FACULTY OF ENGINEERING

1968 HANDBOOK

THE UNIVERSITY OF NEW SOUTH WALES

FACULTY OF ENGINEERING

1968 HANDBOOK

FIFTY CENTS

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FOREWORD

Although a detailed survey has not been taken in recent years, there is no doubt that the present demand for graduates in Engineering far exceeds the supply. To what extent major national projects are being delayed as the result, one can only guess, but the present shortage has existed for a number of years.

It is quite obvious, however, that the number of Engineering graduates must increase at a significantly higher rate if we are to meet the deadlines set for national planning. Satellite communication systems, fast communications links between computing centres, automatically controlled natural gas transmission and distribution systems, nuclear power stations, major dams and structures and improved transportation systems, to mention only a few, of the developments planned, must become realities by the early 1970's. Many industries and systems, too, double every eight to ten years, often presenting unforeseen problems in system planning and design.

Students enrolling for the first time in 1968 will not be available to industry until 1972 at the earliest. By that time many of the projects now envisaged will be under way, some will have been abandoned and others substituted to take their place, I have no doubt, however, that the future can provide an interesting career for the professional engineer. The range and scope of work are broadening all the time, and should satisfy a wide range of personal interests.

The courses in the various Schools of the Faculty, as presented in this handbook, have been planned to meet the challenge of the future.

R. E. Vowels
Pro-Vice-Chancellor and Acting Dean,
Faculty of Engineering

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CALENDAR DATES FOR 1968

Term 1: March 4 to May 18
Term 2: June 3 to August 10
Term 3: September 2 to November 2

JANUARY—

Monday, 22	Last day for acceptance of applications to enrol by new students and students repeating First Year
Tuesday, 30	Deferred examinations begin

FEBRUARY—

Saturday, 10	Deferred examinations end
Monday, 19	Enrolment Week begins for new students and students repeating First Year
Monday, 26	Enrolment Week begins for students re-enrolling

MARCH—

Monday, 4	First term lectures begin
Friday, 15	Last day for acceptance of enrolments of new students (late fee applies)
Friday, 29	Last day for acceptance of enrolments of students re-enrolling (late fee applies)

APRIL—

Friday, 12 to Monday, 15	Easter
Thursday, 25	Anzac Day—Public Holiday

MAY—

Saturday, 18	First term ends

JUNE—

Monday, 3	Second term begins
Monday, 10	Queen's Birthday—Public Holiday
Friday, 28	Last day for acceptance of applications for re-admission after exclusion under rules governing re-enrolment

JULY—

Tuesday, 2	Foundation Day
Friday, 19	Last day for acceptance of applications for examinations

AUGUST—

Saturday, 10	Second term ends

SEPTEMBER—

Monday, 2	Third term begins
Saturday, 21	Annual Examinations begin—21-week courses

OCTOBER—

Monday, 7	Six Hour Day—Public Holiday
Saturday, 5	Annual Examinations end—21-week courses

NOVEMBER—

Saturday, 2	Third term ends
Saturday, 9	Annual Examinations begin—30-week courses
Saturday, 30	Annual Examinations end—30-week courses

1969

Term 1: March 3 to May 17
Term 2: June 2 to August 9
Term 3: September 1 to November 1

JANUARY—

Tuesday, 28 to Saturday, Feb. 8	Deferred examinations

FEBRUARY—

Monday, 17	Enrolment Week begins for new students and students repeating First Year
Monday, 24	Enrolment Week begins for students re-enrolling

MARCH—

Monday, 3	First term lectures begin

FACULTY OF ENGINEERING

ACTING DEAN — Professor R. E. Vowels

CHAIRMAN — Professor C. H. Munro

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Professor of Surveying and Head of Department of Surveying

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Executive Assistant to the Dean

I. J. Somervaille, BE *N.S.W.*, ASTC

Department of Water Engineering

(Including Civil Engineering Practice, Public Health Engineering, Soil Mechanics, and the Water Research Laboratory)

Professor of Civil Engineering

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R. J. Tuft, ASTC, AMIE Aust., MRINA

Lecturers

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Department of Agricultural Engineering

Lecturer

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Lecturers

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Lecturer

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Teaching Fellow

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Professional Officers

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Y. F. Leong, BSc *N.S.W.*

THE FACULTY

SCHOOL OF CIVIL ENGINEERING

The School of Civil Engineering consists of three departments, the Department of Water Engineering, the Department of Structural Engineering and the Department of Surveying. The School conducts undergraduate courses in Civil Engineering and in Surveying, both part time and full time. In addition, the Departments conduct graduate courses in Structural Engineering, Water Engineering, Public Health Engineering and Engineering Construction. A vigorous graduate research programme is pursued in many fields.

The Department of Water Engineering encompasses the fields of Hydraulics, Hydrology, Public Health Engineering, Soil Mechanics and Engineering Construction. Public Health Engineering and Soil Mechanics Laboratories are located at Kensington. The Hydrology research centre is also at Kensington, but a substantial amount of investigation is carried out in the field. The Water Research Laboratory at Manly Vale is the centre for hydraulics laboratory instruction and investigations.

The Department of Structural Engineering covers the fields of Structural Engineering, Materials and Applied Mechanics, and Concrete Technology. The Materials and Concrete Technology laboratories, the Model Structures Laboratory, the Experimental Stress Analysis Laboratory and the Solid Mechanics Laboratory are at Kensington. The Structures Laboratory, which was formerly at Ultimo, is being re-established at King Street, Randwick in the vicinity of the Schools of Highway and Traffic Engineering.

The Department of Surveying has facilities for precise astronomical observation and for surveying computation, also a well-equipped Photogrammetrical Laboratory, all at Kensington. As well as the usual surveying equipment, it possesses modern electronic distance measuring equipment.

SCHOOL OF ELECTRICAL ENGINEERING

The School of Electrical Engineering comprises five departments — Communications, Control Engineering, Electric Power Engineering, Electronic Computation, and Solid State Electronics.

Each department carries out research in its own field and offers lecture and laboratory courses at the undergraduate and postgraduate levels. Subjects of common interest are provided by the School as a whole.

Special laboratories are equipped for work in the areas of Microwaves, Plasmas, Computer Control, Machines and Acoustics. A Measurements Laboratory provides a calibrating service under certificate from the National Association of Testing Authorities, and an I.B.M. 360/50 computer is installed in the School.

SCHOOL OF HIGHWAY ENGINEERING

Postgraduate courses are offered, leading to the degree of Master of Engineering Science and to a Postgraduate Diploma, in which road location and geometrics, properties of road materials, construction techniques, bridge design and traffic engineering are studied.

The School has well-equipped laboratories for studying the properties of soils, road aggregates, bitumen and cement concrete, and active studies on these subjects are in progress. Members of the school use a 1620 IBM computer as part of their course, and studies are being made of its utilization in all fields of highway engineering. They also have access to a 360/50 computer.

SCHOOL OF MECHANICAL AND INDUSTRIAL ENGINEERING

Full-time undergraduate courses leading to the degree of Bachelor of Engineering, and part-time, or combined full-time/part-time courses leading to the degree of Bachelor of Science (Technology) are offered in Mechanical, Industrial, and Aeronautical Engineering and in Naval Architecture.

Formal postgraduate courses of study are available, with wide selection of subjects, leading to the degree of Master of Engineering Science in Mechanical Engineering; there are special Master of Engineering Science courses in Refrigeration and Air Conditioning, and in Industrial Engineering; and the Department of Industrial Engineering within the School offers a course leading to a Graduate Diploma.

Research is carried out by members of the staff and by higher degree students, the particular fields of interest being Fluid Mechanics, Heat Transfer and Human Engineering. An Agricultural Engineering section, which is part of the University's Institute of Rural Technology, carries out endowed research within the School.

SCHOOL OF NUCLEAR ENGINEERING

The School of Nuclear Engineering offers a formal graduate course (M.Eng.Sc.) and accepts candidates for the ME and PhD degrees. Nuclear Engineering covers neutron and gamma transport theory, the analysis of the nuclear aspects of reactor performance, heat and fluid flow, heat removal processes, thermal

stress, steady state thermal performance and design, neutron kinetics, reactor and nuclear power system dynamics, and nuclear power system economics, selection and optimization. Digital computation is fundamental to the study of nuclear reactors, and particular attention is given to the efficiency of numerical techniques and the basic mathematical theory.

Research activities in the School include aspects of neutron transport theory, problems of heat flow and thermal stress associated with variable surface heat transfer, ball flow in a pebble bed reactor, reactor noise analysis and studies of nuclear and thermal random processes in nuclear power reactors.

SCHOOL OF TRAFFIC ENGINEERING

The School of Traffic Engineering is located at Randwick, and is associated with the School of Highway Engineering and the Institute of Highway and Traffic Research.

The establishment of the School followed the endowment of a Chair by the Australian Automobile Association, which had long been concerned with the need for a centre for training traffic engineers and specialists. The School is assisting this object by conducting courses in traffic and transport planning and control, and offering opportunities for research into the technical problems created by the tremendous growth in the use of the motor vehicle on the street and highway system, and also into its impact on other forms of transport and on land use activity.

The teaching philosophy is directed at the fundamental properties of Land Use and Transport, for it is only the joint interaction of the two that gives rise to traffic.

The research activities of the School cover a wide range of transport and traffic phenomena, viz.: traffic flow theory — queueing, traffic stream structure, saturation flow; transportation planning — land use and transport interaction, system parameters, synthetic models for growth, distribution and assignment of desire lines; public enterprise economics; and human factors and road safety. Research in these fields can be undertaken for the ME, MSc, and PhD degrees. Formal courses, one year full-time and two years part-time, leading to the degree of Master of Engineering Science are also offered in Transportation and Traffic Engineering.

GENERAL INFORMATION

ADMISSIONS OFFICE

The Admissions Office provides intending students (both local and overseas) with information regarding courses, admission requirements, and enrolment.

Applications for special admission or admission with advanced standing to courses should be made at the Admissions Office. Local residents should apply prior to 31st December of the year preceding that in which admission is sought. Where applicable, documentary evidence should be tendered with the application, and copies should accompany original documents, as this will allow the immediate return of the latter. Students applying from overseas for admission to undergraduate courses and to those postgraduate courses which require completion of formal lecture courses should lodge their applications prior to 1st October of the year preceding that in which admission is sought.

Applications for admission to undergraduate courses from students who do not satisfy the requirements for admission (see section on "requirements for admission"), from students seeking admission with advanced standing, and from students who have had a record of failure at another University, are referred by the Admissions Office to the Admissions Committee of the Professorial Board.

Students seeking to register as higher degree candidates should discuss their proposals initially with the Head of the School in which they wish to register. An application is then lodged on a standard form and the Admissions Office, after obtaining a recommendation from the Head of the School, refers the application to the appropriate Faculty or Board of Studies Higher Degree Committee.

