: To be advised  

References

114471 Met471 Materials Selection  

Prerequisite: Met371  

Hours: About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes  

Examination: 1½ hour paper  

Content: An examination of the important features and properties of the less common and more technically sophisticated materials, their applications and limitations.

Texts: To be advised  

References: A.S.M. Metals Handbook Vol. 1, 8th edn

114472 Met472 Welding and Non-destructive Testing  

Prerequisite: Met374  

Hours: About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes  

Examination: 1½ hour paper
Content
The course covers the important details of welding power supplies, advanced techniques and controls.
Welding of special metals and alloys.
Hard facing and metal cutting processes.
Fundamental principles of modern non-destructive testing.
Detailed examination of each process.

Text
To be advised

Reference
A.S.M. Metals Handbook Vol. 6 8th edn

114481 Met481 Dislocation Theory 1 unit

Prerequisites Met352, Met241

Hours About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination 1½ hour paper

Content
Advanced topics on the structure, interactions and movement of dislocations. Applications to plastic deformation, fracture, transformations and strengthening.

Texts To be advised

References
Friedel, J. Dislocations
Nabarro Dislocations
Rosenfeld et al. Dislocation Dynamics
Hirth & Lothe Theory of dislocations

114482 Met482 Metal Physics 1 unit

Prerequisites Met381, Met354

Hours About 21 hours of lectures and about 21 hours of tutorial, demonstration and practical classes

Examination 1½ hour paper
Content
Topics will be chosen from a list including such items as: Neutron diffraction methods, diffraction theory, lattice vibrations, nuclear reactor materials, magnetic and electrical materials, superconductors, etc.

Text To be advised

References
Kittel *Introduction to Solid State Physics*
Others to be advised
B. POSTGRADUATE COURSES

Diploma in Industrial Engineering

General
The Diploma in Industrial Engineering is a postgraduate course directed especially towards those concerned with the planning, supervision and administration of industrial undertakings. The course has a twofold objective. Primarily it has been designed as a bridging course for those graduates with limited or no formal training in the various basic disciplines of industrial engineering. In this respect the programme of study will be selected so as to complement the person's particular technological knowledge with instruction in the industrial field so that he can better perform the functions of industrial management, planning and control. For those persons who already have had, in their undergraduate programme, a comprehensive training in the basic disciplines of industrial engineering, the course has a secondary objective. In this case the aim is to broaden the person's basic training with the offer of study in a wider range of disciplines which have an important application in the industrial engineering field.

Scope of Course
The Diploma programme consists of ten units of formal course work plus two units of project work. Normally this programme shall be completed in not less than two years of part-time study, although in special cases approved by the Faculty Board, the programme may be completed in one year on a full-time study basis.

As specified in the degree Requirements, the basic unit involves a student in a total of approximately 120 hours' work. This total period includes all formal course work plus assignments and study. For a formal instructional course the unit includes 42 hours of lectures or the equivalent.

The approved subjects for the Diploma are arranged in three Groups and are listed in the schedule that follows. The Group I subjects are those required for a basic understanding of the principles of Industrial Engineering while the Groups II and III subjects permit a wider selection for those students already trained in the basic principles. The programme selected in every case is subject to the approval of the Faculty Board on the recommendation of the Head of the Department.

The general requirements concerning the conditions of award of the Diploma in Industrial Engineering are set out on the following pages.
1. In these requirements, unless the contrary intention appears, the "Faculty Board" means the Faculty Board of the Faculty of Engineering.

2. An applicant for registration as a candidate for the Diploma shall complete the prescribed application form and lodge it with the Secretary at least one calendar month before the commencement of first term. In exceptional circumstances applications will be accepted after that date.

3. An applicant for registration as a candidate for the Diploma shall:—
   (a) have satisfied all of the Requirements for admission to a degree in the University of Newcastle; or
   (b) have satisfied all of the Requirements for admission to a degree in another university recognised for this purpose; or
   (c) hold other qualifications approved by the Faculty Board for the purpose of registration in the course.

4. Notwithstanding the provisions of Clause 3 above, the Faculty Board may require an applicant to complete such other prerequisite studies as it may prescribe or a candidate to complete such other concurrent studies as it may prescribe.

5. (a) To complete a subject qualifying towards the Diploma, a candidate shall attend such lectures, tutorials, seminars, laboratory classes, field work and submit such written work and pass such examinations as the Department may require.
   (b) Under no circumstances will a subject qualify for the Diploma for more than ten years from the year in which it is passed.

6. An applicant for registration as a candidate for the Diploma may be granted standing on conditions to be determined by the Faculty Board.

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

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. To qualify for a Diploma a candidate shall, in not less than two years of part-time study, or in special cases approved by the Faculty Board, one year full-time study, complete satisfactorily a course of studies comprising twelve units composed as follows:

*Formal Course Work*  
10 units

(a) Subjects to be selected from schedule of approved subjects in accordance with the requirements of subsections (b) and (c) of this Clause.

<table>
<thead>
<tr>
<th>ME684D</th>
<th>Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 unit</td>
<td>2 units</td>
</tr>
</tbody>
</table>

12 units

(b) The approved subjects have been arranged in three Groups. Group I contains subjects required for basic understanding of the principles of Industrial Engineering while Groups II and III contain a wider selection of subjects for those already trained in the subject areas of Group I.

The selection of subjects shall normally be made from those in Group I of the Schedule, unless in order to satisfy the conditions of subsection (c) of this Clause or where a broader training is deemed to be desirable, the Faculty Board on the recommendation of the Head of Department, has prescribed a course of study including subjects from Groups II and III. In any event not more than three units may be selected from Group III.

(c) Notwithstanding the requirements of parts (a) and (b) and except where standing is approved by the Board, no subject shall be included such that in the opinion of the Board, the subject concerned substantially overlaps in content that of a similar subject completed or work presented and for which credit has been given in the award of another degree or diploma.

10. All subjects listed in the Schedule may not necessarily be offered in any one year.

11. In order to provide for exceptional circumstances arising in particular cases, the Senate, on the recommendation of the Faculty Board, may relax any requirements provided that such relaxation shall be consistent with the By-Laws.
# SCHEDULE OF SUBJECTS

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group I</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ME381 Methods Engineering</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ME382 Production Engineering</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ME385 Accounting &amp; Financial Studies</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ME401 Systems Analysis</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ME487 Operations Research — Deterministic Models</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ME488 Operations Research — Probabilistic Models</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ME582D Industrial Computations</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ME681D Industrial Law</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>ME682D Case Studies in Industrial Management</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ME683D Engineering Economics</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td><strong>Group II</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ME402 Systems Planning, Organisation &amp; Control</td>
<td>1</td>
<td>ME401</td>
</tr>
<tr>
<td>ME403 Resources Planning &amp; Allocation</td>
<td>1</td>
<td>ME401</td>
</tr>
<tr>
<td>ME404 Mathematical Programming</td>
<td>1</td>
<td></td>
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<tr>
<td>ME407 Environmental Engineering</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ME408 Industrial Safety Engineering</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ME419 Design of Conveyors &amp; Materials Handling Equipment</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ME444 Properties of Materials</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ME449 Reliability Analysis</td>
<td>1</td>
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<tr>
<td>ME485 Tool Design</td>
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<tr>
<td>ME486 Industrial Design</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ME489 Operations Research — Applications in Industry</td>
<td>1</td>
<td>ME487, ME488</td>
</tr>
<tr>
<td>ME685D Industrial Process Control</td>
<td>1</td>
<td>ME401, or equivalent</td>
</tr>
<tr>
<td>ME686D Industrial Psychology</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ME503G Design of Experiments for Engineering Research</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>ME505G Systems Analysis &amp; Design</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>ME507G Resources Planning &amp; Allocation</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>ME517G Materials Handling &amp; Transportation Systems</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>ME535G Vibration &amp; Noise Problems in Industry</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>ME583G Modelling of Management Problems</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ME584G Simulation</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Group III</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subjects approved by the Faculty Board for an individual course but not included in Group I or Group II. The number of units to be assigned to these subjects will be determined by the Board.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Except where indicated the prerequisites will be those indicated in the Faculty of Engineering Handbook.
CONDITIONS FOR GRANTING OF STANDING

1. Standing in a subject in the Diploma in Industrial Engineering shall require the approval of the Faculty Board on the recommendation of the Dean of the Faculty of Engineering.

2. A candidate will not be eligible for standing in any subject for which credit has been given for the award of another degree or diploma except as otherwise provided for in succeeding clauses.

3. A candidate from the Master of Engineering Science course of the University of Newcastle who desires to transfer to the Diploma course in Industrial Engineering may be granted standing in those subjects of the Diploma deemed to be equivalent to any of the subjects already completed in the Master’s programme.

4. A candidate from another university or approved tertiary institution may be granted standing by the Faculty Board in up to six units in recognition of postgraduate course work degree or diploma subjects completed in such university or institution provided that the subjects are equivalent to any of those listed in Groups I and II of the Schedule.

5. Where a candidate has completed the first part-time year of the Diploma course he may be granted standing by the Faculty Board in respect of another subject subsequently passed at another university or approved tertiary institution under the following conditions:
   (a) the subject for which standing is granted shall have a reasonable correspondence with a subject of the Diploma in Industrial Engineering; and
   (b) standing shall not be granted in more than three subject units.

Diploma Subject Entries

540152 ME582D Industrial Computations

Prerequisites Nil

Hours 42

Examination Progressive assessment

Content

Text
Guttman, I. & Wilks, S. S. Introductory Engineering Statistics (Wiley)
References
Moroney, M. J.  Facts from Figures (Pelican)
Paradine, C. G. &  Statistical Methods for Technologists (E.U.P.)
Rivett, B. H. P.  Probability and Random Variables (McGraw-Hill)
Wadsworth, G. P. &  Introduction to Statistics (Macmillan)
Bryan, J. G.
Walpole, R. E.

433240 ME6811 Industrial Law
For subject entry see page 317.

540102 ME682D Case Studies in Industrial Management
Prerequisites  Nil
Hours  42
Examination  Progressive assessment
Content
Studies in organisational and executive action requirements of specific industrial situations, using the case study method.
Texts  Nil
References
Blank, P. M. &  Formal Organisation (Routledge & Keegan)
Scott, W. R.
Dubin, R.  The World of Work (Prentice-Hall)
Haynes, W. W. &  Management, Analysis, Concepts and Cases (Prentice-Hall)
Massie, J. L.
Holden, P. E. &  Selected Case Problems in Industrial Management (Prentice-Hall)
Shallenberger, F. K.
Leavitt, H. J.  Managerial Psychology (Chicago University Press)
Litterer, J.  Organisations: Structure and Behaviour (Wiley)
Martindell, I.  Appraisal of Management (Harper-Bros.)

540171 ME683D Engineering Economics
Prerequisites  Nil
Hours  84

244
Examination
One 3-hour paper

Content
The structure of the Australian economy. The theory of the firm, selection of processes and equipment. Decision theory. The application of engineering economic analysis to industrial operations and engineering projects.

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

References
Grant, E. L. & Ireson, E. G. Principles of Engineering Economy (Ronald)
Samuelson, P. A. Economics (McGraw-Hill)

540173 ME684D Project
Hours 84
Examination Progressive assessment

540174 ME685D Industrial Process Control
Prerequisites Nil
Hours To be advised
Examination Progressive assessment

Content
Principles and techniques applicable to the analysis and design of control systems with particular application to industrial processes. Modelling of control systems. Time and frequency domain analysis of linear systems. Basic control actions. Detecting, measuring and correcting elements. Introduction to non-linear control. Introduction to system identification applied to industrial processes.

Texts Nil
References

Davies, W. D. T.  
*System Identification for Self Adaptive Control*  
(Wiley)

Harrison, H. L. & Bolinger, J. G.  
*Introduction to Automatic Control* 2nd edn  
(International)

Ogata, K.  
*Modern Control Engineering*  
(Prentice-Hall)

Takahashi, Y., Robins, M. J. & Auslander, D. M.

*Control*  
(Addison-Wesley)

540175  ME686D Industrial Psychology

**Prerequisites**  
Nil

**Hours**  
To be advised

**Examination**  
Progressive assessment

**Content**

Course dealing with the psychological aspects of human operation in industrial systems.

**Texts**  
Nil

**References**  
To be advised

**HIGHER DEGREES**

**INTRODUCTION**

(The following statement represents the current policy of the Faculty; but is not part of the formal Degree Requirements).

The Master of Engineering Science degree has the primary aim of increasing the knowledge of the student in a specific and professional area, and therefore places more emphasis on course work; nevertheless it includes project work for its own value both in the broadening and consolidation of knowledge, and as an introduction to research.