The Admissions Office also receives applications from students who wish to transfer from one course to another, or seek any concession in relation to a course in which they are enrolled. These applications should, wherever possible, be lodged before the commencement of the academic year in which the concession is to apply.

Students wishing to resume their studies after an absence of twelve months or more are required to apply to the Admissions

Office for permission to re-enrol. It should be noted that, unless permission has been given to defer their studies for a specified period which will not normally exceed twelve months, students will be required to re-enter the course under the regulations prevailing at the time of resumption. This condition will apply also to students who have been re-admitted to a course after exclusion under the rules restricting students re-enrolling.

The Admissions Office operates an Enrolment Bureau for undergraduate students enrolling in the University for the first time. Details of the procedure to be followed by such students will be published in the preamble to the Higher School Certificate results or may be obtained on application to the Admissions Office.

The Admissions Office is located on the upper campus in the Chancellery, telephone 663-0351. Office hours are from 9 a.m. to 1 p.m., and 1.45 p.m. to 5 p.m. Monday to Friday. An evening service is provided during the enrolment period.

REQUIREMENTS FOR ADMISSION

Candidates may qualify for entry to undergraduate courses by complying with the matriculation requirements set out in Section A below, or by meeting the relevant requirements specified in Section B or, for 1968 only, by complying with the special matriculation requirements set out in Section C.

SECTION A

MATRICULATION REQUIREMENTS

(To operate from 1st January, 1968)

1. (a) A candidate for any first degree of the University must satisfy the conditions for admission set out hereunder before entering upon the prescribed course for a degree. Compliance with these conditions does not in itself entitle a student to enter upon a course.
   (b) A candidate who has satisfactorily met the conditions for admission and has been accepted by the University shall be classed as a "matriculated student" of the University after enrolment.
   (c) A person who has satisfactorily met the conditions for admission may be provided with a statement to that effect on the payment of the prescribed matriculation fee.
2. Except as elsewhere provided a candidate before being admitted to matriculation shall have passed at the required

standard the Higher School Certificate Examination in New South Wales in at least five subjects in accordance with the following conditions:

(a) The subjects shall be chosen from the following subjects taken at the first, second or third level, in the Higher School Certificate Examination:

A. English.

B. (i) French, German, Greek, Latin.
(ii) Ancient History, Art, Economics, Geography, Modern History, Music, Bahasa Indonesia, Chinese, Dutch, Hebrew, Italian, Japanese, Russian, Spanish or such other language as may, in the case of any particular candidate, be approved by the Professorial Board.

C. (i) Mathematics.
(ii) Agriculture, Science.

D. Industrial Arts (1967 & 1968 Higher School Certificate Examinations only).

(b) The subjects shall include:—
(i) English,
(ii) four subjects at the first or second level, and,
(iii) one subject chosen from each of the Groups B and C and of these two subjects at least one must be from Section (i) of either Group B or Group C at the first or second level.

(c) The subjects shall NOT include both Art and Music.

3. Mathematics and Science both passed as full courses together shall, for the purpose of matriculation, be counted as three subjects, but otherwise each shall count as one subject.

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

5. In addition to the above requirements a candidate for admission to any particular faculty, course or subject shall satisfy the special requirements, if any, pertaining to that faculty, course or subject as set out in the following Schedule A. Where these additional requirements are not satisfied at the same examination as the requirements listed in paragraph 2 they may be met at a separate examination.

6. (a) Notwithstanding the provisions of Clauses 2, 3 and 5 of these requirements, any candidate who has taken the Higher School Certificate Examination in the subject of English and no fewer than any four other subjects named in Clause 2, at any level, may be admitted to

matriculation provided he has reached a standard determined from time to time by the Professorial Board.*

(b) Mathematics and Science both taken as full courses together shall, for the purpose of this clause, be counted as three subjects.

(c) A candidate qualifying for matriculation under this clause may also be admitted to a particular faculty, course or subject provided:—

(i) he satisfies the special requirements pertaining to that faculty, course or subject as set out in the following Schedule A, or

(ii) the Professorial Board* deems that his programme of studies for, and his performance at, the Higher School Certificate Examination constitute an adequate preparation for his admission to the particular faculty, course or subject.

Schedule A

ADDITIONAL FACULTY, COURSE AND SUBJECT REQUIREMENTS IN TERM OF CLAUSE 5

(a) Faculty Requirements

Applied Science, Medicine, Engineering, Science

Passes in **Mathematics** and **Science** at the first or second level full course.

Architecture

Passes in **Mathematics** at the first or second level full course and in **Science** at the first or second level full course or second level short course provided that the **Physics** option has been taken in the short course.

Commerce

Passes in **English** at the first or second level and **Mathematics** at the first or second level full course or second level short course.

Arts

Pass in **English** at the first or second level.

(b) Course Requirements

Industrial Arts (B.Sc. and B.Sc. (Tech.)), and Sheep and Wool Technology (Education Option) (B.Sc.).

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* See page 27 for Professorial Board's decision on these matters.

Passes in **Science** at the first or second level full course and in **Mathematics** at the first or second level full or short course provided that a student electing to include the subject **Mathematics I** in his University course shall have passed **Mathematics** at the first or second level full course.

Social Work (B.Soc.Wk.). As For Faculty of Arts

(c) Subject Requirements

French I

Pass in **French** at the first or second level.

German I

Pass in **German** at the first or second level or pass in **Introductory German.**

Introductory German, Introductory Spanish or Preliminary Italian.

Pass in any other **foreign language** at the first or second level.

Economics II or Economics III.

Passes in **English** at the first or second level and **Mathematics** at the first or second level full course or second level short course.

Mathematics I

Pass in **Mathematics** at the first or second level full course.

Geology I

Pass in **Science** at the first or second level full course.

Chemistry I, Physics I or General and Human Biology

Passes in **Mathematics** and **Science** at the first or second level full course.

SECTION B

SUPPLEMENTARY PROVISIONS FOR MATRICULATION

1. Notwithstanding the provisions of Section A above, candidates may be accepted as "matriculated students" of the University under the following conditions subject to the approval of the Professorial Board:—
   (a) Any person who holds a diploma from the New South Wales Department of Technical Education, or any other Technical College which may from time to time be recognised by the University, may be admitted to the University as a "matriculated student" with such status

as the Board may determine, provided that, in the opinion of the Board, the applicant's qualifications are sufficient for matriculation to the Faculty nominated.

(b) The Board may admit as a "matriculated student" in any Faculty with such status as the Board may determine in the circumstances;

(i) A graduate of any approved University.

(ii) An applicant who presents a certificate from a University showing that he has a satisfactory record and is qualified for entrance to that University, provided that in the opinion of the Board there is an acceptable correspondence between the qualifying conditions relied upon by the applicant and conditions laid down for matriculation to the nominated Faculty of the University of New South Wales.

(c) (i) Any person who has completed the first year of the course at the Royal Military College of Australia and submits a certificate from the Commandant to that effect may be admitted as a "matriculated student" of the University.

(ii) Any person who has completed a full course of at least three years' prescribed study at the Royal Military College of Australia and produces a certificate from the Commandant to that effect may be admitted as a "matriculated student" of the University with such status as the Board may determine.

(d) Any person who had completed satisfactorily the passing out examination of the Royal Australian Naval College and submits a certificate from the Commanding Officer may be admitted as a "matriculated student" of the University.

(e) (i) Any person who has completed the first year of the course at the Royal Australian Air Force College and submits a certificate from the Commandant to that effect, may be admitted as a "matriculated student" of the University.

(ii) Any person who has completed two years of the course at the Royal Australian Air Force College and submits a certificate from the Commandant to that effect, may be admitted as a "matriculated student" of the University with such status as the Board may determine.

(f) An applicant who presents a certificate from another University showing that he is qualified for entrance to that University and setting out the grounds of such qualification, provided that in the opinion of the Professorial Board, there is an acceptable correspondence between the qualifying conditions relied upon by the applicant and the conditions laid down for matriculation to the nominated Faculty of the University of New South Wales.

2. (a) The Professorial Board may in special cases, including cases concerning persons of other than Australian education, declare any person qualified to enter a Faculty as a "provisionally matriculated student" although he has not complied with the requirements set out above, and in so doing may prescribe the completion of certain requirements before confirming the person's standing as a "matriculated student". Students who satisfactorily complete these requirements will be permitted to count the courses so passed as qualifying for degree purposes.*

(b) Persons over the age of twenty-five years may be admitted to provisional matriculation status provided that:—

(i) they have satisfactorily completed an approved course of systematic study extending over at least three years after passing the School Certificate Examination or

(ii) they satisfy the Professorial Board that they have reached a standard of education sufficient to enable them profitably to pursue the first year of the proposed course.

(c) Any applicant for provisional status may be required to take such examination as the Professorial Board may prescribe before such status is granted.

3. The Professorial Board may at its discretion permit a person, who does not satisfy the requirements for admission, to attend lectures in a subject or subjects at the University, on payment of the prescribed fees provided that such person shall not necessarily have the privileges of "matriculated students" and shall not be eligible to proceed to a degree.

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* The Professorial Board has determined that normally confirmation of standing as a "matriculated student" will require the successful completion of not less than half the normal programme in the first year of enrolment.

SECTION C

SPECIAL MATRICULATION REQUIREMENTS TO OPERATE IN 1968 ONLY

(Determinations of the Professorial Board in terms of Clause 6 of the normal requirements as set out in Section A above)

The Professorial Board has determined that, for 1968 only,

(a) a candidate who qualifies by means of the 1967 Higher School Certificate examination to matriculate in any other university in New South Wales or in the Australian National University shall be deemed to have qualified to matriculate in the University of New South Wales under the provisions of Clause 6 of the matriculation requirements set out in Section A above.

(b) a candidate who achieves at the 1967 Higher School Certificate Examination a standard acceptable to the Professorial Board in English and any four other subjects approved for matriculation purposes shall be deemed to have qualified to matriculate in the University of New South Wales under the provisions of Clause 6 of the matriculation requirements set out in Section A above. For this purpose Mathematics and Science both taken as full courses shall count as three subjects.

(c) the special requirements pertaining to entry to a particular faculty, course or subject, referred to in Clause 6 of Section A, shall be as set out in Schedule B.

Schedule B

SPECIAL FACULTY, COURSE OR SUBJECT REQUIREMENTS IN TERMS OF CLAUSE 6 OF THE NORMAL REQUIRMENTS AS SET OUT IN SECTION A ABOVE (TO OPERATE ONLY IN 1968)

(a) Faculty Requirements

APPLIED SCIENCE, ENGINEERING, MEDICINE AND SCIENCE

Passes in Science at the second level short course or higher AND in Mathematics either at the second level full course or higher or *at the second level short course at a standard acceptable to the Professorial Board.*

ARCHITECTURE

Passes in Mathematics at the second level short course or higher AND in Science, at the second level short course or higher.