The Master of Engineering degree has the primary aim of introducing the student to research, and bringing him to the point where he will be able to conduct research effectively under direction. Course work will normally be included in the programme with a normal minimum amount of three postgraduate “units”, as defined on page 33 but the quality and standard of work required in the thesis will still be at the high level which should be expected of an Honours Bachelor of Engineering graduate.
In general, students holding an Honours Degree in Engineering will be encouraged to complete the course in the minimum time of one year. The Doctor of Philosophy degree has the primary aim of producing a man who can initiate, execute and supervise research. Course work will normally be included in the programme with a normal minimum amount of six postgraduate units, but the quality and standard of work required in the thesis will be at the high level appropriate to the title, "Doctor of Philosophy". Remission of up to four units of course work may be granted on account of previous postgraduate work.

The three terms remission referred to in Paragraph 6 of the Requirements will normally be granted to candidates holding a research Master of Engineering degree.

**MASTER OF ENGINEERING SCIENCE**

*(M.Eng.Sc.)* Degree Course

**General**

The Faculty of Engineering offers a group of subjects which comprise the major part of the Master of Engineering Science formal Master's degree programme.

The Master of Engineering Science degree course is offered on both a part-time and full-time basis in order to give graduate engineers the opportunity to update themselves in technological areas of interest. This degree course is flexible in that candidates for the degree may select from a large number of subject combinations which may span one or more engineering Departments. Some undergraduate or postgraduate diploma material may be taken from inside or outside the Faculty of Engineering as credit for the degree, provided that such material is relevant to the programme as a whole. This possibility offers the advantage of advanced training and education which is broad in scope. The course supplements existing Master of Engineering and Doctor of Philosophy programmes which are usually of a research nature.

**Scope of Course**

Subject units will be offered on a Faculty-wide basis in areas of existing academic specialisation. It will be necessary for the Dean, as administrative head of the Faculty, to approve the programme.

In general the basic "unit" specified in the degree Requirements is a programme which involves the student in a total of approximately 120 hours' work. This total includes all formal course work plus assignments and study. If the "unit" is a formal instructional course the 120-hour total includes 42 hours of lectures or the equivalent.
A number of the topics offered consist of two units. A complete M.Eng.Sc. programme normally consists of ten units of formal course work and two units of project work although in special cases the size of the project may be increased to three or four units, with a corresponding reduction in the formal course work.

Under normal circumstances, the course may be completed in one year when taken on a full-time basis, and two years when taken on a part-time basis.

The following pages contain departmental listings of approved M.Eng.Sc. subjects and some suggested programmes for integrated courses in various areas of interest. A student may, however, select any combination of the listed topics subject to the approval of the Head(s) of the relevant Department(s) and the Dean.

**REQUIREMENTS FOR THE DEGREE OF MASTER OF ENGINEERING SCIENCE**

1. An application to register as a candidate for the degree of Master of Engineering 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 if—
   (a) he is a graduate or graduand of the University of Newcastle or other approved university; or
   (b) he produces evidence of such academic and professional attainments as may be approved by the Senate, on the recommendation of the Faculty Board.

3. An applicant shall satisfy the Faculty Board that he is adequately prepared to undertake advanced studies in the department appropriate to the field of specialisation proposed, and may be required to undertake preliminary studies and examinations before his registration as a candidate for the degree; or may be given provisional registration requiring concurrently with some of his advanced work the completion of specified preparatory studies before his registration is confirmed.

4. 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.

5. On the recommendation of the Head of the Department concerned the Faculty Board shall appoint a programme supervisor and project supervisor to supervise the work of each candidate.
6. After registration a candidate shall complete satisfactorily a course of studies approved by the Dean of the Faculty, comprising twelve units of advanced work as may be prescribed by the Faculty Board. Not less than two nor more than four of such units shall comprise the investigation of and report on a project specified by the Head of the Department concerned.

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

8. Where it is appropriate to the candidate’s total programme the Dean may approve the inclusion in the individual programme of advanced work from other faculties equivalent in total to not more than six units and senior undergraduate elective subjects offered within the Faculty of Engineering not exceeding two units provided that the total work allowed under this section shall not exceed six units.

9. A candidate from another university or approved tertiary institution may be granted standing by the Faculty Board in up to six units in recognition of work completed in such university or institution.

10. A candidate whose progress is unsatisfactory may be excluded from any examination, subject, or course, or may be permitted to continue his course subject to certain conditions.

11. Withdrawal
   (a) A candidate may withdraw from a subject or course only by notifying the Secretary to the University in writing and the withdrawal shall take effect from the date of receipt of such notification in writing.
   (b) A candidate who after:
       the eighth Monday in first term, in the case of a subject lasting only the first half-year;
       the sixth Monday in second term, in the case of a subject lasting the whole year;
       the second Monday in third term, in the case of a subject lasting only the second half-year;
       withdraws from a subject in which he has enrolled shall be deemed to have failed in that subject, unless granted permission by the Dean of the Faculty of Engineering to withdraw without penalty.

12. A candidate shall submit three copies of his project report in a form according with the instructions of the Head of the Department, not later than three terms after the completion of the course of formal study.
13. It shall be understood that the University retains the three copies of the report and is free to allow the report to be consulted or borrowed. Subject to the provisions of the Copyright Act (1968) the University may issue the report in whole or in part in photostat or microfilm or other copying medium.

14. The Faculty Board, at the request of an examiner, may require the candidate to answer any questions concerning his work.

15. No candidate shall be considered for the award of the degree until the lapse of three complete terms but not more than six complete terms in the case of a full-time student, and six complete terms, but not more than ten complete terms in the case of a part-time student, from the date from which the registration becomes effective.

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

RECOMMENDED PROGRAMMES

It is recommended that candidates wishing to specialise in one of the following areas should select their course work programme from the subjects listed for that area.

A. Applied Mechanics/Structures

<table>
<thead>
<tr>
<th>Department of Civil Engineering</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE515 Elastic Continua</td>
<td>1</td>
</tr>
<tr>
<td>CE516 Plastic Frame Design</td>
<td>1</td>
</tr>
<tr>
<td>CE517 Steel Beams, Columns &amp; Frames</td>
<td>1</td>
</tr>
<tr>
<td>CE555 Civil Engineering Systems II</td>
<td>1</td>
</tr>
<tr>
<td>CE617 Prestressed Concrete Design</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Department of Mechanical Engineering</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME503G Design of Experiments for Engineering Research</td>
<td>2</td>
</tr>
<tr>
<td>ME511G Experimental &amp; Theoretical Stress Analysis</td>
<td>2</td>
</tr>
<tr>
<td>ME515G Advanced Design Concepts in Mechanical Engineering</td>
<td>2</td>
</tr>
<tr>
<td>ME517G Materials Handling &amp; Transportation Systems</td>
<td>2</td>
</tr>
<tr>
<td>ME535G Vibration &amp; Noise Problems in Industry</td>
<td>2</td>
</tr>
<tr>
<td>ME536G Advanced Dynamics of Machines</td>
<td>1</td>
</tr>
<tr>
<td>ME546G Elasticity, Plasticity &amp; Applications</td>
<td>2</td>
</tr>
<tr>
<td>ME581G Mathematical Programming</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Department of Metallurgy</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Met541 Fracture Mechanics</td>
<td>1</td>
</tr>
<tr>
<td>Met571 Materials Selection</td>
<td>1</td>
</tr>
</tbody>
</table>

250
B. Computer Science

**Department of Electrical Engineering**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE516</td>
<td>Computer-Aided Analysis of Power Systems</td>
<td>1</td>
</tr>
<tr>
<td>EE549</td>
<td>Applied Information Theory</td>
<td>1</td>
</tr>
<tr>
<td>EE562</td>
<td>Advanced Switching Theory &amp; Logic Design</td>
<td>1</td>
</tr>
<tr>
<td>EE563</td>
<td>Computer Operating Systems</td>
<td>1</td>
</tr>
<tr>
<td>EE564</td>
<td>Compilers, Assemblers &amp; Interpreters</td>
<td>1</td>
</tr>
<tr>
<td>EE565</td>
<td>Pattern Recognition</td>
<td>1</td>
</tr>
<tr>
<td>EE566</td>
<td>Automata &amp; Computing Machines</td>
<td>1</td>
</tr>
<tr>
<td>EE567</td>
<td>Computer Process Control</td>
<td>1</td>
</tr>
<tr>
<td>EE568</td>
<td>Advanced Computer Architecture</td>
<td>1</td>
</tr>
<tr>
<td>EE569</td>
<td>Formal Languages &amp; Automata</td>
<td>1</td>
</tr>
</tbody>
</table>

**Department of Mechanical Engineering**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME581G</td>
<td>Mathematical Programming</td>
<td>2</td>
</tr>
</tbody>
</table>

**Subjects offered by other Faculties**

**Department of Mathematics**

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>Programming &amp; Algorithms</td>
<td>1</td>
</tr>
<tr>
<td>Data Structures &amp; Programming</td>
<td>1</td>
</tr>
<tr>
<td>Mathematics III, Topic Z</td>
<td>1</td>
</tr>
</tbody>
</table>

**Department of Commerce**

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Programming</td>
<td>1</td>
</tr>
</tbody>
</table>

C. Engineering Materials

**Department of Civil Engineering**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE526</td>
<td>Advanced Materials</td>
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</tr>
<tr>
<td>CE527</td>
<td>Concrete Technology</td>
<td>1</td>
</tr>
<tr>
<td>CE528</td>
<td>Soil Mechanics</td>
<td>1</td>
</tr>
<tr>
<td>CE529</td>
<td>Foundation Engineering</td>
<td>1</td>
</tr>
<tr>
<td>CE574</td>
<td>Transportation Planning</td>
<td>1</td>
</tr>
<tr>
<td>CE674</td>
<td>Traffic Engineering</td>
<td>1</td>
</tr>
</tbody>
</table>

**Department of Mechanical Engineering**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>ME503G</td>
<td>Design of Experiments for Engineering Research</td>
<td>2</td>
</tr>
<tr>
<td>ME511G</td>
<td>Experimental &amp; Theoretical Stress Analysis</td>
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<tr>
<td>ME581G</td>
<td>Mathematical Programming</td>
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</table>

**Department of Metallurgy**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Met541</td>
<td>Fracture Mechanics</td>
<td>1</td>
</tr>
<tr>
<td>Met551</td>
<td>Electron Metallography</td>
<td>1</td>
</tr>
<tr>
<td>Met552</td>
<td>Physical Metallurgy</td>
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</tr>
<tr>
<td>Met553</td>
<td>Metallography</td>
<td>1</td>
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<tr>
<td>Met571</td>
<td>Materials Selection</td>
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<tr>
<td>Met582</td>
<td>Metal Physics</td>
<td>1</td>
</tr>
</tbody>
</table>

Together with approved topics and subjects which may be offered from the Faculty of Science.
D. Environmental Studies/Environmental Engineering Units

Department of Chemical Engineering

ChE501 Chemical Process Principles for Effluent Control 1
ChE513 Advanced Combustion 2
ChE521 Air Pollution Effluent Control 2
ChE522 Control of Industrial Liquid Effluents 2
ChE623 Advanced Topics in Effluent Control 1 or 2

Department of Civil Engineering

CE543 Water Quality Management 1
CE643 Water Pollution & Water Quality Management 1
CE644 Water & Wastewater Treatment 2
CE645J Microbiology of Water Resources 2
CE646 Public Health Science 1
CE647 Unit Operations in Public Health Engineering 1

Department of Mechanical Engineering

ME503G Design of Experiments for Engineering Research 2
ME505G Systems Analysis & Design 2
ME507G Resources Planning & Allocation 2
ME508G Air Pollution Studies 2
ME535G Vibration & Noise Problems in Industry 2
ME575G Heat Transfer 1
ME581G Mathematical Programming 2

Together with approved topics or subjects which may be offered by other Faculties.

E. Fluid Mechanics/Water Resources Engineering

Department of Civil Engineering

CE533 Theoretical Hydrodynamics 1
CE534 Open Channel Flow 1
CE535 River & Coastal Engineering I 1
CE543 Water Quality Management 1
CE634 Advanced Fluid Mechanics 1
CE635 River & Coastal Engineering II 1
CE636 Water Reticulation & Wastewater Collection 1
CE643 Water Pollution & Water Quality Management 1
CE644 Water & Wastewater Treatment 2
CE645J Microbiology of Water Resources 2
CE646 Public Health Science 1
CE647 Unit Operations in Public Health Engineering 1

252
F. Furnace Engineering

**Department of Chemical Engineering**

<table>
<thead>
<tr>
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<th>Course</th>
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<td>ChE511/512</td>
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<td>ChE513</td>
<td>Advanced Combustion</td>
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<td>ChE521</td>
<td>Air Pollution Effluent Control</td>
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**Department of Electrical Engineering**

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**Department of Mechanical Engineering**

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**Department of Metallurgy**

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G. Operations Research/Management Science

**Department of Chemical Engineering**

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**Department of Civil Engineering**

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**Department of Mechanical Engineering**

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**Subjects offered by other Faculties**

**Department of Mathematics**

Selected Topics in Mathematics IV.
Department of Commerce

Selected topics from Diploma in Business Studies.