COMMERCE

Passes in Mathematics at the second level short course or higher AND in English at either the second level or higher or *at the third level at a standard acceptable to the Professorial Board.*

ARTS

A pass in English at the second level or higher, or a pass at the third level *at a standard acceptable to the Professorial Board.*

(b) Course Requirements

(Courses under the control of the Board of Vocational Studies)

SOCIAL WORK COURSE (Bachelor of Social Work)

As for Faculty of Arts.

INDUSTRIAL ARTS COURSE (B.Sc. and B.Sc. (Tech.)) and SHEEP AND WOOL TECHNOLOGY (EDUCATION OPTION) COURSE (B.Sc.)

As for Faculties of Applied Science, Engineering, Medicine and Science.

(c) Subject Requirements

10.011 HIGHER MATHEMATICS I	A pass in Mathematics at the second level full course or higher.
10.001 MATHEMATICS I	A pass in Mathematics *at the second level short course at a standard acceptable to the Professorial Board.*
10.021 MATHEMATICS IT	A pass in Mathematics at the second level short course.
PHYSICS I CHEMISTRY I GENERAL AND HUMAN BIOLOGY GEOLOGY I	As for Faculties of Applied Science, Engineering, Medicine and Science.
ECONOMICS II ECONOMICS III	As for Faculty of Commerce.
FRENCH I	A pass in French at second level or higher.
GERMAN I	Pass in German at second level or higher or in Introductory German.
INTRODUCTORY GERMAN INTRODUCTORY SPANISH PRELIMINARY ITALIAN	Pass in any other foreign language at second level or higher.

NOTE: Candidates who depend for matriculation on a pass in a subject "at a standard acceptable to the Professorial Board" (indicated in italics throughout the above statement may ascertain whether they have satisfied this standard by **written** application to the Registrar which must be lodged not later than 22nd January 1968.

ENROLMENT PROCEDURE

First Enrolments. Application for enrolment in first year must wherever possible be made in person to the Student Enrolment Bureau, Unisearch House, 221 Anzac Parade, Kensington, as soon as the results of the Higher School Certificate Examination are published, but in any event not later than 22nd January.

Country residents who wish to enrol with the University should write to the Registrar, P.O. Box 1, Kensington, for a form on which to make their preliminary application. This form must be returned not later than 22nd January.

New students complete their enrolment at a specified appointment time in the second week before the start of First Term. Fees must be paid on the day of the appointment. However, in special circumstances and provided class places are still available students may be accepted for enrolment after the prescribed week subject to the payment of a late fee.

Applicants for enrolment with advanced standing or applicants relying on overseas examinations for matriculation should lodge an application with the Admissions Office prior to 1st October of the year preceding that in which admission is sought.

First Year Repeats. First Year students who fail all subjects at the annual examinations and who are not granted any deferred examinations must apply for re-enrolment to the Student Enrolment Bureau at the time set out above for First Enrolments. Other first year repeat students follow the procedure set out below for Later Year Enrolments.

Later Year Enrolments. All students enrolling other than for the first time should enrol through the appropriate School and bring with them their notification of examination results for the previous year. This enrolment must be effected before or during the week before the commencement of First Term in accordance with the special arrangements made by the individual Schools. However, Medical students in the third and later years of their course enrol earlier since their academic year commences in advance of the normal commencement date.

Miscellaneous Subject Enrolments. Students may be permitted to enrol for miscellaneous subjects (i.e. as students not proceeding to a degree or diploma) provided the Head of the School offering the subject considers it will be of benefit to the student and there is accommodation available. Only in exceptional cases will subjects taken in this way count towards a degree or diploma. Where a student is under exclusion he may not be enrolled in miscellaneous subjects unless given approval by the Professorial Board.

Students who have completed the final examinations but have a thesis still outstanding are required to enrol for the period necessary to complete the thesis and to pay the requisite fees.

Course details must be completed during the prescribed Enrolment Week. For details of fee requirements, including late fee provisions, see under Fees.

Final Dates for Enrolment. No enrolments will be accepted from **new students** after the end of the second week of term (15th March, 1968) except with the express approval of the Registrar and the Head of the School concerned; no **later year enrolments** will be accepted after 31st March without the express approval of the Registrar which will be given in exceptional circumstances only.

UNIVERSITY UNION CARD

All students other than miscellaneous students are issued with a University Union membership card. This card must be carried during attendance at the University and shown on request.

The number appearing on the front of the card in the space at the top right-hand corner is the student registration number used in the University's records. This number should be quoted in all correspondence.

The card must be presented when borrowing from the University libraries, when applying for travel concessions and when notifying a change of address. It must also be presented when paying fees on re-enrolment each year when it will be made valid for the year and returned. Failure to present the card could result in some inconvenience in completing re-enrolment.

A student who loses a Union card must notify the University Union as soon as possible.

New students will be issued with University Union cards by mail to their term address as soon as possible after fee payment. In the meantime, the fees receipt form should be carried during attendance at the University and shown on request. If the Union card is not received within three weeks of fee payment, the University Union should be notified.

FEES *

COURSE FEES

Where course fees are assessed on the basis of term hours of attendance the hours for each subject for purposes of fee assessment shall be those prescribed in the Calendar, irrespective of any variation from the prescribed hours which may be necessary in conducting the subject.

Fee determination for courses in the Faculty of Engineering is on a term basis. A full-time course fee will be charged for any term where more than 15 hours' per week instruction, etc., is involved.

(i) Full-time Course Fee (more than 15 hours' attendance per week)—$110 per term.
In courses in which the Third Term is limited to five weeks of formal studies the fee for this term is $55.

(ii) Part-time Course Fee—over 6 hours and up to 15 hours' attendance per week—$55 per term.

(iii) Part-time Course Fee—6 hours' or less attendance per week—$28 per term.

(iv) Course Continuation Fee—A fee of $23 per annum (no term payment) is payable by:
(a) students who have once been enrolled for a thesis and have only that requirement outstanding, *or*
(b) students given special permission to take annual examinations without attendance at the University.
(Students in this category are not required to pay the subscriptions to the University Union, the Students' Union, the Sports Association and the Library Fee.)

OTHER FEES

In addition to the course fees set out above all registered undergraduates will be required to pay:

Matriculation Fee — $7 — payable at the beginning of first year.

Library Fee — annual fee — $12.

University Union — $20 — entrance fee.

*** Fees quoted are current at time of publication. The Council reserves the right to alter them at any time.**

Student Activities Fees:

University Union*	— $12	— annual subscription.
Sports Association*	— $2	— annual subscription.
Students' Union*	— $4	— annual subscription.
Miscellaneous	— $10	— annual fee.

Graduation or Diploma Fee — $7 — payable at the completion of the course.

Depending on the course being taken, students may also be required to pay:

Applied Psychology Kit Hiring Charge — $2 per kit. Additional payment for breakages and losses in excess of $1.

Biochemistry Kit Hiring Charge — $4 per kit. Additional charge for breakages and losses in excess of $1 may be required.

Chemistry Kit Hiring Charge — $4 per kit. Additional charge for breakages and losses in excess of $1 may be required.

Excursion Fee — $2 per subject (biology, botany, zoology, entomology).†

Anatomy Dissection Manual and Histology Slides deposit — $10 (refundable on return in satisfactory condition).

Pathology Instrument Kit — $10 (refundable on return in satisfactory condition).

SPECIAL EXAMINATION FEES

Deferred examination — $5 for each subject.

Examinations conducted under special circumstances — $7 for each subject.

Review of examination result — $7 for each subject.

LATE FEES

First Enrolments

Fees paid at the late enrolment session and before the commencement of term	$6
Fees paid during the 1st and 2nd weeks of term	$12
Fees paid after the commencement of the 3rd week of term with the express approval of the Registrar and Head of the School concerned	$23

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* Life members of these bodies are exempt from the appropriate fee or fees.

† Students in the original Applied Biology degree course pay an excursion fee of $1 per subject for Botany, Zoology and Entomology.

Re-Enrolments

First Term

Failure to attend enrolment centre during enrolment week	$6
Fees paid after the commencement of the 3rd week of term to 31st March	$12
Fees paid after 31st March where accepted with the express approval of the Registrar	$23

Second and Third Terms

Fees paid in 3rd and 4th weeks of term	$12
Fees paid thereafter	$23
Late lodgement of Application for Admission to Examinations (late applications will be accepted for three weeks only after the prescribed dates)	$5

WITHDRAWAL FROM COURSE

Students withdrawing from a course are required to notify the Registrar in writing. Fees for the course accrue until a written notification is received.

Where notice of withdrawal from a course is received by the Registrar before the first day of First Term a refund of all fees paid other than the matriculation fee will be made.

Where a student terminates for acceptable reasons a course of study before half a term has elapsed, one half of the term's fee may be refunded. Where a student terminates a course of study after half a term has elapsed, no refund may be made in respect of that term's fees.

The Library fee is an annual fee and is not refundable where notice of withdrawal is given after the commencement of First Term.

On notice of withdrawal a partial refund of other fees is made on the following basis:

University Union Entrance Fee — refund details are available from the Warden.

University Union — $2 in respect of each half term.

University of New South Wales Students' Union — where notice is given prior to the end of the fifth week of first term $2, thereafter no refund.

University of New South Wales Sports Association — where notice is given prior to 30th April a full refund is made, thereafter no refund.

Miscellaneous — where notice is given prior to 30th April $5.

PAYMENT OF FEES

Completion of Enrolment

All students are required to attend the appropriate enrolment centre during the prescribed enrolment period* for authorization of course programme. Failure to do so will incur a late fee of $6.

First year students (including students repeating first year) must complete enrolment (including fee payment) before they are issued with class timetables or permitted to attend classes. A first year student who has been offered a place in a course to which entry is restricted and fails to complete enrolment (including fee payment) at the appointed time may lose the place allocated.

Fees should be paid during the prescribed enrolment period but will be accepted without incurring a late fee during the first two weeks of First Term. (For late fees see below.) No student is regarded as having completed an enrolment until fees have been paid. Fees will not be accepted (i.e., enrolment cannot be completed) from new students after the end of the second week of term (i.e. 15th March, 1968) and after 31st March from students who are re-enrolling, except with the express approval of the Registrar, which will be given in exceptional circumstances only.

Payment of Fees by Term

Students who are unable to pay their fees by the year may pay by the term, in which case they are required to pay first term course fees and other fees for the year, within the first two weeks of First Term. Students paying under this arrangement will receive accounts from the University for Second and Third Term fees. These fees must be paid within the first two weeks of each term.