Where possible it is recommended that students who wish to study in this area undertake subjects ME581G to ME584G inclusive as a first year programme.

H. Mineral Process Engineering

Department of Chemical Engineering

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Department of Electrical Engineering

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Department of Mechanical Engineering

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Department of Metallurgy

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1. Systems

Department of Civil Engineering

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**Department of Electrical Engineering**

*Units*

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<td>EE547</td>
<td>Digital Communications</td>
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<td>EE552</td>
<td>Advanced Topics in Communication Systems</td>
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<tr>
<td>EE562</td>
<td>Advanced Switching &amp; Logic Design</td>
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<td>EE567</td>
<td>Computer Process Control</td>
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**Department of Mechanical Engineering**

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<td>Mathematical Programming</td>
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**Subjects offered by other Faculties**

**Department of Mathematics**

- Stochastic Processes
- Signal Detection

**General Statement**

Before preparing their course for any year students should check in the Departmental lists which subjects are to be offered in that year. Approval for any course chosen from the subject listings must be given by the Head of the Department concerned and the Dean of the Faculty of Engineering.

**General Prerequisites**

The general prerequisite for all subjects is graduate level in appropriate subjects. However, specific prerequisites are necessary for certain subjects and these are listed in the subject description where applicable.

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**DEPARTMENT OF CHEMICAL ENGINEERING**

The following topics have been approved for inclusion in the M.Eng.Sc. course programme. Those topics which will not be offered in 1976 are marked 1. The other topics are offered subject to adequate enrolment. Units are equivalent to 42 hours contact time.
Formal lecture courses 1976

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<td>Chemical Process Principles for Effluent Control*</td>
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<td>ChE503</td>
<td>Computational Methods in Chemical Engineering</td>
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<td>Advanced Heat Transfer</td>
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<td>(a) Radiative Transfer*</td>
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<td>ChE512</td>
<td>(b) Conduction &amp; Convention**</td>
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<td>ChE513</td>
<td>Advanced Combustion***</td>
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<td>Furnace Engineering***</td>
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<td>ChE512</td>
<td>Air Pollution Effluent Control***(P)</td>
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<td>ChE522</td>
<td>Control of Industrial Liquid Effluents***(P)</td>
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Tutorial Topics

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On consultation with the Department, courses can be planned to specialise either in environmental control or in furnace engineering.

* First half year
** Second half year
*** Full year

*(P) Chemical Process Principles is recommended as a prerequisite to these courses for students who have not previously completed Chemical Engineering subjects.

SUBJECT ENTRIES

510128 ChE501 Chemical Process Principles for Effluent Control

Hours Approx. 42 hours

Content

This is primarily a bridging course for students in the field of environmental control who have not had a chemical engineering background, and deals with specific problems in stoichiometry, particle separation and reaction rate related to gas and water treatment methods.

Texts Nil
References
Himmelblau, D. M. Basic Principles and Calculations in Chemical Engineering 2nd edn (Prentice-Hall 1967)
Levenspiel, O. Chemical Reaction Engineering 2nd edn (Wiley 1972)

510129 ChE503 Computational Methods in Chemical Engineering

Hours Approx. 84 hours
Examination To be advised

Content
The advent of digital computers has changed the approach of chemical engineers to design and analysis. The course is aimed at illustrating how mathematics may be applied to chemical engineering problems when it is realised that the resulting model can be solved on computers. Examples will be taken from statistics, fluid mechanics, stage operations, reaction engineering, automatic control and optimization.

Texts
Jensen, K. A. & Jeffries, G. U. Mathematical Methods for Chemical Engineers (Academic 1965)
Fortran IV Manual

510117 ChE511 Advanced Heat Transfer

510118 ChE512 Advanced Heat Transfer

Hours ChE512 — 42 hours ChE511 — 42 hours

Content
Part (a)
ChE511

Part (b)
ChE512
Studies in heat transfer in packed beds (e.g. blast furnaces, catalytic reactors) and in unsteady conditions.
Text
Part (a)

510122 ChE513 Advanced Combustion

Hours \hspace{1cm} \text{Approx. 84 hours}

Content
A detailed study of the nature of industrial flames and their behaviour in furnace enclosures — the chemical reaction involved, mixing aerodynamics of jets, flames and combustion systems; prediction of flame length, shape and radiative properties.

Texts

References

510126 ChE514 Furnace Engineering

Prerequisites \hspace{1cm} \text{Advanced Heat Transfer desirable but not essential}

Hours \hspace{1cm} \text{Approx. 84 hours}

Content
The design and operation of furnaces; heat balances, calculation of losses, insulation, gas recuperation and regeneration; approximate methods of heat-transfer computation; temperature distribution; refractories; physical construction; control; fuels and firing methods; economics of fuel selection and waste-heat recovery; effluent pollution control.

Texts
Trinck, W. & MacWhinney \textit{Industrial Furnaces} (J. Wiley)
510135 ChE515 Energy Management

**Hours**
Three hours per week

**Content**
The cost-price structure of energy supply; factors influencing relative costs of coal-oil gas-electricity.
Technical possibilities and limitations in change of fuel and energy sources for existing equipment.
Primary fuel conversion; liquid fuels from coal and gas.
Energy economy in process plant; the thermodynamics of heating and power generation. Methods of loss assessment and management of in plant energy use; loss control by furnace inculation, sensible heat recuperation and regeneration. Combustion control. Steam economy; the high cost of steam, the sensible use of latent heat; heat exchangers for low level heat recovery. Energy losses in mechanical and fluid-flow systems. Efficient and inefficient speed and flow control systems.
Combined power and process heat systems; the gas turbine in process plant; reversed cycles; the heat pump for distillation and other process systems. Energy storage, in hot water, as latent heat, in solid storage systems, as chemical energy in cells or in intermediate products.
The international resource situation. Energy resources for the future. (Nuclear, solar direct and vegetable growth, etc.)

**Text**
Hottel, H. C. & Howard, J. B. *New Energy Technology* (Massachusetts Institute of Technology 1971)

**References**
To be advised

510125 ChE516 Reaction Engineering

**Hours**
Approx. 84 hours

**Content**
Kinetics of reactions involving mass transfer with chemical reaction and their application to the design of reactors for gas-solid catalytic reactions.
510123 ChE521 Air Pollution Effluent Control

Hours Approx. 84 hours

Content
The general problem; legislative controls; combustion and other processes producing gaseous or gas carried effluents; control methods; practice and fundamental principles of gas washing, settlement filtration, cycloning and electrostatic precipitation. Process modification, by-product recovery, removal of pollutants by reaction, costs and economics.

Text
Strauss, W. *Industrial Gas Cleaning* (Pergamon 1967)

OR

Dept of Health Education & Welfare


References
Fuchs, N. *Mechanics of Aerosols* (Pergamon 1965)

Stern, A. C. *Air Pollution* (Pergamon 1965)

510124 ChE522 Control of Industrial Liquid Effluents

Part 1: The General Problem; chemical processes

Part 2: Unit Operations

Part 1:

Hours Approx. 42 hours

Content
The general problem; statutory requirements; practice and fundamental principles. By-product recovery.

Cooling water—make up and draw off cycles, treatment chemicals and their recovery or disposal. Sour water strippers—gas or steam stripping of sulphides, phenols.

**Part 2: Unit operations in Water and Wastewater Engineering**

**Content**

Theory of treatment processes dealt with as various Unit Operations, together with practical aspects of overall treatment plants and costs of alternatives.

**Topic outlines**


**Texts**

For Parts I and II


Geyer, J. C. & Okun, D. A.

**Reference**

Nemerow, N. L. *Liquid Waste of Industry* (Addison-Wesley 1971)

**510127 ChE531 Process Optimization**

**Hours**

Approx. 84 hours

**Content**

The course will consist of lectures, tutorials and guided reading on the mathematical methods used in the optimisation of process plant.
Students should be proficient in mathematics and computer programming. Numerical and analytical methods for the optimising of single and multivariable functions including hill climbing techniques. Linear and dynamic programming. Economic profitability criteria including the handling of uncertainty — simulation. Introduction to reliability engineering.

Text
Jelen, F. C.  
*Cost and Optimization Engineering* (McGraw-Hill 1970)

Reference
Beveridge & Schecter  
*Process Optimization Theory and Practice*  
(McGraw-Hill 1970)

DEPARTMENT OF CIVIL ENGINEERING

The following subjects have been approved for inclusion in the M.Eng.Sc. course programme. Those subjects which will not be offered in 1976 are marked 1. The other subjects will be offered subject to adequate enrolment.

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1
SUBJECT ENTRIES

520115 CE515 Elastic Continua

Hours
One lecture hour and half tutorial hour per week

Examination
One 2-hour final paper

Content

References

520116 CE516 Plastic Frame Design

Hours
One lecture and half tutorial hour per week

Examination
One 2-hour final paper

Content
Review of upper and lower bound theorems, beams, columns, connections, design of braced frames, column deflection curves, subassemblages, unbraced frames.

References
Lehigh University Plastic Design of Multi-Story Frames (1965)
Massonet, C. E. & Save, M. A. Plastic Analysis and Design Vol. 1 Beams and Frames (Blaisdell 1965)
520117 CE517 Steel Beams, Columns and Frames

Hours One lecture hour and half tutorial hour per week

Examination One 3-hour paper

Content
Instability of beams, columns and frames, including analysis of thin-walled sections in torsion; box girder analysis.

References
Galambos, T. V. *Structural Members and Frames* (Prentice-Hall 1968)

" *Combined Bending and Torsion Beams and Girders Pts 1 & 2* Publication No. 31 (British Constructional Steelwork Association)


520118 CE519 Engineering Seismology

Hours One and one half hours per week

Examination Progressive assessment

Content
Causes of earthquakes, the theory of plate tectonics, introduction to classical seismology; seismicity, source mechanisms, source parameters, simple source models; wave propagation, propagation of strong ground motion; effects of local geology and topography; design earthquake estimation; statistical characterization of high-frequency ground motion, introduction to random vibration theory; tectonics and seismicity of the South-West Pacific and resulting earthquake engineering problems.

Texts To be advised

520119 CE526 Advanced Materials

Hours One lecture hour and half tutorial hour per week

Examination One 3-hour paper
Content

Texts
References
To be advised

520120 CE527 Concrete Technology

Hours
One and one half hours per week for 20 weeks and one and one half laboratory hours per week for 8 weeks

Examination
One 2-hour paper

Content
Characteristics of special concretes. Use of high alumina, slag, fly ash and other special cements; gap-graded mixes; lightweight aggregate; fibre reinforcement; small scale concrete models.

Texts
References
To be advised

520121 CE528 Soil Mechanics

Hours
One lecture hour and half tutorial hour per week

Examination
Progressive assessment

Content
More advanced work, including recent experimental and analytical advances in soil mechanics.

Texts
Nil

Reference
Scott, R. F. Principles of Soil Mechanics (Addison Wesley 1963)
520122 CE529 Foundation Engineering

Hours One lecture hour and half tutorial hour per week

Examination Progressive assessment

Content
Course time will be divided between more advanced analytical and design methods, and exercises in practical soils engineering. Current soil mechanics projects in and about Newcastle will be followed and sites visited. Each student will undertake a small but complete foundation investigation including site investigation, laboratory testing, design recommendations and presentation of a brief written report.

Texts Nil

References To be advised

520123 CE533 Theoretical Hydrodynamics

Hours One lecture hour and half tutorial hour per week

Examination One 3-hour paper

Content
Proof and applications of the Navier Stokes equations and the vorticity equation; irrotational flow and the use of complex variable methods to solve some of the basic engineering problems such as airfoil lift and percolation under dams.

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

Reference
Milne-Thompson, L. M. Theoretical Hydrodynamics (Macmillan)

520124 CE534 Open Channel Flow

Hours One lecture hour and half tutorial hour per week

Examination One 3-hour paper

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Content
Further methods of plotting longitudinal profiles, and solution of more difficult problems involving channel transitions and controls. Introduction to unsteady flow, the method of characteristics, and the principles of flood routing.

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

References
As for CE 332

520125  CE535 River and Coastal Engineering I

Hours
One lecture hour and half tutorial hour per week

Examination
One 3-hour paper

Content

Texts
Henderson, F. M.  *Open Channel Flow* (Collier-Macmillan 1966)
Muir Wood, A. M.  *Coastal Hydraulics* (Macmillan 1969)

References
Leliavsky, S.  *An Introduction to Fluvial Hydraulics* (Dover 1966)
Leopold, L. B., Wolman, M. G. & Miller, J. P.  *Fluvial Processes in Geomorphology* (Freeman 1964)
Wiegel, R. L.  *Oceanographical Engineering* (Prentice-Hall 1964)
520126 CE543 Water Quality Management

Hours
One lecture hour and half tutorial hour per week

Examination
One 3-hour paper

Content

Preliminary Reading
Imhoff, K., Muller, W. J. & Thistlewayte, D. K. B. Disposal of Sewage and other Waterborne Wastes 2nd edn (Butterworth 1971)

Text

Reference

520127 CE554 Critical Path Planning

Hours
One and one half lecture hours per week

Examination
Progressive assessment

Content

520128 CE555 Civil Engineering Systems II

Hours
One lecture hour and half tutorial hour per week

Examination
One 3-hour paper
Content
Mathematical programming and optimisation techniques, applications to problems in structural design, engineering management, water resource systems and transportation.