Assisted Students

Scholarship holders or Sponsored Students who have not received an enrolment voucher or appropriate letter of authority from their sponsor at the time when they are enrolling should complete their enrolment paying their own fees. A refund of fees will be made when the enrolment voucher or letter of authority is subsequently lodged with the Cashier.

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* The enrolment periods for Sydney students are prescribed annually in the leaflets "Enrolment Procedure for New Students" and "Enrolment Procedure for Students Re-enrolling".

Extension of Time

Any student who is unable to pay fees by the due date may apply in writing to the Registrar for an extension of time. Such application must give year or stage, whether full-time or part-time, and the course in which the applicant wishes to enrol, state clearly and fully the reasons why payment cannot be made and the extension sought, and must be lodged before the date on which a late fee becomes payable. Normally the maximum extension of time for the payment of fees is until 31st March for fees due in First Term and for one month from the date on which a late fee becomes payable in Second and Third Terms.

Where an extension of time is granted to a first year student in First Term, such student may only attend classes on the written authority of the Registrar, but such authority will not normally be given in relation to any course where enrolments are restricted.

Failure to Pay Fees

Any student who is indebted to the University and who fails to make a satisfactory settlement of his indebtedness upon receipt of due notice ceases to be entitled to membership and privileges of the University. Such a student is not permitted to register for a further term, to attend classes or examinations, or to be granted any official credentials.

No student is eligible to attend the annual examinations in any subject where any portion of his course fees for the year is outstanding after the end of the fourth week of Third Term (27th September, 1968).

In very special cases the Registrar may grant exemption from the disqualification referred to in the two preceding paragraphs upon receipt of a written statement setting out all relevant circumstances.

Cashier's Hours

The cashier's office is open for the payment of fees from 9.30 a.m. to 1.00 p.m., and from 2.00 p.m. to 4.30 p.m. Monday to Friday. It is open for additional periods during the first three weeks of each term.

RULES RELATING TO STUDENTS

GENERAL CONDUCT

Acceptance as a member of the University implies an undertaking on the part of the student to observe the regulations, by-laws and other requirements of the University, in accordance with the declaration signed at the time of the enrolment.

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

ATTENDANCE AT CLASSES

Students are expected to be regular and punctual in attendance at all classes in the course or subject in which they are enrolled. All applications for exemption from attendance at lectures or practical classes must be made in writing to the Registrar.

Where a student has failed a subject at the annual examinations in any year and re-enrols in the same course in the following year, he must include in his programme of studies for that year the subject in which he has failed. This requirement will not be applicable if the subject is not offered the following year; is not a compulsory component of a particular course; or if there is some other cause, which is acceptable to the Professorial Board, for not immediately repeating the failed subject.

COURSE TRANSFERS

Students wishing to transfer from one course to another (including transfer from full-time to part-time study or vice versa) must make application to the Admissions Office as soon as possible and preferably before Enrolment Week. The Admissions Office will give each applicant an acknowledgement of his application to transfer.

Having made application to the Admissions Office students transferring are required to attend the School Enrolment Centre at the time set down for the year/stage of the new course in which they expect to enrol. They must present the letter granting approval of the transfer to the enrolling officer.

Students who have not received a letter granting approval to the transfer before the date on which they are required to enrol

must present their acknowledgement to the enrolling officer who will decide whether to permit them to attend classes provisionally in the new course. Students who are permitted to attend classes provisionally should not pay fees until they have received their letter granting formal approval to transfer.

CHANGES IN COURSE PROGRAMMES AND WITHDRAWAL FROM SUBJECTS

Students seeking approval for variation of enrolment programme or seeking to withdraw from subjects must make application to the Head of the School responsible for the course on a form available from school offices. The Registrar will inform students of the decision. Approval of withdrawal from subjects is not automatic each application being determined after considering the circumstances advanced as justifying withdrawal. It should be noted that withdrawal from a subject or course after Term I will not be approved unless there are special circumstances. It is emphasized that failure to sit for the examination in any subject for which a student has enrolled is regarded as failure to pass that examination unless written approval to withdraw has been given by the Registrar.

RESUMPTION OF COURSES

Students wishing to resume their studies after an absence of twelve months or more are required to apply to the Admissions Office for permission to re-enrol. Students re-enrolling in this way will normally be required to satisfy conditions pertaining to the course at the time of re-enrolment. This condition applies also to students who have been re-admitted to a course after exclusion under the rules restricting students re-enrolling.

ANNUAL EXAMINATIONS

The annual examinations take place in November-December for students in thirty-week courses, and in September for students in twenty-one and twenty-four week courses. Timetables showing time and place at which individual examinations will be held are posted on the central notice boards. Misreading of the timetable is not an acceptable excuse for failure to attend an examination. Examination results are posted to the term addresses of students. No results will be given by telephone.

All students (including students enrolled for a thesis only) must lodge an application for admission to examinations by 19th July, 1968.

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The Accountant is authorized to receive application forms during the three weeks immediately following the prescribed closing dates if they are accompanied by a late fee of $5. Applications forwarded more than three weeks after the closing date will not be accepted except in very exceptional circumstances and with the approval of the Registrar. Where an application is not accepted the student concerned is not eligible to sit for the examination.

Applications lodged prior to the due date will be acknowledged by postcard. Students who do not receive an acknowledgement within ten days of lodging the application should contact the Examinations Branch or the office of the college attended.

As a result of the application of machine methods to the processing of examination results, all students in Sydney, Wollongong and Broken Hill receive a pro-forma application for admission to examinations listing the subjects for which the student has formally enrolled. The return of this pro-forma duly completed constitutes the application for admission to examinations. Pro-forma applications will be posted to students on 30th June. Any student who does not receive a pro-forma application must contact the Examinations Branch prior to the date prescribed for the return of applications.

DEFERRED EXAMINATIONS

Deferred examinations may be granted in the following cases:

(i) When a student through illness or some other acceptable circumstance has been prevented from taking the annual examination or has been placed at a serious disadvantage during the annual examinations.

(ii) To help resolve a doubt as to whether a student has reached the required standard in a subject.

Applications for deferred examinations in the first category must be lodged with the Registrar with appropriate evidence of the circumstances (e.g., medical certificate) not later than seven days after the examination concerned.

A student eligible to sit for a deferred examination must lodge with the Accountant an application, accompanied by the fee of $5 per subject, by the date indicated on the notification of results.

APPLICATION FOR ADMISSION TO DEGREE OR DIPLOMA

Applications for admission to a degree or diploma of the University must be made on the appropriate form by 31st January. Applicants should ensure that they have completed all requirements for the degree or diploma, including industrial training where necessary.

RESTRICTION UPON STUDENTS RE-ENROLLING

The University Council has adopted the following rules governing re-enrolment with the object of requiring students with a record of failure to show cause why they should be allowed to re-enrol and retain valuable class places. These rules will be applied retrospectively from January, 1962.

(i) As from 1st January, 1962, a student shall show cause why he should be allowed to repeat a subject in which he has failed more than once. (Failure in a deferred examination as well as in the annual examination counts, for the purpose of this regulation, as one failure.) Where such subject is prescribed as a part of the student's course he shall be required to show cause why he should be allowed to continue the course. A student in the medical course shall show cause why he should be allowed to repeat the second year of the course if he has failed more than once to qualify for entry to the third year.

(ii) Nothwithstanding the provisions of Clause (i), a student shall be required to show cause why he should be allowed to continue a course which he will not be able to complete in the time set down in the following schedule:

Number of years in course	Total time allowed from first enrolment to completion (years)
3	5
4	6
5	8
6	9
7	11
8	12

(iii)* No full-time student shall, without showing cause, be permitted to continue a course unless all subjects of the first year of his course are completed by the end of his second year of attendance. No student in the Faculty of Arts shall, without showing cause, be permitted to continue a course unless he completes four subjects, one of which must be from Group VII, by the end of his second year of attendance.

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* Rule (iii) in so far as it relates to students in the Faculty of Arts will apply retrospectively as from the 1st January. 1967, and in so far it relates to students in the Faculty of Medicine, will apply to students enrolling for the first time in 1967 or thereafter.

No part-time student shall, without showing cause, be permitted to continue a course unless all subjects of the first two stages of his course are completed by the end of his fourth year of attendance and all subjects of the third and fourth stages of his course by the end of his seventh year of attendance. No student in the Faculty of Medicine shall, without showing cause, be permitted to continue with the medical course unless he completes the second year of the course by the end of his third year of attendance, and the third year of the course by the end of his fourth year of attendance.

(iv) A student who has a record of failure in a course at another University shall be required to show cause why he should be admitted to this University. A student admitted to a course at this University following a record of failure at another University shall be required to show cause, notwithstanding any other provisions in these rules, why he should be permitted to continue in that course if he is unsuccessful in the annual examinations in his first year of attendance at this University.

(v) Any student excluded under any of the Clauses (i)-(iii) may apply for re-admission after two academic years and such application shall be considered in the light of any evidence submitted by him.

(vi) A student wishing "to show cause" under these provisions shall do so in writing to the Registrar. Any such application shall be considered by the Professorial Board, which shall determine whether the cause shown is adequate to justify his being permitted to continue his course or re-enrol as the case may be.

(vii) The Vice-Chancellor may on the recommendation of the Professorial Board exclude from attendance in a course or courses any student who has been excluded from attendance in any other course under the rules governing re-enrolment and whose record at the University demonstrates, in the opinion of the Board and the Vice-Chancellor, the student's lack of fitness to pursue the course nominated.

(viii) A student who has failed, under the provisions of Clause (vi) of these rules, to show cause acceptable to the Professorial Board why he should be permitted to continue in his course, and who has subsequently been permitted to re-enrol in that course or to transfer to another course, shall also be required to show cause, notwithstanding any other provisions in these rules, why he

should be permitted to continue in that course if he is unsuccessful in the annual examinations immediately following the first year of resumption or transfer of enrolment as the case may be.

(ix) A student may appeal to an Appeals Committee, constituted by Council for this purpose, against his exclusion by the Professorial Board from any subject or course.

RE-ADMISSION AFTER EXCLUSION

Applications for re-admission must be made on the standard form and lodged with the Registrar not later than 30th June of the year prior to that for which re-admission is sought. An application should include evidence of appropriate study in the subjects (or equivalents) on account of which the applicant was excluded. In addition, evidence that the circumstances which were deemed to operate against satisfactory performance at the time of exclusion are no longer operative or are reduced in intensity should be furnished. An applicant may be required to take the annual examinations in the relevant subjects as qualifying examinations in which case re-admission does not imply exemption from the subject.

It should be noted that a person under exclusion may not be enrolled in miscellaneous subjects unless he has received the approval of the Professorial Board.

Persons who intend applying for re-admission to the University at a future date may seek advice as to ways in which they may enhance their prospects of qualifying for re-admission. Enquiries should be made on a form obtainable from the Examinations Branch, and lodged with the Registrar.

OWNERSHIP OF STUDENTS' WORK

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

CHANGE OF ADDRESS

Students are requested to notify the Registrar in writing of any change in their address as soon as possible. Failure to do this could lead to important correspondence or course information not reaching the student. The University cannot accept responsibility if official communications fail to reach a student who has not notified the Registrar of a change of address.

NOTICES

Official University notices are displayed on the notice boards and students are expected to be acquainted with the contents of those announcements which concern them.

LOST PROPERTY

All enquiries concerning lost property should be made to the Chief Steward on Extension 2503 or to the Lost Property Office at the Union.

PARKING WITHIN THE UNIVERSITY GROUNDS

Because of the limited amount of parking space available, only senior undergraduates (full-time students who have completed three years of their course and part-time students who have completed four years of their course) and postgraduate students may apply for parking permits. Applications should be made to the Property Section (Bursar's Division). It should be noted that increasing demand for parking space may require the imposition of further restrictions.

APPLICATION OF RULES

General

Any student who requiries information on the application of these rules or any service which the University offers may make inquiries from the Admissions Office, the Student Counselling Centre or the Registrar.

Appeals

Section 5(c) of Chapter III of the By-laws provides that "Any person affected by a decision of any member of the Professorial Board (other than the Vice-Chancellor) in respect of breach of discipline or misconduct may appeal to the Vice-Chancellor, and in the case of disciplinary action by the Vice-Chancellor, whether on appeal or otherwise, to the Council".

STUDENT SERVICES

THE LIBRARY

The University Library is on the upper campus and adjacent to the Chancellery and the Arts and Commerce buildings. The Bio-Medical Library is in the Biological Sciences building with a branch at Prince Henry Hospital ('Phone: 661-0111). There are also branches at Broken Hill and Wollongong.

THE UNIVERSITY UNION

The University Union is a common meeting ground for all students. Eating and general recreational facilities are available as well as a shop for stationery and other student requisites, branches of several banks, a pharmacy, branch of Anthony Horderns, and hairdressing facilities. Membership is compulsory for all registered students. The headquarters of the Union is located in the new Union Building, which is adjacent to the circular building near Anzac Parade.

STUDENT ACCOMMODATION

Residential Colleges

Accommodation for students is provided within the complex of the Residential Colleges of the University which comprises Basser College, Goldstein College, Philip Baxter College and Post-Graduate Hall. The College complex houses 500 men and women students, as well as staff members. Tutors in residence provide tutorial assistance in a wide range of subjects.

Board and residence fees, which are payable on a term basis, amount to $18.50 per week. Intending students should apply in writing to the Master, Box 24, Post Office, Kensington, N.S.W. 2033, from whom further information is available.

Other Accommodation

Students requiring other than Residential College accommodation may make personal application to the Student Amenities Unit for assistance in obtaining suitable lodgings at recognised boarding houses, private homes, and in serviced and unserviced apartments. To accommodate the needs of the individual student it is essential that a personal interview be arranged with an officer of the Amenities Service.

STUDENT AMENITIES UNIT

The Student Amenities Service was established to promote the physical, social and educational development of students through their leisure time activities.

The Amenities Service, working in close liaison with the Sports Association and the University authorities, assists various recognised clubs by arranging and providing facilities essential to their general development, and by handling on their behalf all inquiries and applications for membership.

Concession Fares

Application forms for travelling concessions may be obtained at the Inquiry Office in the Chancellery, or at the Amenities Service Offices, Kensington.

Omnibus: *Concessions are available to*:

(a) students under 18 years of age irrespective of whether they are employed or receive income or remuneration,
(b) students between 18 and 30 years of age who are not in employment or in receipt of any income or remuneration.

NOTE: Income or remuneration includes allowances paid to Colombo Plan students, Public Service trainees, etc., but does not include allowances paid to holders of Commonwealth Scholarships or Scholarships granted by the State Bursary Endowment Board.

Train:

(a) Periodical tickets are available during term time to full-time students not in employment or in receipt of any remuneration.
(b) Vacation travel concessions are available to students qualifying under (a) above.

Ferry: Concession fares are available for travel on ferries controlled by the Port Jackson & Manly Steamship Co. Ltd. and Sydney Harbour Ferries Pty. Ltd. All applicants must be registered full-time students under the age of 21 years.

Aircraft: Concession fares for travel overseas, interstate and intrastate are available under the conditions ruling for the various operating companies.

Location

The Student Amenities Service at Kensington is located opposite the Basser College end of the new Electrical Engineering building ('Phone: 663-0351, Ext. 2235).

STUDENT EMPLOYMENT UNIT

Assistance is offered in finding vacation employment, giving course-related experience, or industrial training where this is a course requirement. Casual employment and odd jobs, full-time employment for evening students, and permanent employment after graduation. This service is located in the Chancellery on the ground floor.

CHAPLAINCY SERVICE

The Service is provided for the benefit of students and staff by five Christian Churches (Anglican, Roman Catholic, Methodist, Baptist, Churches of Christ) and by the Jewish congregation. Chaplains are in attendance at the University at regular times.

STUDENT HEALTH UNIT

Director: M. A. Napthali, MB BS, *Syd.*

A student health and first aid centre is situated within the University, staffed by a qualified medical practitioner and a nursing sister.

The centre is located in hut "E" on the northern side of the campus, adjacent to Basser College. The service is available to enrolled students, free of charge, between 9 a.m. and 5 p.m. Monday to Friday, and during term from 6 p.m. to 8 p.m. Tuesday and Thursday.

The medical service is diagnostic, and in most instances therapeutic, but it is not intended to replace private or community health services. Thus, where chronic or continuing conditions are revealed or suspected, the student will be advised and may be referred to his own doctor or to an appropriate hospital for specialist opinion and treatment. The health service is not responsible for fees incurred in these instances.

The service is confidential and students are encouraged to attend the centre for advice on all matters pertaining to health.

Appointments may be arranged by calling at the centre or by telephoning 663-0351, extension 2679.

STUDENT COUNSELLING AND RESEARCH UNIT

Prospective students seeking advice or guidance regarding the selection and planning of courses (particularly in relation to a career), or advice regarding their suitability for a particular course, are invited to consult the University Student Counselling and Research Unit. Appointments may be made by telephone (663-0351, extensions 2600 to 2605).

In addition to its counselling service, the Unit provides a variety of study skills programmes throughout the year, on a group or individual basis. Programmes offered in the past have included Reading Improvement, Study Methods, Written Expression, Note Taking, Studying Mathematics, Improving Listening, Preparing for Statistics.

STUDENT LOAN FUND

The Students' Union and the University have co-operated to provide assistance to students who are in financial difficulties which are considered likely to prejudice their progress with their studies.

Three forms of assistance are available. In the first, the University considers, in certain circumstances, deferment of the payment of fees; this scheme is not intended to replace the established procedure for granting deferment for short periods but rather to supplement it by making deferment over longer periods possible. Secondly, students in need may receive a cash loan not exceeding $200 from the Student Loan Fund established from contributions made by the Students' Union and the University. Thirdly, a Students' Union donation of $1,000 has made possible urgent cash loans not exceeding $50 for a period of one month.

In all cases assistance is limited to students with reasonable academic records and whose financial circumstances warrant loans. Students granted assistance of either kind are required to give an undertaking to repay the loan under the conditions agreed upon.

Applications are made personally to Mr. J. B. Rowe, Deputy Registrar (Student Services).

UNIVERSITY CO-OPERATIVE BOOKSHOP LTD.

Membership is open to all students, on payment of a fee of $5, refundable when membership is terminated. Members receive an annual rebate on purchases of books.

LOCATION OF SCHOOLS, LABORATORIES AND ADMINISTRATIVE DIVISION

The Schools and Laboratories of the Faculty of Engineering, the servicing schools and the administrative division are located as follows:

(i) Kensington

The Schools of Civil, Electrical and Mechanical and Industrial Engineering; the School of Nuclear Engineering; the servicing Schools of Physics, Architecture, Mathematics, Mining Engineering Applied Geology, Metallurgy,

Chemistry and Biological Sciences; the Department of General Studies, which provides the Humanities and Social Science subjects for engineering students.

In addition to the teaching schools, there are at Kensington the Library, the Examinations Branch, the Admissions Office, the Union, the Students' Union, the Student Amenities Unit and the Student Counselling Unit.

(ii) Broadway

The Structures Laboratory of the School of Civil Engineering, which is being moved to Randwick.

(iii) Randwick

The Schools of Highway and Traffic Engineering occupy new buildings on the site of the old Tramway Depot at King Street, Randwick.

(iv) Manly Vale

The Water Research Laboratory of the School of Civil Engineering.

UNDERGRADUATE SCHOLARSHIPS

Students undertaking courses in the Faculty of Engineering are eligible to apply for the following scholarships.

Except where otherwise specified, applications on the forms obtainable from the Admissions Office ('phone: 663-0351, ext. 2485) must be lodged with the Registrar, the University of New South Wales, P.O. Box 1, Kensington, within seven days of the publication of the results of the Higher School Certificate Examination. A separate application must be lodged for each category of scholarship.

In addition to those scholarships made available by the University and other bodies as set out below, cadetships are offered by the Commonwealth Service, the New South Wales Public Service Board, the Department of Railways and a number of private industrial organizations. Cadets generally have their University fees paid by the employer, and are employed at cadet rates of pay during their course.

Commonwealth University Scholarships

There are three types, and all may be applied to full-time, part-time and external courses, and for pass and honours courses:— **Open Entrance Scholarships,** which are granted on the results of the Higher School Certificate examination to students who are under twenty-five years of age on 1st January of the year in which they are first awarded the scholarship, and who with their parents are permanent residents of Australia; **Second or Later Year Scholarships,** which are awarded on the results obtained in approved university courses, are available to students who have completed at least one year of a full-time or two years of a part-time course (age and residential requirements are the same as for Open Entrance); and **Mature Age Scholarships,** which are available to students who are over twenty-five on 1st January of the year in which they are first awarded a scholarship. Applicants should be permanent residents of Australia.

Benefits include payment of all tuition fees and other compulsory fees and living allowances (these latter being subject to a means test) up to $559 per annum or $852.80 per annum if living away from home. The closing date for applications is 30th September in the year immediately preceding that for which the

scholarship is desired. Full particulars and application forms may be obtained from the Officer-in-Charge, New South Wales Branch Office, Department of Education and Science, 70 Castlereagh Street, Sydney. 2000. (Telephone 27 5475).