References

520129 CE574 Transportation Planning

Hours One and one half lecture hours per week
Examination One 2-hour paper

Content
Transportation in the national economy; sociological, environmental and economic requirements of transportation systems; demands for travel; land use/transport interaction. Transportation planning; data collection; trip generation; trip distribution; traffic assignment; modal split; economic evaluation. Recent innovations in transportation systems.

Text
Bruton, M. J. *Introduction to Transportation Planning* (Hutchinson Educational 1970)

520600 CE617 Prestressed Concrete Design

Hours Two lecture hours and one tutorial hour per week
Examination One 3-hour paper

Content
Text

SAA Prestressed Concrete Code AS1481-1974
(Standards Association of Australia)

References

Bennett, W. Structural Concrete Elements (Chapman-Hall)
Guyon, Y. Limit State Design of Prestressed Concrete
Vols. 1 and 2 (Applied Science 1974)
Leonhardt, W. Prestressed Concrete Design and Construction
(Wilhelm Ernst & John)

520601 CE634 Advanced Fluid Mechanics

Hours

One lecture hour and half tutorial hour per week

Examination

One 3-hour paper

Content

Treatment at an advanced level of selected topics that are relevant to civil engineering problems, for example in pipe systems and the design and performance of hydraulic structures.

Texts

To be advised

References

520602 CE635 River and Coastal Engineering II

Hours

One lecture hour and half tutorial hour per week

Examination

Progressive assessment

Content


References

Ippen, A. T., (ed.) Estuary and Coastline Hydrodynamics
(McGraw-Hill 1966)
Wiegel, R. L. Oceanographical Engineering (Prentice-Hall 1964)
520603  CE636 Water Reticulation and Wastewater Collection

**Hours**  
One lecture hour and half tutorial hour per week

**Examination**  
Progressive assessment

**Content**  
Design and analysis of water collection, transmission and distribution systems. Design and analysis of wastewater collection systems.

**Texts**  
To be advised

520604  CE643 Water Pollution and Water Quality Management

**Hours**  
One lecture hour and half tutorial hour per week

**Examination**  
One 3-hour paper

**Content**  

**References**

Eckenfelder, W. W.  
*Water Quality Engineering* (Barnes & Noble 1970)

Imhoff, K., Muller, W. G. & Thistlewayte, D. K. B.  
*Disposal of Sewage and other Waterborne Wastes* 2nd edn (Butterworths 1971)

Klein, L.  
*River Pollution Vol. 2 Causes and Effects* (Butterworths 1962)

Klein, L.  
*River Pollution Vol. 3 Control* (Butterworths 1966)

Kneesse, A. & Bower, B. T.  

520605  CE644 Water and Wastewater Treatment

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

**Examination**  
One 3-hour paper
Content

References

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Water Treatment Plant Design (New York, American Water Works Association 1969)

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Metcalf & Eddy, Inc. Wastewater Engineering (McGraw-Hill 1972)

520606 CE645J Microbiology of Water Resources

Hours Two lecture hours and one tutorial hour per week

Examination Progressive assessment and final examination

Content

Texts To be advised

520607 CE646 Public Health Science

Hours One lecture hour and half tutorial hour per week

Examination Progressive assessment and final examination

Content

Texts To be advised
520608 CE647 Unit Operations in Public Health Engineering

Hours One lecture hour and half tutorial hour per week

Examination Progressive assessment and final examination

Content Theory of treatment processes used in municipal water and wastewater treatment works.

Texts To be advised

520609 CE654 Construction Management

Hours One and one half lecture hours per week

Examination Progressive assessment

Content The civil engineering construction industry in perspective. Functions of construction management, project evaluation, planning, cost estimating, bidding, construction supervision. Day-labour versus contract organisations. Work study in construction. Labour relations.

Texts To be advised

520610 CE674 Traffic Engineering

Hours One and one half lecture hours per week

Examination One 2-hour paper

Content The relationship between speed, flow and density of a highway traffic stream. Intersection design with and without signal control. Economic analysis for highways.

Texts


Winfrey, R. *Economic Analysis for Highways* (Intext 1969)
DEPARTMENT OF ELECTRICAL ENGINEERING

The following subjects have been approved for inclusion in the M.Eng.Sc. course programme. Those subjects which will not be offered in 1976 are marked †. The other subjects will be offered subject to adequate enrolment.

All subjects are 1 unit (42 hours) unless otherwise noted.

†EE516 Computer-Aided Analysis of Power Systems
EE541 Sample Data Control Systems *
†EE542 Modern Control **
EE543 Optimization Techniques **
EE544 Communication Systems *
EE545 Communication Systems *
†EE546 Modern Control
EE547 Digital Communications **
†EE552 Advanced Topic in Communication Systems **
EE562 Advanced Switching Theory and Logic Design *
EE563 Computer Operating Systems *
EE564 Compilers, Assemblers & Interpreters **
†EE565 Pattern Recognition **
†EE566 Automata & Computing Machines
†EE567 Computer Process Control
EE568 Advanced Computer Architecture **
†EE569 Formal Languages & Automata *
EE580 Thesis/Project (by arrangement)
EE590 Seminar ***
†EE641 Multivariable Control Systems
†EE642 Stochastic Control

* First half year
** Second half year
*** Full year

SUBJECT ENTRIES

530100 EE516 Computer-Aided Analysis of Power Systems (not offered in 1976)

530127 EE541 Sample Data Control Systems (Digital Signal Processing)*

Prerequisites Consent of instructor

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

Examination Progressive assessment, a term paper and a final examination
Content
Digital filtering and digital control systems, z-transforms, state-variable techniques, sampling and reconstruction, fast fourier transforms.

Text
Oppenheim & Schafe Digital Signal Processing (Prentice-Hall 1975)

References
Kuo, B. C. Discrete-Data Control Systems (Prentice-Hall Inc. 1970)

530130 EE522 Advanced Topics in Communications Systems** (not offered in 1976)

530102 EE542 Modern Control** (Nonlinear Optimal Control Theory) (not offered in 1976)

530120 EE543 Optimization Techniques**

Prerequisites Maths II, Topics C, D, E.

Content
Mathematical background to optimization. Comparison of optimization methods; engineering applications — such as to problems of identification, control, pattern recognition and resource allocation.

Text
Luenberger, D. G. Introduction to Linear and Non-Linear Programming (Addison Wesley 1973)

Reference
Luenberger, D. G. Optimization via Vector Space Methods (Wiley 1969)

530104 EE544 Communication Systems*

Prerequisites EE331, EE332 or EE341, EE342 or consent of instructor.

Hours Three hours per week

Examination Progressive assessment and final examination
Content
Introduction to the common forms of analog modulation, as well as pulse modulation systems including pulse code modulation. Performance in the presence of noise is considered.

Text
Carlson, A. B.  
*Communications Systems* (McGraw-Hill 1975)

Reference
Taub, H. & Schilling, D. L.  

530123 EE545 Communications Systems*

Prerequisites EE342 or equivalent

Content
Stochastic processes including stationary gaussian processes from a time-domain viewpoint. Kalman filtering and application to AM and FM demodulation.

Text
Astrom, K. J.  

530128 EE546 Modern Control (not offered in 1976)
(Linear Optimal Control Theory)

530129 EE547 Digital Communication**

Prerequisites Consent of instructor

Hours Three hour of lectures and tutorials per week

Examination Progressive assessment, a term paper and a final examination

Content
As for EE447

Text To be advised

References
Lucky, Galz & Weldon  
*Principles of Data Communication* (McGraw-Hill)

Wozencraft & Jacobs  
*The Principles of Communication Engineering* (Wiley)
530132  EE562 Advanced Switching Theory and Logic Design*

Prerequisite
EE362 or consent of instructor

Hours
Three hours of lectures and tutorials per week

Content

Text
To be determined

References
Friedman, A. D. & Menon, P. R. Fault Detection in Digital Circuits (Prentice-Hall)
Kohavi, Zvi Switching and Finite Automata Theory (McGraw-Hill)

530117  EE563 Computer Operating Systems*

Prerequisite
EE361

Hours
Three hours per week

Examination
Progressive assessment and final examination

Content

Text
Madnick & Donovan Operating Systems (McGraw-Hill)

References
Coffinan & Denning Operating System Theory (Prentice-Hall)
Donovan Systems Programming (McGraw-Hill)
Hansen Operating System Principles (Prentice-Hall)
530118 EE564 Compilers, Assemblers and Interpreters **

Prerequisite
EE361

Hours
Three hours per week

Examination
Progressive assessment and final examination

Content

Text
Nil

References
Aho & Ullman
*The Theory of Parsing, Translation and Compiling* (2nd Vol.) (Prentice-Hall)

Donovan
*Systems Programming* (McGraw-Hill)

Gries
*Compiler Construction for Digital Computers* (Wiley)

Stone
*Introduction to Computer Organisation and Data Structures* (McGraw-Hill)

530108 EE565 Pattern Recognition ** (not offered in 1976)

530119 EE566 Automata and Computing Machines (not offered in 1976)

530125 EE567 Computer Process Control (not offered in 1976)

530121 EE568 Advanced Computer Architecture **

Hours
Three hours of lectures, seminars and tutorials per week

Examination
Progressive assessment and final examination

Content

Texts
Nil
References
Bell & Newell  Computer Structures
Foster  Computer Architecture
Iliffe  Basic Machine Principles

530122  EE569 Formal Languages and Automata* (not offered in 1976)

530110  EE580 Thesis/Project

Content
Multiples of 1 unit
Topics to be arranged

530111  EE590 Seminar***

Content
A series of seminars for full-time postgraduate students. Each student will prepare approximately one seminar per semester on a technical or theoretical subject. Each student will also attend EE491 seminars.

530133  EE641 Multivariable Control Systems (not offered in 1976)

530134  EE642 Stochastic Control (not offered in 1976)

DEPARTMENT OF MECHANICAL ENGINEERING

The following subjects have been approved for inclusion in M.Eng.Sc. programmes. The offering of any subject is dependent on adequate enrolments in that subject. Subjects marked † are unlikely to be offered in 1976:

ME404  Mathematical Programming  1
ME502G  Operations Research & Decision Theory  2
†ME503G  Design of Experiments for Engineering Research  2
ME505G  Systems Analysis & Design  2
†ME507G  Resources Planning & Allocation  2
ME508G  Air Pollution Studies  2
ME511G  Experimental & Theoretical Stress Analysis  2
ME515G  Advanced Design Concepts in Mechanical Engineering  2
†ME517G  Materials Handling & Transportation Systems  2
ME535G  Vibration & Noise Problems in Industry  2
SUBJECT ENTRIES

540115 ME502G *Operations Research and Decision Theory* (Refer also ME487/488)

*Hours* Three hours of lectures, seminars and tutorials per week

*Examination* Progressive assessment

*Content*

*Texts* Nil

*References*
- Vajda, S. *Readings in Mathematical Programming* (Pitman)
- Wagner, H. M. *Principles of Operations Research* (Prentice-Hall)

540101 ME503G *Design of Experiments for Engineering Research*

*Prerequisites* Nil

*Hours* Three hours of lectures, seminars and tutorials per week

*Examination* Progressive assessment

*Content*
A systematic approach to the analysis and design of experiments and the interpretation of experimental results. The course has been divided into three approximately equal parts as follows:
(1) Statistical methods for the design and evaluation of experiments.
(2) Model analysis, use of true and distorted models as well as analogues. Use of dimensional analysis.
(3) Methods of measurement, mechanical, optical, electrical and electronic instrumentation. Recording techniques and data processing. Use of computers. Planning of computer and laboratory operations.

**Texts**

Nil

**References**

Bright-Wilson *Introduction to Scientific Research* (McGraw-Hill)

Cook & Rabinowicz *Physical Measurements and Analysis* (Addison-Wesley)

Ezekiel & Fox *Methods of Correlation Analysis and Regression Analysis* (Wiley)


— *Experimental Statistics* Handbook 91 (U.S. National Bureau of Standards)

540111 ME505G Systems Analysis and Design

**Hours**

Three hours of lectures, tutorials and seminars per week

**Examination**

Progressive assessment

**Content**


**Texts**

Nil

**References**

Busacker & Saaty *Finite Graphs and Networks* (McGraw-Hill 1965)

Holerman, C. *Engineering Systems Analysis* (Merrill 1965)


540116  ME507G Resources Planning and Allocation

Hours
Three hours per week

Examination
Progressive assessment

Content
Classification of resources. The distribution and abundance of natural resources and their importance to industrial societies. Issues in resource management: depletion of nonrenewable resources; policies for conservation and substitution, their goals, utility and practical implementation; management of renewable resources, quantitative models, optimal rates of utilisation.

Man-made resources: formulation of capital, technological development.

Texts
Nil

References
Barnett, J. H. & Morse, C.  
Scarcity and Growth: The Economics of Natural Resource Availability (John Hopkins University Press 1963)

Clawson, M. (ed.)  
Natural Resources and International Development (John Hopkins University Press 1963)

Jarrett, H. (ed.)  
Comparisons in Resource Management (John Hopkins University Press 1961)

McDivitt, J. F.  
Minerals and Men (John Hopkins University Press 1965)

National Academy of Science  
Resources and Man (Freeman & Co. 1969)

Sinden, J. A. (ed.)  
The Natural Resources of Australia (Angus & Robertson 1972)

540117  ME508G Air Pollution Studies

Hours
Three hours per week

Examination
Progressive assessment

Content
This course will cover the following themes:
(a) Atmosphere diffusion models and physico-chemical interactions on the local and global scale.
(b) Establishing air quality goals with incomplete information.
(c) Pollution sources and ambient pollution measurements: emphasis on the motor vehicle.
(d) Control strategies: legislation, environmental impacts, and economic considerations.

Texts
Nil

References
Chanlett, E. T.  Environmental Protection (McGraw-Hill 1973)
McCalmac, B. M.  Introduction to the Scientific Study of Air Pollution (Reidel 1971)
Pasquill, F.  Atmospheric Diffusion (Van Nostrand 1962)
Royal College of Physicians  Air Pollution and Health (Pitman 1970)
Stern, A. C.  Air Pollution 3 Vols (Academic Press 1968)

540106 ME511G Experimental and Theoretical Stress Analysis

Hours Three hours of lectures and tutorials per week
Examination Progressive assessment

Content
An introduction to the experimental and theoretical analysis of complex components with emphasis on the use of computer techniques. Theoretical and experimental applications of the use of strain gauge, photoelastic and modelling methods will be covered. Certain aspects of simulation techniques will also be given.

Texts
Nil

References
Durelli, A. J. & Riley, W. F.  Introduction to Photomechanics (Prentice-Hall 1965)
McMillan, C.  Mathematical Programming (Wiley 1970)
Southwell, R. V.  An Introduction to the Theory of Elasticity (Dover 1969)
540107 ME515G Advanced Design Concepts in Mechanical Engineering

Hours Three hours per week
Examination Progressive assessment
Content
The application of system analysis principles to the solution of problems associated with the design of mechanisms. Formalising of the design process. Fundamental concepts of reliability. Reliability analysis. Methods of improving the reliability of Systems. Computer programming for mechanical design applications. The optimum design of typical mechanical components.

Texts Nil

References
Furman, T. T. The Use of Computers in Engineering Design (E.U.P.)
Haviland, R. P. Engineering Reliability and Long Life Design (Van Nostrand 1964)
Johnson, R. C. Optimum Design of Mechanical Elements (Wiley)
Matouseki, R. Engineering Design (Blackie)
Morrison, D. Engineering Design (McGraw-Hill)

540113 ME517G Materials Handling and Transportation Systems

Hours Three hours per week
Examination Progressive assessment
Content
An introduction using a systems approach to transport needs, which makes use of Systems Analysis, Network Methods, Stock Control Techniques as well as Sensitivity Studies.
The technical characteristics and unit-cost data for various types of transport systems are examined. Examples considered will include conveyor systems, pipeline systems (pneumatic and hydraulic), road and rail systems and sea transport systems such as Lash, Splash, RoRo, Container, &c. Other studies will include stockpiling, packaging and cargo transfer systems.
Evaluation and optimisation of transport systems with an introduction to their design.
540102 ME535G Vibration and Noise Problems in Industry

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

*Examination*  Progressive assessment

*Content*

The course presents a systematic study of both noise and vibration problems which are of common occurrence in industrial plants and structures. The course is divided into two parts, as follows:


*Texts*

Anderson, R. A.  *Fundamentals of Vibrations* (Macmillan)

Beranek  *Noise Reduction* (McGraw-Hill)

*References*


540108 ME536G Advanced Dynamics of Machines

*Hours*  One and a half hours per week

*Examination*  Progressive assessment

*Content*

Dynamic motion analysis: the energy distribution method, equivalent mass-and-force method, the rate-of-change-of-energy method.

Advanced kinematics of the Plane Motion: the inflection circle, Euler-Savary equation, Bobilliers construction, Hartmann’s construction.

Introduction to synthesis; graphical methods, analytical methods.

*Text*

Hirschhorn, J.  *Kinematics and Dynamics of Plane Motion* (McGraw-Hill)
References
Hall, A. S. \textit{Kinematics and Linkage Design} (Prentice-Hall 1960)
Holowenko, A. R. \textit{Dynamics of Machinery} (Wiley)

540109 ME546G Elasticity, Plasticity and Applications

Hours \hspace{1cm} Three hours of lectures and tutorials per week
Examination \hspace{1cm} Progressive assessment
Content
Development of theories of elasticity and plasticity; application of these theories to elastic, elasto-plastic and plastic problems; use of approximate methods of solution; application of slip-line field solutions to certain plasticity problems; use of experimental methods.

Texts \hspace{1cm} Nil

References
Ford \hspace{1cm} \textit{Advanced Mechanics of Materials} (Longmans)
Hill, R. \hspace{1cm} \textit{The Mathematical Theory of Plasticity} (Oxford)
Wang \hspace{1cm} \textit{Applied Elasticity} (McGraw-Hill)
Zienkiewicz & Holister \hspace{1cm} \textit{Stress Analysis} (Wiley)

540114 ME554G Fluid Mechanics

Hours \hspace{1cm} One and a half hours of lectures per week
Examination \hspace{1cm} Progressive assessment
Content
Lectures and laboratory work dealing with a section of the following topics. Two phase flow particularly related to transport of solids in pipelines; Fractional analysis and its application; Pump and compressor design; Application of hydrodynamics; Computer applications in fluid mechanics.

Texts \hspace{1cm} Nil

References
Kovats, A. \hspace{1cm} \textit{Centrifugal and Axial Flow Pumps and Compressors} (Pergamon)
Streeter, V. L. \hspace{1cm} \textit{Handbook of Fluid Dynamics} (McGraw-Hill)
Vallentine, H. R. \hspace{1cm} \textit{Applied Hydrodynamics} (Butterworths)

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540103 ME555G Advanced Turbomachinery

Hours Three hours of lectures and tutorials per week

Examination Progressive assessment

Content
More advanced study of the fluid mechanics and thermodynamics of flow in cascades and three-dimensional guiding surfaces, leading to the design of a selected turbomachine.

Texts Nil

Reference
Csanyi, G. T. Theory of Turbomachines (McGraw-Hill 1964)

540118 ME575G Heat Transfer

Hours One and a half hours of lectures and laboratory per week

Examination Progressive assessment

Content
Lectures and laboratory work dealing with a selection of the following topics.
Heat transfer in laminar and turbulent flow; Heat transfer with boiling; Condensation heat transfer; Heat exchangers; Radiant heat transfer and furnace applications; Applications of dimensional analysis; Applications of computer techniques in heat and mass transfer.

Reference To be advised

540119 ME581G Mathematical Programming

Hours Three hours of lectures and tutorials per week

Examination Progressive assessment

Content
A survey of methods for the solution of statics, deterministic optimisation problems.
Linear programming; the simplex algorithm and its revised form duality theory; sensitivity analysis; decomposition algorithms transportation and assignment problems.
Linear programming in integers; cutting plane algorithms branch-and-bound methods; implicit enumeration; algorithms for binary integer programmes.

Network, scheduling and other combinatorial problems.

Introduction to the theory of convex nonlinear programmes; the Kuhn-Tucker theorem applications to quadratic programming and geometric programming.

Dynamic programming methods.

**Texts**


Geoffrion, A. M. (ed.) *Perspectives on Optimisation* (Addison-Wesley 1972)


**References**


Hadley, G. *Linear Programming* (Addison-Wesley, World Student Series 1969)

Künzi, H. P., Krelle, W. & Oettli, W. *Nonlinear Programming* (Blaisdell 1966)

Luenberger, D. G. *Introduction to Linear and Nonlinear Programming* (Addison-Wesley 1973)


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**540120 ME582G Probabilistic Models in Operations Research**

**Hours**

Three hours of lectures, tutorials and seminars per week

**Examination**

Progressive assessment

**Content**

Review of relevant, probability and statistics theory; utility theory; Bayes' theorem; decision trees; decision models under risk and uncertainty; queueing theory; Markov models, renewal theory; variable inventory models; forecasting; time series analysis; production-inventory models; quality assurance models; reliability.

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Texts
Nil

References
Taha, H. A.  Operations Research (Macmillan)
Wagner, H. M.  Principles of Operations Research (Prentice-Hall)

540121 ME583G Modelling of Management Problems

Hours  One and a half hours of lectures per week
Examination  Progressive assessment
Content
Principles of model building; classification of models; cause-effect structures; organizational objectives; problem formulation; management problems in industry and government; models for marketing, manpower, production, inventory, distribution, and investment; case studies of management problems.

Reference
Rivett, B. H. P.  Principles of Model Building (Wiley)

540122 ME584G Simulation

Hours  One and a half hours of lectures per week
Examination  Progressive assessment
Content
The basic methodology of simulation and its relationship to operations research and the scientific method; analogue, digital and hybrid simulation; the representation of uncertainty in simulation models, sampling methods; simple example of simulation of a queue to illustrate the problems and methods involved in the construction of different models to answer different questions; the general discrete event network and its limitations; general solutions to the modelling of such networks; the classical 3 phase model; programming languages for simulation; design of simulation experiments; simulation project.

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Texts

References
Tocher, K. D. The Art of Simulation (E.U.P. 1963)

433260 ME681G Industrial Law

For subject description see page 317.

540123 ME685G Advanced Operations Research

Prerequisite
ME502G or ME487/488

Hours
Three hours of lectures, tutorials and seminars per week

Examination
Progressive assessment

Content
The application of the Operational Research Method and techniques to tactical and strategic industrial problems. Analysis and simulation of production — inventory control systems, queueing systems, investment and replacement, quality control and reliability.

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

DEPARTMENT OF METALLURGY

The following subjects have been approved for inclusion in M.Eng.Sc. programmes. The offering of any subject is dependent on adequate enrolments in that subject. Subjects marked † are unlikely to be offered in 1976.

115521 Met 521 Metallurgical Thermodynamics 1
115531 Met 531 Heat Transfer 1
115532 Met 532 Fluid Mechanics 1
115533 Met 533 Metallurgical Rate Processes 1
115541 †Met 541 Fracture Mechanics 1
115551 Met 551 Electron Metallography 1
115552 Met 552 Physical Metallurgy 1
115553  Met 553  Metallography  1
115561  Met 561  Extraction Metallurgy  1
115562  Met 562  Reactor Analysis  1
115571  †Met 571  Materials Selection  1
115572  †Met 572  Welding & Non-Destructive Testing  1
115581  Met 581  Dislocation Theory  1
115582  Met 582  Metal Physics  1

SUBJECT ENTRIES

115521  Met521  Metallurgical Thermodynamics

Prerequisite  Met321
Hours  About 21 hours of lectures and 21 hours tutorial, demonstration and practical classes
Examination  To be advised
Content
Texts  To be advised
References
Richardson, F. D.  The Physical Chemistry of Melts in Metallurgy Vols. 10-11 (Academic 1974)
Wagner, C.  Thermodynamics of Alloys (Addison Wesley 1952)

115531  Met531  Heat Transfer

Prerequisite  Met331
Hours  About 21 hours of lectures and about 21 hours of tutorials, demonstrations and practical classes
Examination  To be advised
Content
Heat transfer modelling in casting and solidification, welding, pyrometallurgical reaction systems, heat treatment and fabrication systems.
Texts  To be advised
References  To be advised
115532 Met532 Fluid Mechanics

**Prerequisite** Met332

**Hours** About 21 hours of lectures and about 21 hours of tutorials, demonstrations and practical classes

**Examination** To be advised

**Content**
Topics treated will include:
The teeming system geometry for continuous or batch ingot production.
The solidifying interface with various morphologies.
The impinging jet geometry in gas-liquid metal contacting in pyrometallurgy.
Melting packed beds.