University Scholarships

The University annually awards up to fifteen scholarships tenable in degree courses to students who have matriculated at the Higher School Certificate Examination; ten scholarships to students who have completed certificate courses (Department of Technical Education); ten scholarships to students who have completed Trade Courses (Department of Technical Education); and ten scholarships to part-time students who have taken the Diploma Entrance course of the Department of Technical Education. The scholarships exempt the holder from payment of course fees during the currency of the scholarship. Scholarships will be awarded in order of merit on Higher School Certificate Examination results. They may be held only by persons who do not hold another award. Applications must be lodged after publication of Higher School Certificate Examination results and after the announcement of the award of Commonwealth University Scholarships, but not later than 31st January.

Bursaries

A number of Bursaries tenable at the University are awarded to candidates of merit at the Higher School Certificate Examination whose family income falls within certain limits prescribed by the Bursary Endowment Board. Applications should be made to the Secretary, Bursary Endowment Board, C/- Department of Education, Bridge Street, Sydney.

Public Service Association Scholarship

The Public Service Association of New South Wales is offering a scholarship to children of members of the Association who are entering the first year of any full-time course. It is valued at $200 per annum and is tenable for the normal duration of the course.

South Sydney Junior Rugby League Club Ltd. Scholarships

Two scholarships, each valued at $300, are available to male residents in the South Sydney area who wish to enrol in a full-time course at the University. The scholarships, tenable for one year only, will be awarded on the results of the Higher School Certificate Examination in the immediately preceding year and may not be held concurrently with any other scholarship award.

The scholarship is intended to enable a student to undertake the first year of a course with the possibility (provided that his first-year performance warrants it) of obtaining a later year Commonwealth University Scholarship. Applications must be lodged with the Registrar after the announcement of the award of the Commonwealth University Scholarships, but not later than 31st January each year.

The Fell Scholarship (University Residential Colleges)

The Fell Scholarship is available to any undergraduate who is or will be in residence at one of the Colleges under the administration of Kensington College Ltd. during 1968. The annual value of the Scholarship is $100. It may be held concurrently with Commonwealth and other scholarships.

In awarding the scholarship the academic merit and financial need of the applicant will be taken into consideration.

Applications must be made on the appropriate form and lodged with the Master, Kensington College Ltd., Box 24, P.O., Kensington 2033.

Joint Coal Board and Australian Coal Industry Research Laboratories Limited Scholarships

The Joint Coal Board and the Australian Coal Industry Research Laboratories Limited each offer scholarships in full-time courses in Mechanical Engineering, Electrical Engineering, Mining Engineering, Fuel Engineering and Applied Geology. The value of these scholarships ranges from $700 to $1,200 per annum (including allowance for books and instruments). These scholarships are awarded on the understanding that students will normally hold a Commonwealth University Scholarship which covers the cost of University fees. However, applicants without Commonwealth University Scholarships may be given consideration. While scholarship holders are not under bond, it is expected that they will obtain employment in coal mining or a related industry on graduation. Applications on forms obtainable from headmasters or from the Secretary, Joint Coal Board, Box 3842, G.P.O., Sydney, must be lodged with the Board's Secretary not later than seven days after the notification of Higher School Certificate results.

The John Heine Memorial Scholarship

This scholarship is designed to assist students to undertake the final two years of the degree course in Mechanical, Electrical or Chemical Engineering, Applied Chemistry, Metallurgy, or Physics.

Applicants must have qualified for admission to the third year of the course (fourth year for Chemical Engineering). The scholarship has a maximum total value of $700. Applications should be made not later than 31st January each year to the Secretary, The John Heine Memorial Foundation, C/- the Metal Trades Employers' Association, 101 Walker Street, North Sydney.

The A. E. Goodwin Memorial Scholarship

The Directors of A. E. Goodwin Ltd. provide a scholarship each year to students who are eligible to enrol in the second year of the Mechanical Engineering degree course. The total value of the scholarship is $360, payable in three equal amounts of $120 each at the beginning of the second, third and fourth years of the course. Applications should be lodged with the Registrar by 31st January each year.

The Tyree Electrical Company Scholarship in Electrical Engineering

The Tyree Electrical Company Pty. Ltd., has undertaken to provide two scholarships for students enrolling in the full-time courses in Electrical Engineering. The value of the scholarships is between $500 and $1,500 per annum, payable in fortnightly instalments as a living allowance to students. They will normally be tenable for four years but may be extended to a fifth year when the holder intends to qualify for the two degrees, Bachelor of Science and Bachelor of Engineering. They may be held concurrently with any other scholarship.

Mining and Metallurgical Bursaries Fund

Mining and Metallurgical Bursaries at the University of New South Wales, valued at $100 per annum, will be awarded by the Trustees of the Mining and Metallurgical Bursaries Fund, Melbourne. Candidates must be British subjects and have completed the first year of the course for the degree of Bachelor of Engineering in Mining Engineering, Bachelor of Science in Applied Geology, or Bachelor of Science in Metallurgy, or have been awarded corresponding status in consideration of work done elsewhere.

ENGINEERING COURSES

The Faculty of Engineering consists of the Schools of Civil Engineering, including the Department of Surveying, of Electrical Engineering, and Mechanical and Industrial Engineering, and the Schools of Highway Engineering, Nuclear Engineering, and Traffic Engineering, the three last named Schools offering graduate courses only. The Schools of Civil, Electrical, and Mechanical and Industrial Engineering offer full-time courses leading to the degrees of Bachelor of Engineering or Bachelor of Surveying, and part-time courses leading to the degrees of Bachelor of Science (Technology) or Bachelor of Surveying.

All the post-graduate activities of the Faculty are co-ordinated under the Graduate School of Engineering. For full details of such activities please see the Graduate School of Engineering Handbook.

Common First Year

The Schools of Civil, and Mechanical and Industrial Engineering have the same first year course in physics, mathematics, chemistry and engineering, thus making it possible for students to transfer from one Bachelor of Engineering course to another within these schools at the end of their first year without loss of standing.

However, the first year in Electrical Engineering is different from that of the other two Schools, the details being shown under the various courses. Notwithstanding the fact that the first year courses are not identical in the three Schools, sympathetic consideration will be given to requests by students who have completed first year to transfer to an allied course without loss of standing. When such transfer is desired an application must be made to the Registrar.

FULL-TIME COURSES

Full-time courses of four-years' duration are offered in Civil, Electrical, Mechanical, Industrial, and Aeronautical Engineering, and in Naval Architecture: all of these lead to the degree of Bachelor of Engineering. A four-year full-time course in Surveying is offered by the School of Civil Engineering leading to the degree of Bachelor of Surveying.

The award of the degree of Bachelor of Engineering is recognized by the Institution of Engineers, Australia, as giving complete exemption from the examinations required for admission to the grade of Associate Member. In nearly all cases substantial or complete recognition is accorded to these courses by overseas engineering institutions.

General Studies Programme

All undergraduates in Faculties other than Arts are required to complete a General Studies programme. In this way the University hopes to give its students a general understanding of the different aspects of the world in which they live. Full-time students will do an initial forty-five-hour course in 26.501 English or 26.571 An Introduction to Modern Drama, two forty-five-hour electives* and an advanced elective, to be chosen from the following groups.

(A) **Electives**

(45 hours, except where otherwise stated)

11.011H	History of Fine Arts
11.021H	History of Architecture
26.121	Psychology
26.151	Economics
26.301	Music
26.511	History
26.521	Philosophy
26.531	Sociology
26.541	Political Science
†26.561	Introduction to French Civilization (90 hours)
26.562/1	German Literature and Civilization, Part I
26.563/1	Spanish and South American Literature, Part I
26.601	History of Technology

* In 1968 Third Year students from the School of Civil Engineering (including the Department of Surveying) and the School of Mechanical and Industrial Engineering will study one elective in Term 1 and the corresponding advanced elective in Term 2. These students will study a second elective in Fourth Year.

† 26.561 counts as an elective, plus an advanced elective. It is only available to students whose General Studies programme includes an advanced elective and who have reached a reasonable standard in French at Matriculation.

Students who have chosen 26.571 An Introduction to Modern Drama as their initial course may select only one of the following electives:

26.301	Music
26.601	History of Technology
11.011H	History of Fine Arts
11.021H	History of Architecture

(B) Advanced Electives

(60 hours in 1968, except where otherwise stated)

11.031H	History of Fine Arts and Architecture (90 hours)
26.122	Psychology
26.152	Economics
26.502	English Literature
26.512	History
26.522	Philosophy
26.532	Sociology
26.542	Political Science
*26.562/2	German Literature and Civilization, Part 2
*26.563/2	Spanish and South American Literature, Part 2

All of the above courses except 11.031H (History of Fine Arts and Architecture) require a previous course in the same subject as a pre-requisite. 11.031H may not be taken as an advanced elective if either 11.011H (History of Fine Arts) or 11.021H (History of Architecture) has previously been taken as an elective.

Conditions for award of degrees of B.Sc. and B.E.

Subject to their being recommended by the Dean of the Faculty of Engineering and accepted by the Dean of the Faculty of Science, students in the Electrical Engineering full-time courses may qualify for the two degrees of B.Sc. and B.E. by completing a course of five years of full-time study in accordance with the following provisions:

A student shall have attended the prescribed course of study and satisfied the examiners in

(i) the first year of the course of the Faculty of Engineering;

(ii) the second year of the courses for the degree of Bachelor of Engineering in Electrical Engineering.

(iii) two Group III Science subjects, together with the appropriate General Studies programme (see Science Course Regulations set out in the University Calendar).

(iv) the third and fourth years of the courses for the degree of Bachelor of Engineering in Electrical Engineering.

The degree of B.Sc. may be awarded on the completion of the requirements of (i), (ii) and (iii) above.

Industrial Training Requirements

All full-time engineering courses incorporate industrial training and reference should be made to the entries under each School heading for details of the arrangements applicable. All students are strongly recommended to gain further industrial experience in those long vacations where such training is not already prescribed.

The staff of the University will, where possible, assist students to obtain this employment, but it is emphasized that the primary responsibility for obtaining suitable industrial experience rests with each student. Progression to succeeding years of the course and the award of the degree are dependent on the completion of the requisite periods of industrial employment of a standard approved by the University.

PART-TIME COURSES

Since 1961 the Schools of the Faculty have offered six-year part-time courses in a variety of engineering fields leading to the degree of Bachelor of Science (Technology). Courses for this degree are offered in Civil, Electrical, Industrial and Mechanical Engineering and in Naval Architecture and Aeronautical Engineering (these last two being offered by the School of Mechanical and Industrial Engineering).

The General Studies programme is the same for part-time as for full-time students, except that part-time students do not do an Advanced Elective.

The award of the degree of B.Sc. (Tech.) is recognised by the Institution of Engineers, Australia, as giving complete exemption from the examinations required for admission to the grade of Associate Member.