**Texts**
To be advised

**References**
To be advised

115533 Met533 Metallurgical Rate Processes

**Prerequisite** Met231

**Hours** About 21 hours of lectures and 21 hours of tutorials, demonstrations and practical classes

**Examination** To be advised

**Content**
Single particle reaction systems in pyrometallurgy.
Heterogeneous reaction kinetics, Fe-C-O reaction in a steelmaking environment.

**Texts**
To be advised

**References**
To be advised
115541 Met541 Fracture Mechanics

Prerequisite
Met341

Hours
About 21 hours of lectures and 21 hours of tutorials, demonstrations and practical classes.

Examination
To be advised

Content
Linear elastic fracture mechanics, stress distribution round a crack tip, effect of yielding.
Development of equations for idealized fracture situations, testing procedures, specimen design, C.O.D. testing.
Data analysis and life predictions, prediction of fatigue life, effect of hostile environments. Application of fracture mechanics to non-ferrous metals and polymers.

Texts
Knott, J. F.  Fundamentals of Fracture Mechanics

References
To be advised

115551 Met551 Electron Metallography

Prerequisites
Met351, Met352, Met354

Hours
About 21 hours of lectures and 21 hours of tutorials, demonstrations and practical classes

Examination
To be advised

Content
The interaction of electrons with crystalline materials and the development of image contrast. Characterization of structural defects.

Texts
To be advised

References
Hawkes, P. W.  Electron Optics and Electron Microscopy
Heidenreich, R. D.  Fundamentals of Transmission Electron Microscopy (It)
Muir, L. E.  Electron Optical Application in Materials Science
115552  Met552  Physical Metallurgy

**Prerequisites**          Met351, Met352, Met353

**Hours**               About 21 hours of lectures and 21 hours of tutorials, demonstrations and practical classes

**Examination**          To be advised

**Content**
Topics on the relation between mechanical properties and microstructure. Strengthening mechanisms. Internal friction in metals.

**Texts**                To be advised

**References**
Cahn, R. W.                  *Physical Metallurgy*
Kelly, A. &                 *Strengthening Mechanisms in Crystals*
               Nicholson, K. B.
Kelly, A.                  *Strong Solids*
Norwich, A. S. &             *Aelastic Relaxation in Crystalline Solids*
               Berry, B. S.

115553  Met553  Metallography

**Prerequisites**          Met351, Met352, Met353

**Hours**               About 21 hours of lectures and about 21 hours of tutorials, demonstrations and practical classes

**Examination**          To be advised

**Content**
Metallography of phase transformations in metals. Recrystallization, grain boundaries and interfaces.

**Texts**                To be advised

**References**
A.S.M.                      *Phase Transformations* (Manchester Conference "The Mechanism of Phase Transformation in Crystalline Solids")
Christian, J. W.            *The Theory of Phase Transformations in Metals and Alloys*
115561 Met561 Extraction Metallurgy

Prerequisites Met361, Met362

Hours About 21 hours of lectures and about 21 hours of tutorials, demonstrations and practical classes

Examination To be advised

Content
Study in depth of selected topics in the current technology of extraction metallurgy from the field of: hydrometallurgy, pyrometallurgy and electrometallurgy.

Texts To be advised

References

115562 Met562 Reactor Analysis

Prerequisite Met363

Hours About 21 hours of lectures and about 21 hours of tutorials, demonstrations and practical classes

Examination To be advised

Content
Modelling and analysis of processes in extraction pyro-, hydro- and electro-metallurgy. Reactor kinetics of industrial reactors.

Texts To be advised

References

115571 Met571 Materials Selection

Prerequisite Met371

Hours About 21 hours of lectures and about 21 hours of tutorials, demonstrations and practical classes

Examination To be advised
Content
An examination of the important features and properties of the less common and more technically sophisticated materials, their application and limitations.

Texts
To be advised

Reference
A.S.M. Metals Handbook Vol. 1, 8th edn

115572 Met572 Welding and Non-destructive Testing

Prerequisite
Met374

Hours
About 21 hours of lectures and about 21 hours of tutorials, demonstrations and practical classes

Examination
To be advised

Content
The course covers the important details of welding power supplies, advanced techniques and controls.
Welding of special metals and alloys.
Hard facing and metal cutting processes.
Fundamental principles of modern non-destructive testing.
Detailed examination of each process.

Texts
To be advised

References
A.S.M. Metals Handbook Vol. 6, 8th edn

115581 Met581 Dislocation Theory

Prerequisites
Met352, Met241

Hours
About 21 hours of lectures and about 21 hours of tutorials, demonstrations and practical classes

Examination
To be advised

Content
Advanced topics on the structure, interactions and movement of dislocations. Applications to plastic deformation, fracture, transformations and strengthening.
Texts
References
Friedel, J. Dislocations
Nabarro Dislocations
Rosenfeld, et al. Dislocation Dynamics
Theory of Dislocations

115582 Met582 Metal Physics

Prerequisites Met381, Met354

Hours About 21 hours of lectures and about 21 hours
of tutorials, demonstrations and practical
classes

Examination To be advised

Content
Topics will be chosen from a list including such items as:
Neutron diffraction methods, diffraction theory, lattice vibrations,
nuclear reactor materials, magnetic and electrical materials, super-
conductors, etc.

Texts To be advised

References
Kittel Introduction to Solid State Physics

Others to be advised

Approved Diploma Subjects Offered
By Other Faculties

(a) Faculty of Economics and Commerce Units
ME585D 1Accounting & Financial Studies 1
ME681D 1Industrial Law 2
2Commercial Programming 1

(b) Faculty of Mathematics
3Programming & Algorithms 1
3Data Structures & Programming 1

1 Refer to Diploma in Industrial Engineering
2 Refer to Diploma in Business Studies
3 Refer to Diploma in Computer Science
REQUIREMENTS FOR THE DEGREE OF
MASTER OF ENGINEERING

1. An application to register as a candidate for the degree of Master 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 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 applicants to carry out such work and pass such examinations as the Board may determine before registration as a candidate for the degree of Master 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 double-spaced typescript, shall include a summary of approximately 200 words, and a certificate signed by the candidate to the effect that the work is his own and 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
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 a 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.

1 Separate sheet on the preparation and binding of higher degree theses 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;

(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 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. Any 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.

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.

REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF SCIENCE

1. The degree of Doctor of Science may be awarded by the Council on the recommendations 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.
C. SUBJECTS OFFERED BY NON-ENGINEERING DEPARTMENTS

The subjects included in this section are those offered by Departments in other Faculties which are compulsory subjects in one or more Engineering courses. A few subjects which are popular as Electives are also included. For details of other subjects, it will be necessary to refer to the appropriate Faculty Handbook.

The subjects names are arranged in alphabetical order.

416105 ME385 Accounting and Financial Studies

Note Enrolment in this subject is restricted to students who have not previously passed any accounting examinations at tertiary level.

Prerequisites Nil

Hours A course of 2 lecture hours per week throughout the year

Examination An examination each half-year

Content

The use of accounting information for business decisions. Analysis of balance sheets. Income appropriation and flow of funds statements; basic accounting procedures; the concept of cost; types and uses of internal accounting systems; cost allocation; the concept of income; inventory valuation; measurement and accounting; accounting for inflation; preparation of financial statements; analysis and interpretation of financial statements.

Basic cost accounting; management control processes; budget as a planning device; budget as a control device; budgeting and employee behaviour; responsibility accounting; performance evaluation; cost analysis for management decisions including capital acquisitions and optimal investment behaviour; transfer pricing; capacity utilisation and control; statistical techniques for operational cost control.

Text


References To be advised

411100 Accounting I

Prerequisites Nil

Hours A course of 2 lecture hours and a 2 hour tutorial per week throughout the year

Examination Two 3-hour papers
Content
An analysis of the accounting function in the social structure; the historical cost model of income measurement and asset valuation. Alternative systems of accounting measurement—current purchasing power, current value and present value. Various types of entities: partnerships, companies, manufacturing and non-trading concerns. An introduction to basic techniques of management accounting including job costing, process costing, allocation of overheads, and budgeting; analysis and interpretation of financial statements; funds statements and an introduction to business finance. A brief survey of external influences on accounting.

Texts
Burns, T. J. & Hendrickson, H. S. The Accounting Sampler 2nd edn (McGraw-Hill)
Colditz, B. T. & Gibbins, R. W. Accounting Perspectives (McGraw-Hill)
Colditz, B. T., Meigs, W. B. & Johnson, C. E. Australian Accounting: The Basis for Business Decisions (McGraw-Hill)
Accountancy Exercises (University of Newcastle)

References
Bakker, P. Inflation and Profit Control (Methuen-Law Book Co.)
Barton, A. D. The Anatomy of Accounting (University of Queensland Press)
Carey, J. L. The Rise of the Accounting Profession Vols I & II (A.I.C.P.A.)
Chambers, R. J. Accounting and Action (Law Book Co.)
Gibson, G. J. & Gillard, R. A. The Accounting Process (Butterworths)
Goldberg, L. Fitzgerald's Accounting (Butterworths)
Gole, V. L. Fitzgerald's Analysis and Interpretation of Financial and Operating Statements (Butterworths)
Hunter, M. H. & Allport, N. J. A. Accounting (Holt, Rinehart & Winston)

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Mathews, R.  
McCrae, T. W.  
McNeel, E.  
Morrison, L. & Cooper, K.  
Meigs, W. B., Mosich, A. N. & Meigs, R. F.

721100 Chemistry I

Prerequisites  
Nil

Hours  
About 3 lecture hours and 3 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 related 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; bonding and energy; chemical equilibria and energetics; chemical kinetics.

Texts

Aylward, G. H. & Findlay, T. J. V.  
Bencey, O. T.  
Hart, H. & Scheutz, R. D.  
a, b Pimentel, G. C. & Sprately, R. D.

S.I. Chemical Data 2nd edn (Sydney, Wiley & Sons Australasia 1974)
The Names and Structures of Organic Compounds (New York, Wiley & Sons 1966)
Organic Chemistry 4th edn (Boston, Houghton Mifflin 1973)
Understanding Chemistry (Calif. Holden-Day 1971)

Several other texts provide suitable alternative approaches, one widely used is:

Brescia, F. et al.  
b Students with deficient background knowledge are advised to consolidate basic understanding through study of books such as:

Parry, R. W. et al.  Chemistry, Experimental Foundations
                        (Englewood Cliffs, N.J., Prentice-Hall
                        1970)

or

                        (Melbourne, Melbourne University Press
                        1970)

721900 Chemistry IS
(for Civil, Electrical and Mechanical Engineering Students)

Prerequisites  Nil

Hours  About 2 lecture hours and one hour of tutorials, computational classes and student participation per week

Examination  One 3-hour paper

Content
The central theme is the contribution of chemistry to the control and exploitation of man’s environment with special reference to energy and material resources. Among the topics included are the following:
The chemical nature of natural resources; chemical energetics in relation to combustion; ionic and phase equilibria against a background of water usage, treatment and beneficiation; electrochemistry in relation to corrosion and related phenomena; structural chemistry of engineering materials; organic chemistry with special reference to petrochemistry, polymers, fuels and lubricants.

Texts

Aylward, G. H. & S.I. Chemical Data (Sydney, Wiley & Sons
Findlay, T. J. V. Australasia 1970)

Cartmell, E. Chemistry for Engineers 2nd edn (London,
Butterworths 1964)

Pimentel, G. C. & Understanding Chemical Thermodynamics

Turk, A., Meislich, H. Introduction to Chemistry (New York,
Brescia, R. & Academic 1968)
Arents, J.
722200  Chemistry IIA

Prerequisite  Chemistry I
Preparatory Subjects  Mathematics I and either Physics IA or IB
Hours  About 3 lecture hours and 6 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

Geissman, T. A.  *Principles of Organic Chemistry* 3rd edn (Freeman 1968)

or


Students intending to proceed to Chemistry IIIA are advised to purchase a copy of either:


or

660112 CS — Data Structures and Programming — J. A. Campbell

Assumed Standard of Programming and Algorithms Attainment

Hours Two lecture hours and one tutorial hour per week for the second half of the year

Examination One paper of two hours duration

Content
Introduction to data structures: lists, strings, arrays, trees, graphs, searching and sorting; list processing.
Higher level programming languages: Syntax and semantics. Backus normal form. Polish notation. Declarations, storage allocation, subroutines and linkage. Compilation, interpretation and translation. Study and comparison of data structures in several languages, e.g. ALGOL 60, ALGOL 68, COBOL, FORTRAN, LISP, etc.

Text Nil

References
Day, A. C. Fortran Techniques: with Special Reference to Non-numerical Applications (Cambridge University Press 1972)
Galler, B. A. & Perlis, A. J. A View of Programming Languages (Addison-Wesley 1970)
Knuth, Donald E. The Art of Computer Programming
  Vol. I — Fundamental Algorithms
  Vol. II — Semi-numerical Algorithms
Sammet, Jean E. Programming Languages: History and Fundamentals (Prentice-Hall 1969)

421105 Economic History I

Prerequisites Nil

Hours Two lecture hours per week and one tutorial per week
Examination

Assessment is on the basis of three major essays, a minimum of ten tutorial papers and an end-of-year examination.