Recognition by overseas engineering institutions varies in the different branches of engineering, and particular enquiries on this matter should be addressed to the head of the appropriate School.

A student completing the B.Sc. (Tech.) degree course and wishing to qualify for the corresponding B.E. degree may, on the recommendation of the Head of the School, transfer to the corresponding full-time B.E. course provided he does not take out the B.Sc. (Tech.) degree. Further, provided he continues as a registered student on transfer from one course to the other, he may retain any concession granted in the B.Sc. (Tech.) degree course.

Holders of the B.Sc (Tech.) award are eligible to proceed to the degree of Master of Engineering, Master of Engineering Science or Master of Surveying Science subject to the conditions for the award of these degrees set out in Section C of the University Calendar.

Courses leading to the B.Sc. (Tech.) award are basically part-time and the prescribed industrial experience should be gained concurrently with the course of study (a minimum of three years of suitable engineering experience is required). Students transferring from full-time courses must, therefore, also satisfy these industrial experience requirements before being admitted to the degree of B.Sc. (Tech.).

The programme towards the B.Sc (Tech.) may in some cases be accelerated by a student attending for one or more years full-time. For example, in all courses of the Faculty it is possible to take the equivalent of the full-time first year in two part-time years.

The School of Civil Engineering offers a part-time course in Surveying of seven years' duration for the degree of Bachelor of Surveying.

FACULTY OF APPLIED SCIENCE

The Faculty of Applied Science offers courses to students desiring a career in a specialized technology with an engineering element. These courses are as follows:

	Full-time	*Part-time*
Chemical Engineering	B.E.	B.Sc. (Tech.)
Ceramic Engineering	B.Sc.	,,
Fuel Engineering	B.E.	,,
Metallurgy*	B.Sc.	,,
Mining Engineering†	B.E.	—
Textile Engineering	B.Sc.	—

* A part-time course is also available at Wollongong.

† Part-time course are available only at Wollongong and Broken Hill.

Entrance to these courses, which are of four years' duration full-time (pass or honours) and six years' duration part-time, is conditional upon Engineering I being taken in first year and on transference to the Faculty of Applied Science before second year. Full-time Engineering students may enter the Mining Engineering course after the second year of courses in Mechanical, Electrical or Civil Engineering without loss in standing of subjects completed.

Part-time engineering students may enter the courses offered by the Schools of Chemical Engineering, Chemical Technology and Metallurgy after the second stage part-time or the full-time first year. They may enter the Mining Engineering course after the fourth stage. In all cases the requirements for the degree of B.Sc. (Tech.) demand three years approved concurrent industrial training.

The degrees of B.E. (pass or honours) in Chemical Engineering and Mining Engineering are recognised by the Institution of Engineers of Australia for exemption from the Associate Membership examinations.

Ceramic Engineering

Ceramics are inorganic, non-metallic materials which usually require the use of high temperatures in their processing. Products of the industry include glass, refractories, bricks, tiles, pipes, abrasives, cement, plaster, nuclear ceramics, whitewares, enamels and electric insulators, dielectrics and magnetic materials. The ceramic engineer is concerned with the relationship between the atomic and crystal structure of materials and their chemical, physical and engineering properties, as well as the methods of their manufacture and fabrication into useful shapes.

Graduates in Ceramic Engineering take positions in the fields of research and development, production control, product evaluation and technical service.

Chemical Engineering

Chemical Engineering is the application of the principles of the physical sciences, together with principles of economics and human relations to fields in which matter undergoes a change in state, energy content or composition. The chemical engineer is generally responsible for the design, construction and operation of plant and equipment used in the chemical processing industries.

Fuel Engineering

The Department of Fuel Technology, the first of its kind in Australia, was established to meet the growing need of industrial

and research establishments for personnel with specialized training in the science and technology of fuels and their utilization.

A degree in Fuel Engineering qualifies for exemption from the examinations for admission to corporate membership of the Institute of Fuel.

Metallurgy

Metallurgy deals with the nature, production, properties and uses of metals. Its importance today is associated with the demands for better materials for aircraft, rockets, nuclear reactors and the like.

The School of Metallurgy is located at Kensington, and also has a department in Wollongong. It has excellent facilities for teaching and research. Emphasis in these courses is on the application of science to technological problems and in this respect there is a close relationship between metallurgy and engineering. Information on the Metallurgy courses and on opportunities for postgraduate work for engineering graduates in the School of Metallurgy may be obtained from the University Calendar, or from Professor Hugh Muir at the School of Metallurgy.

Mining Engineering

The aim of the training is to give students a thorough foundation in Mining Engineering and so permit them to enter coal mining, metalliferous mining or the petroleum industry, and to be employed in any of the phases of these industries ranging from exploration to production.

During the undergraduate course, students will spend portion of the long vacations obtaining practical experience in mining. Mining companies prepare programmes so that the students obtain a comprehensive experience in many aspects of the profession. This experience is important and it is related to the academic training received in the School. Practical experience in mining, gained as a student, can contribute to the experience record of mining engineers when making application for a statutory certificate of competency from one of the Australian State Government Departments of Mines.

The School of Mining Engineering offers, at Broken Hill and Wollongong, a part-time course in Mining Engineering leading to the Degree of Bachelor of Science (Technology).

Textile Engineering

The textile industry, being a manufacturing one, depends on many types of machinery and engineering services to produce its products. In order to cope with technological problems in production, quality control and research, a competent textile engineer

must have a good understanding of the fundamental sciences and extensive theoretical and practical knowledge of the applied textile and engineering sciences.

There are many challenging and lucrative positions for textile engineers in industry and research.

HIGHER DEGREES AND GRADUATE COURSES

Research Degress

The higher degrees of Master of Engineering, Master of Surveying, and of Doctor of Philosophy are awarded on the presentation of a thesis, satisfactory to the examiners, which embodies the results of an original investigation or design. Candidates for these degrees must possess a bachelor's degree in an appropriate field and meet the conditions governing the award of these degrees. The full conditions are set out in the University Calendar and in the Handbook of the Graduate School of Engineering.

The degree of Doctor of Science is also awarded for a contribution of distinguished merit in the field of engineering.

Courses of Study for Graduate Awards

In addition to the research degrees listed above, the Faculty offers courses of instruction at the graduate level leading to the award of the degree of Master of Engineering Science, Master of Surveying Science or to a graduate diploma.

Courses for the Degree of Master of Engineering Science

Engineering Construction, Public Health Engineering, Structural Engineering, Water Engineering (School of Civil Engineering); Electrical Engineering (School of Electrical Engineering); Highway Engineering (School of Highway Engineering); Industrial Engineering, Mechanical Engineering, Refrigeration and Air Conditioning (School of Mechanical and Industrial Engineering); Nuclear Engineering (School of Nuclear Engineering); and Transportation and Traffic Engineering (School or Traffic Engineering).

Course for the Degree of Master of Surveying Science

The Department of Surveying in the School of Mechanical and Industrial Engineering offers courses leading to the degree of Master of Surveying Science.

Courses for Graduate Diplomas

Highway Engineering and Industrial Engineering.

Full details of all these courses are given in the section on postgraduate study in the University Calendar, in the Handbooks of the appropriate Schools, and in the Handbook of the Graduate School of Engineering.

The Faculty of Engineering also supervises the Graduate Diploma course in Human Communications, offered by the Division of Postgraduate Extension Studies.

Special Courses

Short, intensive graduate and special courses are provided throughout each year designed to keep practising engineers in touch with the latest developments in their various fields. The programmes of such courses for 1968 are published separately.

OUTLINES OF UNDERGRADUATE COURSES

SCHOOL OF CIVIL ENGINEERING

Civil engineering is broad in its scope, utilizing other specialized branches of engineering in planning, co-ordinating and constructing national works such as water supply and conservation projects, hydro-electric development, roads, railways, bridges, tunnels, large buildings, and 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 must include a study of science and of engineering practice. He must combine this with experience and judgment and the knowledge and personality necessary to control large organizations of workers. This profession offers to a young man a considerable variety of types of work, ranging from specialized research and investigations, through routine design and construction work to higher positions which are often largely managerial and organizational in their nature.

The School of Civil Engineering offers two courses in civil engineering; a four-year full-time course leading to the degree of Bachelor of Engineering, and a six-year part-time course leading to the degree of Bachelor of Science (Technology)—B.Sc. (Tech.). In the full-time course a period of one hundred working days' industrial training must be completed between Years III and IV. It is also strongly recommended that industrial experience be gained in the long vacations between Years I and II and Years II and III. Details of courses leading to the Bachelor of Surveying degree are set out below under the heading 'Department of Surveying.'

The Civil Engineering courses are being revised in stages. A revised full-time Second Year was introduced in 1967. In 1968 revised full-time First and Third Years are introduced, also revised Stages I and II of the B.Sc. (Tech.) course. Stages III and IV of the B.Sc. (Tech.) course remain unchanged.

The degree of Bachelor of Engineering may be awarded with Honours in the First Class, or Second Class, Divisions I and II. The award of Honours is made in recognition of superior performance throughout the course. The degree of Bachelor of Science (Technology) may be awarded with Merit in recognition of superior performance throughout the course.

CIVIL ENGINEERING—FULL-TIME COURSE

FIRST YEAR

(30 weeks day course)

		Hours per week for 3 terms lec. lab./tut.
1.051	Physics IE	3 — 3
2.021	Chemistry IE*	3 — 3
5.011	Engineering IA	4½— 3½
10.011	Higher Mathematics I *or*	4 — 2
10.001	Mathematics I	
		14½— 11½

* 15 weeks only.

SECOND YEAR

(30 weeks day course)

		Hours per week for 3 terms lec. lab./tut.
5.511	Fluid Mechanics	1½— 1½
5.711	Thermodynamics	1 — ½
6.801	Electrical Engineering	1 — 2
8.151	Mechanics of Solids	2 — 1
8.251	Properties of Materials	1½— 1½
8.261	Geotechnics*	2 — 1
8.441	Engineering Surveying†	1½— 1½
8.621	Engineering Construction	2 — 0
10.022	Mathematics	3 — 1
26.501	English *or*	1 — ½
26.571	An Introduction to Modern Drama	
		16½—10½

THIRD YEAR‡

(21 weeks day course)

		Hours per week for 24 weeks lec. lab./tut.
8.152S	Structures	4½— 1½
8.161S	Engineering Mathematics	2 — 2
8.252S	Engineering Materials	2 — 3
8.531S	Water Engineering	4 — 2
	General Studies Elective‡	2½— 1½
		15 —10

* A total of 2½ hrs./week only in Term III.

† A one-week Survey Camp must be attended in Term III.

‡ Students will study one Elective in Term I and the corresponding Advanced Elective in Term II. They will study a second Elective in 4th Year.