Content

Economic History I is designed to introduce the first year student to the history of economic development on a world-wide scale. Basic economic theory and principles, historical and modern, are examined and utilised throughout the course. The first half of the year is largely concerned with an analysis of pre-industrial economies and societies, concentrating on the gradual change in Western Europe which culminated in the Industrial Revolution in Britain. The second half of the course deals with the impact of industrialisation on the international economy of the nineteenth century.

Preliminary Reading

Cipolla, C. M. and either Heilbroner, R. L. or Gill, R. T.

Other Texts

Davis, R. 
Hughes, J. E. T. 
Landes, D. (ed.) 
North, D. C. & Thomas, R. P.

References


Fontana Economic History of Europe Vols I-IV (1972-74)

The Pre-Industrial Economy in England 1500-1750 (Batsford 1971)

The Question of Imperialism (Macmillan 1974)

The Pattern of the Chinese Past (Methuen 1973)

An Economic History of West Africa (Longmans 1973)
Kenwood, A. G. & Lougheed, A. L.  
Malthias, P.  
The First Industrial Nation (C. Scribners 1969)
Robertson, R. M.  
History of the American Economy 3rd edn (Harcourt Brace 1973)
Supple, B. E. (ed.)  
The Experience of Economic Growth (Random House 1963)
Youngson, A. J. (ed.)  
Economic Development in the Long Run (Allen & Unwin 1972)

421106 Economic Statistics I

Prerequisites  
Nil

Hours  
Two hours lectures/tutorials per week in small groups

Examination  
One 3-hour paper

Content
This course is an introductory course aimed at giving students an understanding of basic quantitative methods used in economics and business. The course covers three broad areas: elementary statistics, mathematical techniques in economics and elementary computing.

Elementary Statistics: Topics covered include probability, measures of central tendency and dispersion, introductory sampling and sampling distributions, linear regression and correlation analysis, time series analysis and index numbers.

Mathematical Techniques: Topics covered include the use of functions in economics, elementary calculus in economics and matrices in economics.

Elementary Computing: Students will be taught some BASIC programming and how to use the Faculty's computing facilities.

Preliminary reading
Moroney, M. J.  
Facts from Figures (Penguin)
Yeomans, K. A.  

Texts
James, D. E. & Throsby, C. D.  
Introduction to Quantitative Methods in Economics (John Wiley 1973)
Newton, B. L.  
Statistics for Business (Science Research Associates Inc. 1973)
References
Shao, S. P. \textit{Statistics for Business and Economics} (Merrill)
Yamane, T. \textit{Statistics—An Introductory Analysis} (Harper)

742101. PH221 Electromagnetics and Quantum Mechanics—see Physics II

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 Department

Content
This is a study of processes and patterns in man's physical environment. One section of the subject deals with the behaviour of the atmosphere, including its interaction with the earth's surface, over wide ranges of scale in space and time.
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 and Advanced Geomorphology electives in Geography III.

Texts
Barry, R. G. & Chorley, K. J. \textit{Atmosphere, Weather and Climate} Paperback (London, Methuen 1968)
Strahler, A. W. \textit{Physical Geography} 4th edn (N.Y., Wiley 1975)

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

(i) 353110 Advanced Geomorphology

**Prerequisite**  
Geography IIB

**Hours**  
Two hours per week and related fieldwork

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

**Content**

The elective is made up of two parts. One section focusses attention on fluvial processes within the drainage basin system. The other deals with the historical-geomorphological interpretation of selected landscapes and, to some extent, with the significance of the physical features for human occupation.

**Texts**

Gregory & Walling  

Lambert, A. M.  
*The Making of the Dutch Landscape* (Seminar Press 1971)

(ii) 353111 Advanced Urban Geography

**Prerequisite**  
Geography IIA

**Hours**  
Two hours per week and related fieldwork

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

**Content**

This topic is designed for the study of selected aspects of human behaviour in cities. About one term is given over to a time-space approach to urban activity systems. Examples are related to U.S.A., U.K., Sweden and Australia. Recent developments in the study of urban images; intra-urban residential movements and the processes associated with spatial behaviour of minority groups are also considered. A study of urban space-time profiles related to urban and sub-urban health care needs in socially stratified space will be a group-project, in doing fieldwork. Discussion of the control of urban social systems and the future of cities concludes the course.

**References**

Lists will be distributed to students at the commencement of the year, and at appropriate times thereafter.
(iii) 353103 Biogeography

Prerequisite (Recommended) Geography IIB

Hours Two hours per week and related fieldwork

Examination As prescribed by the Head of 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.

433220 ME681 Industrial Law

Prerequisites Although Legal Studies I is not a mandatory prerequisite for Industrial Law, it is desirable that students taking the subject should have completed such a "legal system" course. Alternatively, they should be prepared to undertake intensive preliminary reading (see the "Suggested Preliminary Reading" for Legal Studies I)

Hours 2 lecture hours and one tutorial hour

Examination Two papers. Students will be permitted to take into the examination copies of Statutes as advised and lists of case names and references to be supplied during the course, provided the copies are not marked otherwise than by underlining

Content

A study of industrial law divided into two broad parts: a study of the law affecting the individual employer and employee; and a study of the law affecting employer-and employee-groups. The first part includes analysis and description of the master-servant relationship at common law; duration, termination and terms of the contract of service; remedies for breach by either party of the contract of service; promises in restraint of trade; the doctrine of vicarious liability; the employer's duty of care at common law; the employer's statutory duties; the employer's defences to an employee's action for damages; workers' compensation. The second part includes an examination of the constitutional background of industrial legislation: the legal framework of the Federal and State systems of conciliation and arbitration;
strikes and lockouts; special "industrial torts"; enforcement and penal provisions; standard working hours and leave with pay; wage fixation; legal status of industrial organisations.

Suggested Preliminary Reading

Sykes, E. I. *The Employer, the Employee and the Law* 3rd edn (Law Book Co.)

Texts

Glasbeek, H. J. & Eggleston, E. M. *Cases and Materials on Industrial Law in Australia* (Butterworths)

Sykes, E. I. & Glasbeek, H. J. *Labour Law in Australia* (Butterworths)

Statutes

— *Annual Holidays Act, 1974* (N.S.W. Government Printer)

— *Conciliation and Arbitration Act, 1904* (Australian Government Printer)

— *Industrial Arbitration Act, 1940* (N.S.W. Government Printer)

— *Long Service Leave Act, 1955* (N.S.W. Government Printer)

— *Workers' Compensation Act, 1926* (N.S.W. Government Printer)

— *Commonwealth of Australia Constitution Act, 1900* (U.K.) (Australian Government Printer)

References

Boulter, N. *Workers' Compensation Law and Practice in N.S.W.* (Law Book Co.)

Cullen, C. L. & Macken, J. J. *An Outline of Industrial Law* (Law Book Co.)

Foenander, O. de R. *Australian Industrial Regulation* (Law Book Co.)

Foenander, O. de R. *Industrial Conciliation and Arbitration in Australia* (Law Book Co.)

Foenander, O. de R. *Recent Developments in Australian Industrial Regulation* (Law Book Co.)

Foenander, O. de R. *Trade Unionism in Australia* (Law Book Co.)

Hepple, B. A. & O'Higgins, P. *Individual Employment Law* (Sweet & Maxwell)

Macken, J. J. *Australian Industrial Law — The Constitutional Basis* (Law Book Co.)

Mills, C. P. *Federal Industrial Laws* (Butterworths)

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Mills, C. P.  New South Wales Industrial Laws  
(Butterworths)
Mills, C. P.  Workers' Compensation in New South Wales  
(Butterworths)
O'Dea, R.  Industrial Relations in Australia  
(West Publishing Corp.)
Portus, J. H.  Australian Compulsory Arbitration 1900-1970  
(Law Book Co.)
Portus, J. H.  The Development of Australian Trade Union  
Law  (Melbourne University Press)
Shtein, B. J. L. & Lindgren, K. E.  Introduction to Business Law  
(Law Book Co.)
Sykes, E. I.  The Employer, The Employee and the Law  
(Law Book Co.)
Sykes, E. I.  Strike Law in Australia  (Law Book Co.)

Statutes
—  Apprentices Act, 1909  (N.S.W. Government Printer)
—  Factories, Shops and Industries Act, 1962  
(N.S.W. Government Printer)
—  Scaffolding and Lifts Act, 1912  
(N.S.W. Government Printer)

431100 Legal Studies I

Prerequisites  Nil

Hours  3 hours including at least one tutorial, the remaining hours throughout the year varying between lectures and seminars

Examination  Continuous assessment during the year (whether with or without an end of year examination) in which students will be required to produce several assignments, some under examination conditions and some not.

Content
A. The nature and purpose of law; basic legal concepts; organization of law; sources of law; the structure and workings of our courts, parliamentary systems, and the legislative process.
B. A study of the general principles of the law of contract.
Preliminary Reading

Baalman, J.  
Outline of Law in Australia (Law Book Co.)

Derham, D. D.,  
Maher, R. K. &  
Waller, L.  
An Introduction to Law (Law Book Co.)

Graveson, R. H.  
Law: An Outline for the Intending Student  
(Routledge & Kegan Paul)

Sawer, G.  
The Australian and the Law (Pelican Original)

Shtein, B. J. L. &  
Lindgren, K. E.  
Introduction to Business Law (Law Book Co.)

Williams, G. L.  
Learning the Law (Stevens)

Students will be informed at the first class of books which it is essential for them to possess. In addition, roneoed material will be made available by the Department of Legal Studies.

References

Campbell, E. &  
Whitmore, H.  
Freedom in Australia (Sydney University Press)

Lloyd, D. D.  
The Idea of Law (Penguin)

Lumb, D.  
The Constitutions of the Australian States  
(Queensland University Press)

Mayer, H. (ed.)  
Australian Politics (Cheshire)

Paton, G. W.  
A Textbook of Jurisprudence (Oxford University Press)

Potter, H.  
Historical Introduction to English Law  
(Sweet & Maxwell)

Sawer, G.  
Australian Government Today (Melbourne University Press)

Vermeesch, R. B. &  
Lindgren, K. E.  
Business Law of Australia (Butterworths)

422101 Macroeconomics

Prerequisite  
Microeconomics

Hours  
Two lecture hours and one tutorial hour per week

Examination  
One 3-hour paper

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This course deals with the determination and measurement of the levels of income, employment and economic activity. Models of closed systems are introduced and the connections between the major aggregate economic variables are outlined. This includes consideration of the factors bearing on major components of aggregate demand and aggregate supply, including the effects of monetary influences. The external sector and the government sector are also incorporated. The emphasis is on short-run models of aggregate economic behaviour, but policy implications are taken into consideration.

Texts
Wonnacott, Paul *Macroeconomics* (Irwin 1974)

References
Ackley, G. *Macroeconomic Theory* (Macmillan 1961)
Bober, D. *Economics of Cycles and Growth* (Wiley 1967)
Keiser, N. F.* Macroeconomics* (Random House 1971)
Keynes, J. M. *General Theory of Employment, Interest and Money* (Macmillan)
Shapiro, E. *Macroeconomic Analysis* 3rd edn (Harcourt, Brace & World 1974)
Shapiro, E. *Macroeconomics, Selected Readings* (Harcourt, Brace & World 1970)
Trevithick, J. A. & Mulvey, C. *The Economics of Inflation* (Martin Robinson 1975)

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 consist 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 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.)

PART 1 SUBJECT

661100 Mathematics I

Prerequisites Nil
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

PART 1 TOPICS

Topic AN — Real Analysis — M. J. Hayes

Prerequisites Nil
Hours One lecture hour per week and one tutorial hour per fortnight
Content
Texts Nil
References Apostol, T. Calculus Vol. 1 2nd edn (Ginn Blaidsell 1967)
Giles, J. R. Real Analysis — an Introductory Course (Wiley 1973)
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: vector spaces, 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)
- Tropper, A. Mary *Linear Algebra* (Nelson 1973)

**Topic CA — Calculus — R. F. Berghout**

**Prerequisites**
Nil

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

**Content**

**Texts**
Nil

**References**
- Apostol, T. *Calculus* Vol. 1 2nd edn (Ginn Blaisdell 1967)
- 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)  
Kaplan, W. & Lewis, D. J.  Calculus and Linear Algebra Vol. I  
(Wiley 1970)  

Topic NM — Numerical Mathematics — A. J. Guttmann

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 programmes is a required part of this topic.

Texts
Blatt, J. M.  Basic Fortran IV Programming VERSION MIDITRAN (Computer Systems of Australia Pty Ltd (1969)

Wilkes, M. V.  A Short Introduction to Numerical Analysis (Cambridge University Press 1971)

References

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

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 pre- or corequisite for Mathematics IIC, and IIA and IIC together a prerequisite for any Part III subject, so students wishing to take two Part II subjects would normally choose Mathematics IIA and IIC. Students taking all three of the Part II subjects would study all twelve of the topics listed below. Summaries of these topics, and extended booklists, will appear in the Mathematics Handbook, and will be available from the Mathematics Department.
List of Topics for Part II Mathematics

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

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

662100 Mathematics IIA

**Prerequisite**
Mathematics I

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

**Examination**
Each topic is examined separately

**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

**Prerequisite**
Mathematics I

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

**Examination**
Each topic is examined separately
Content

For students in the Department of
Chemical Engineering, 
Civil Engineering, 
Electrical Engineering, 
Mechanical Engineering, 
Surveying,
For students taking a combined BSc/BE course:

Topics C, D, E, F
Topics C, D, E, H
Topics C, D, E, H
Topics C, D, E, H
Topics B, C, D, H
Any four of the eight topics A-H from the Part II list on page 325.

662300 Mathematics II C

Prerequisite Mathematics I
Corequisite Mathematics IIA
Hours Four lecture hours and two tutorial hours per week for three terms
Examination Each topic is examined separately

Content

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

Notes

1. Students may, with the consent of the Head of Department, take Mathematics IIB in two parts each of two lectures per week for three terms.
2. In order to pass both Mathematics IIA and Mathematics IIB a student must study all the topics A to H above and offer them for examination.
3. Mathematics IIA is a corequisite 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 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, 1975 and 1976 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 Department.

Texts

662101 Topic A Nil
662102 Topic B
Spiegel, Murray R.

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

662103 Topic C
Greenspan, H. D. & Benney, D. J.

Calculus—an Introduction to Applied Mathematics
(McGraw-Hill 1973)

OR
Marder, L.

Calculus of Several Variables (Allen Unwin 1972)

Marder, L.

Vector Fields (Allen Unwin 1972)

OR
Spiegel, M. R.

Theory and Problems of Advanced Calculus
(Schaum Outline Series, McGraw-Hill 1963)

662104 Topic D
Lipschutz, S.

Linear Algebra (Schaum 1968)

662201 Topic E
Boyce, W. E. & Di Prima, R. C.

Elementary Differential Equations and Boundary Value Problems
(New York, Wiley 1969)

662202 Topic F
Nil

662203 Topic G
Weinberger, H. F.

A First Course in Partial Differential Equations
(Ginn Blaisdell 1965)

AND
Sneddon, I. N.

Fourier Series (Routledge 1961)

662204 Topic H
Freund, J. E.

Mathematical Statistics 2nd edn (Prentice-Hall 1971)

OR
Hoel, P. G.

Introduction to Mathematical Statistics
4th edn (New York, Wiley 1971)

662301 Topic I
Nil

662302 Topic J
Nil

662303 Topic K
Nil
PART III SUBJECTS

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

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

Passes in both Mathematics IIA and IIC are prerequisite for entry to Mathematics IIIA, and Mathematics IIIA is a pre- or corequisite for Mathematics IIIB. It will be assumed that students taking a third-year subject in 1976 have already studied topics C, D, E, K and L in their Part II subjects.

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

Summaries of these topics together with 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>—</td>
</tr>
<tr>
<td>PD</td>
<td>Applications 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>
</tbody>
</table>
The selection rules and definitions of the Part III subjects follow.

**663100 Mathematics IIIA**

*Prerequisites*  
Mathematics IIA & 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, PD, Q, R, U, or Y. In addition, students taking this subject will be required to complete an essay on a topic chosen from the history or philosophy of Mathematics.

**663200 Mathematics IIIB**

*Prerequisite or Corequisite*  
Mathematics IIIA

*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 chosen from the fifteen listed above.

*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, PD, Q, R, U, or Y must be included in these eight topics.

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

Subject to meeting any pre- or corequisite requirements, students may take additional Part II and III topics as elective units. When taken in this way each topic is regarded as a separate subject of one unit value designated by an Engineering number.

The numbers allocated are:—

662105 EM2A Mathematical Models
662106 EM2B Complex Analysis
662107 EM2C Calculus and Vector Calculus
662108 EM2D Linear Algebra
662205 EM2E Differential Equations and Integral Transforms
662206 EM2F Numerical Analysis and Computing
662207 EM2G Fourier Series, Partial Differential Equations and Special Functions
662208 EM2H Probability and Statistics
662305 EM2I Topic in Statistics, e.g. Applications of Statistics
662306 EM2J Topic in Applied Mathematics, e.g. Mechanics
662307 EM2K Topic in Pure Mathematics, e.g. Group Theory
662308 EM2L Analysis of Metric Spaces

Recommended electives for students in the different Departments are as follows:—

Chemical Engineering — EM2B, EM2G
Civil Engineering — EM2B, EM2G
Electrical Engineering — EM2B, EM2F
Mechanical Engineering — EM2B, EM2G, EM2L

Students may not take as an elective unit any topic which is included in Mathematics IIB for the Department in which they are enrolled.

Topics in Mathematics III subjects are also available as electives for Engineering students, and have been allocated EM3 numbers. Details are available as required.

Full descriptions of these subjects and book lists will be found in the Faculty of Mathematics Handbook, and will also be available from the Department of Mathematics.

421101 Microeconomics

Prerequisites Nil

Hours Two lecture hours and one tutorial hour per week
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.

Preliminary Reading

Samuelson, P., Hancock, K. & Wallace, R.

Texts

one of the following

Leftwich, R. H. The Price System and Resource Allocation 5th edn (Holt, Rinehart & Winston 1973)
Tisdell, C. Microeconomics: The Theory of Economic Allocation (John Wiley 1972)

References

Breit, W. & Hochman, H. M. Readings in Microeconomics 2nd edn (Holt, Rinehart & Winston 1971)
Clower & Due Microeconomics (Irwin 1972)
Mansfield, E. Microeconomics—Selected Readings 2nd edn (Norton 1975)
Shows, E. W. & Burton, R. H. Microeconomics (Heath 1972)
412600 Organisational Behaviour

**Prerequisites**
Nil

**Hours**
A course of 2 lecture hours per week throughout the year

**Examination**
Two 2-hour papers (Terms 1 and 2)
One 3-hour paper (Final)

**Content**
Theories and research results relevant to problems of administration from the behavioural sciences viewpoint. Topics include behavioural models, values and attitudes, learning, perception, motivation, creativity, problem-solving, communications, group dynamics and leadership. These are treated in relation to the classical managerial functions, and the management of specialised functional areas, such as personnel, marketing, production and finance.

**Texts**
Leavitt, H. J. & Pondy, L. R. *Readings in Managerial Psychology* 2nd edn (Chicago University Press)
Luthans, F. *Organisational Behaviour* (McGraw-Hill)

**References**
Gellerman, S. W. *The Management of Human Relations* (Holt, Rinehart & Winston)
Leavitt, H. J. *Managerial Psychology* (Chicago University Press)
Miner, J. B. *Management Theory* (Macmillan)
Pugh, D. S. *Writers on Organisations* (Penguin)
Schein, E. H. *Organisational Psychology* (Prentice-Hall)
Sutermeister, R. *People and Productivity* (McGraw-Hill)
Tannenbaum, A. S. *Social Psychology of the Work Organisation* (Wadsworth)

**Philosophy**

**General Note**
One subject only is offered in First Year and Fourth Year, but two subjects are offered in Second Year and Third Year, of which students may take one or both. For each subject there will be two examination papers.

To enrol in Fourth (Honours) Year, students should have completed at least four Philosophy subjects and obtained at least Credit grading. In addition to course work, Fourth Year students will write a thesis. In other years, essays and exercises will be part of the year's work.
381100 Philosophy I

Prerequisites Nil

Hours Three to four hours per week

Examination See below

Content
Section 1: Introduction to Philosophy
Section 2: Logic and Options
Section 3: Seminars

Section 1

381101 Introduction to Philosophy (Professor Ritchie, Dr Dockrill, Mr Sparkes)

Hours One hour per week

Examination One three-hour paper

Content
This section is an introduction to Philosophy, and is divided into two parts. The first part is concerned with Plato's theory of political activity, morality, the nature of the soul and its immortality, and universals. The second part is concerned with Descartes' quest for infallible knowledge, his theory of innate ideas, and his attempt to prove the existence of God and the immaterial character of the soul. This section will continue throughout the year.

Texts
Descartes

Philosophical Writings (Anscombe & Geach ed. Nelson)

Plato

The Last Days of Socrates (Penguin)

References
Burnet, J. Greek Philosophy (Macmillan)
Guthrie, W. K. C. The Greek Philosophers (Methuen)
Guthrie, W. K. C. Socrates (C.U.P.)
Kenny, A. Descartes (Random House)
Taylor, A. E. Plato: the Man and his Work (Methuen)
Section 2

381103 Logic and Options

Hours
Two hours per week

Examination
An examination will be conducted in second term — for those dissatisfied with their result, a further examination will be available in November

Content

First half-term, introduction to logic.

This course assumes no prior acquaintance with logic and is intended to introduce students to a formal study of validity of arguments as encountered in philosophy and elsewhere. Among the topics studied will be truth and implication, the structure of propositions and arguments, class and logical relations.

There is no set text. Lecture notes with further reference will be issued at the beginning of the course.

Examination
One three-hour paper for two options

Second and Third Terms, two of a series of options. These will include

Content
(a) More advanced logic
(b) Scientific Method
(c) Introduction to Ethics
(d) Introduction to Political Philosophy

Special seminars of a more advanced kind than those of first term will be given.

Details of options will be provided during the first half-year, and choice should be discussed with members of the Department:

Examination
One three-hour paper for two options

Section 3

381104 Seminars

Hours
One hour per fortnight

Content

Seminars are conducted in small groups, and the programme is related to the material of Section 1. Members of groups are expected to prepare papers, and to develop acquaintance with problems and ways of discussing them.
As with essays, marks awarded for papers will be included in the mark for the year's work. Credit is also given for performance as a group member.

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

741300 Physics IB

Prerequisite: Science 2S (Advisory)

Hours: Three lecture-hours and three hours of laboratory work 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.
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
To be announced. Refer to Physics Department notice board.

742100 Physics II

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

Hours
Three lecture hours and three hours laboratory work per week

Examination
Three two-hour papers, one at the commencement of third term

Content
Physics II as a required subject for B.E./B.Sc. students.
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 combined B.E./B.Sc. student will qualify as a prerequisite for Physics IIIA.

Texts
Smith, F. G. & Thompson, J. H. Optics (N.Y., Wiley 1971)
Young, H. D. Fundamentals of Optics and Modern Physics (N.Y., McGraw-Hill)

Any further texts will be listed in the Physics Department.
742101 PH221 Electromagnetics and Quantum Mechanics

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

Hours
45 lecture hours and 45 laboratory hours

Examination
One two-hour paper and one one-hour paper

Content
The course is intended for students in Electrical Engineering and covers Electromagnetics and Quantum Physics. Students who may later wish to continue Physics in the Science Faculty are advised that Science Faculty regulations require that Physics II be completed in a single year.

Texts
Young, H. D. Fundamentals of Optics and Modern Physics (N.Y., McGraw-Hill)

Further texts will be listed on the Physics Department notice board.

660101 Programming and Algorithms — A. J. Guttmann

Assumed Standard of Mathematics I

Attainment

Hours
Two lecture hours and one tutorial hour per week for the first half of the year

Examination
One paper of three hours duration. There may also be a second examination on programming techniques.

Content
Boolean algebra, propositional logic, binary and other number systems, representation of numbers and instructions. Flow charts. Description of machine code, assemblers, etc. Introduction to FORTRAN, ALGOL and the conversational language BASIC. Use of higher level languages to solve problems of a non-numerical nature. Programming techniques, efficient programming, evaluation of expressions, sources of error. Programme development, diagnostics, testing, etc. Nature of algorithms and heuristics. Analysis of algorithms. Programme structure, procedures, subroutines, scope of variables. Recursion. Graphs, trees, and the Travelling Salesman Problem.

Text
Nil
References

Knuth, Donald E.

*The Art of Computer Programming*
Vol. I — Fundamental Algorithms
Vol. II—Semi-numerical Algorithms
Vol. III — Sorting and Searching
(Addison-Wesley 1968, 1969, 1973)

International Computers Ltd.

*Algol Programming Manual*

Blatt, J. M.

*Introduction to Fortran IV Programming*
(Goodyear 1967)

Dav, A. C.

*Fortran Techniques: with Special Reference to Non-numerical Applications* (Cambridge University Press 1972)


*Computers and Problem Solving* (Addison-Wesley 1970)

Kreitzberg, C. B. & Shneiderman, B.

*The Elements of FORTRAN Style* (Harcourt, Brace Jovanovich 1972)

Ralston, A.

*Introduction to Programming and Computer Science* (McGraw-Hill 1971)