FOURTH YEAR
(30 weeks day course)

		Hours per week Terms 1 & II lec. lab./tut.	Term III lec. lab./tut.
8.132	Structures	2 — 3	1½— 1½
8.142	Engineering Analysis	1½— 1½	1 — 1
8.223	Engineering Materials	3 — 2½	1½— 1½
8.522	Hydraulics	1½— 1½	1½— 1½
8.613	Civil Engineering	5 — 0	0 — 0
8.011	Thesis	0 — 3	0 —15
	General Studies, Advanced Elective ...	3 — 0	0 — 0
		16 —11½	5½—20½

CIVIL ENGINEERING—PART-TIME COURSE

FIRST STAGE
(30 weeks part-time course)

		Hours per week for 30 weeks lec. lab./tut.
1.051	Physics IE	3 — 3
10.011 / 10.001	Higher Mathematics I or Mathematics I	4 — 2
		7 — 5

SECOND STAGE*
(30 weeks part-time course)

		Hours per week for 30 weeks lec. lab./tut.
2.021	Chemistry IE†	3 — 3
5.011	Engineering IA	4½— 3½
		7½— 6½

THIRD STAGE
(30 weeks part-time course)

		Hours per week for 30 weeks lec. lab./tut.
1.212	Physics II(T)	1½— 1½
5.301	Engineering Mechanics	1¼— ¾
8.112	Materials and Structures	1½— 1½
10.022/1	Mathematics II, Part I	1 — 1
26.501	English	1 — ½
		6¼— 5¼

* Students who did Stage I in 1967 will do the old Stage II in 1968. This appears in the 1967 Calendar.
† Fifteen weeks only.

FOURTH STAGE

(30 weeks part-time course)

		Hours per week for 30 weeks lec. lab./tut.
5.501	Fluid Mechanics	1 — 1
5.701	Thermodynamics	1 — 1
8.121	Structures	1½ — 1½
8.421	Engineering Surveying*	1 — 0
25.101	Geology†	1½ — ½
	General Studies Elective	1 — ½
		7 — 4½

FIFTH STAGE

(30 weeks part-time course)

		Hours per week for 30 weeks lec. lab./tut.
6.801	Electrical Engineering	1½ — 1½
8.221	Engineering Materials	3 — 2
8.422	Engineering Surveying	1 — ½
8.521	Hydraulics	1 — 1
		6½ — 5

SIXTH STAGE

(30 weeks part-time course)

		Hours per week for 30 weeks lec. lab./tut.
8.131	Structures	2 — 2
8.141	Engineering Computations	1 — 0
8.222	Engineering Materials	1 — 1
8.611	Civil Engineering	2 — 0
8.612	Civil Engineering	2 — 0
	General Studies Elective	1 — ½
		9 — 3½

* Saturday fieldwork additional. Also, a one-week survey camp must be attended in sixth week of third term.

† Two one-day Geology excursions are an essential part of the course.

DEPARTMENT OF SURVEYING

The Department of Surveying offers a four-year full-time course and a seven-year part-time course, both leading to the degree of Bachelor of Surveying.

Surveying is broad in its scope. The academic training is first in the basic sciences of mathematics, physics and geology; a number of engineering subjects are studied; then surveying and its various branches, geodesy, astronomy and photogrammetry; and their application in trigonometric, engineering, cartographic and cadastral work. There is a correspondingly wide choice of types of surveying open to the graduate in surveying.

Surveying involves taking measurements in the field, and the course includes practical classes in which the theory studied in lectures is applied to actual surveys and acquaintance is made with surveying instruments. Survey camp must be attended for two weeks at the end of the second and third years of the course. In addition, students must gain practical experience under a surveyor for ninety working days between Years III and IV. They are also strongly advised to obtain further practical experience during the long vacations between Years I and II and Years II and III, including as much time as possible under a registered surveyor during all vacations.

For those wishing to become Registered Surveyors after graduation the degree confers exemption from all written examinations of the Board of Surveyors. Additional time must, however, be served under a Registered Surveyor, some exemption from this time being obtainable in respect of vacation experience, provided the Board gives prior recognition. For further information consult the Registrar of the Board.

SURVEYING—FULL-TIME COURSE

Bachelor of Surveying

FIRST YEAR

(30 weeks day course)

		Hours per week for 3 terms lec. tut. etc.
1.041	Physics IC	3 — 3
5.001	Engineering I	3 — 3
8.801	Surveying I	2 — 4
10.011 or 10.001	Higher Mathematics I *or* Mathematics I	4 — 2
		12 —12

SECOND YEAR

(30 weeks day course)

		Hours per week for 3 terms lec. lab./tut.
2.212	Physics II(T)	1½ — 1½
8.711	Engineering for Surveyors	2½ — ½
8.802	Surveying II*	3 — 2½
8.841	Surveying Computations	1 — ½
10.022	Mathematics	3 — 1
10.341	Statistics	1½ — 0
25.101	Geology†	2 — 1
26.501 26.571	English *or* An Introduction to Modern Drama }	1 — ½
		15½ — 7½

THIRD YEAR**

(21 weeks day course)

		Hours per week for 21 weeks lec. tut., etc.
8.712S	Engineering for Surveyors	2 — 0
8.803S	Surveying III*	2 — 1½
8.821S	Geodesy*	2½ — 2
8.831S	Astronomy	2 — 1
8.842S	Surveying Computations	1½ — 1
8.851S	Photogrammetry	2 — 1½
8.881S	Land Law, Valuation and Utilization†	3½ — 0
	General Studies Electives‡	2½ — 1½
		18 — 8½

* A two-week survey camp must be attended as part of this subject.

† Two one-day excursions are an essential part of the course.

** Terms I and II only.

‡ Students will study one elective in Term I and the corresponding advanced elective in Term II. They will study a second elective in 4th Year.

FOURTH YEAR

(30 weeks day course)

		Hours per week for 3 terms lec. tut., etc.
6.811	Electronic Instrumentation for Surveyors	1 — 0
8.822	Geodesy	2 — 1½
8.832	Astronomy	1½ — 1
8.852	Photogrammetry	1 — 3½
8.882	Cadastral Surveying	1½ — ½
11.411	Town Planning*	1 — 1
25.303	Geophysics†	2 — 0
8.081	Thesis	3 — 0
	General Studies Elective	2 — 0
		15 — 7½

SURVEYING—PART-TIME COURSE

Bachelor of Surveying

FIRST STAGE

(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
8.801	Surveying I	3 — 3
10.011 10.001	Higher Mathematics I *or* Mathematics I }	4 — 2
		7 — 5

SECOND STAGE

(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
1.041	Physics IC	3 — 3
5.001	Engineering I	3 — 3
		6 — 6

* Lectures cease at end of Second Term.

† During Term III there will be only one hour of lectures per week. A one-day Geophysical excursion is an essential part of the subject.

THIRD STAGE

(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
1.212	Physics II (T)	1½ — 1½
8.711	Engineering for Surveyors	2½— ½
8.841	Surveying Computations	1 — ½
10.022/1	Mathematics II, Part I	1½— ½
26.501	English	1 — ½
		7½— 3½

FOURTH STAGE

(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
8.802	Surveying II*	3 — 2½
10.022/2	Mathematics II, Part II	1½— ½
10.341	Statistics	1½— 0
25.101	Geology†	2 — 1
	General Studies Elective	1 — ½
		9 — 4½

FIFTH STAGE

(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
8.712	Engineering	1½— 0
8.803	Surveying III**	1½— 1
8.831	Astronomy I	1½— ½
8.842	Surveying Computations	1 — ½
8.881	Land Law, Valuation and Utilization†	2½— 0
	General Studies Elective	1 — ½
		9 — 2½

* Students must attend a two-week survey camp.

† Two one-day excursions are an essential part of the course.

** A one-week survey camp must be attended as part of this subject.

SIXTH STAGE
(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
6.811	Electronic Instrumentation for Surveyors	1 — 0
8.821	Geodesy*...	1½ — 1½
8.851	Photogrammetry	1½ — 1
8.882	Cadastral Surveying	1½ — ½
25.303	Geophysics†	2 — 0
	General Studies Advanced Elective	2 — 0
		9½ — 3

SEVENTH STAGE
(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
8.822	Geodesy	2 — 1½
8.832	Astronomy	1½ — 1
8.852	Photogrammetry	1 — 3½
11.411	Town Planning**	1 — 1
		5½ — 7

SCHOOL OF ELECTRICAL ENGINEERING

In preparation for a career in any branch of electrical engineering students must acquire a knowledge of the basic sciences of mathematics and physics. Students should realize that 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 a proper understanding of its problems.

The School offers a full-time course of four years' duration leading to the degree of Bachelor of Engineering (pass or honours), and a six-year part-time course for the degree of Bachelor of Science (Technology). This course may also be completed in three years of part-time and two years of full-time study.

The degrees of Bachelor of Engineering and Bachelor of Science (Technology) are recognized by the Institution of Electrical Engineers, England, as giving complete exemption from the examinations required for admission to the grade of Associate Member.

In the early years of the electrical engineering courses students will concentrate on the basic sciences, mathematics, physics and chemistry, and, as well, will receive an introduction to engineering. In the final year students will elect, with the approval of the

* A one-week survey camp must be attended as part of this subject.
† A one-day Geophysical excursion is an essential part of this subject.
** 20 weeks only. Lectures cease at end of Term II.

Head of the School, to study in one of the specialized fields of electrical engineering (referred to as options), at the same time taking the common subjects in electrical engineering.

The elective electrical options are the following:

(a) Power and control systems and apparatus — concerned with the generation, distribution and control of electrical energy, and

(b) Communications — concerned with radio line communications, radar and other navigational aids, and television.

Each student in the full-time course is required to work on a project under the guidance of members of the lecturing staff. Generally, the project will involve the design and construction of experimental apparatus together with laboratory tests. Where possible the projects will be related to the research programme of the School and will be designed to develop the student's initiative. Each student will be required to deliver a seminar paper and to prepare a thesis based on the results of the project work.

Provision is made in the full-time course for students to undertake additional work in their third and fourth years towards the award of an honours degree.

ELECTRICAL ENGINEERING—FULL-TIME COURSE

The full-time course is of four years' duration and leads to the degree of Bachelor of Engineering (pass or honours). The four years of the course each require full-time day attendance at the University for thirty weeks. All students are required to complete two periods of industrial training, one of forty-five working days between Years II and III, and the other of forty-five working days between Years III and IV. They are also strongly recommended to obtain practical experience during the long vacation between Years I and II.

FIRST YEAR

(30 weeks day course)

		Hours per week for 3 terms lec. lab./tut.
1.001	Physics I *or*	
1.011	Higher Physics I	3 — 3
2.001	Chemistry I *or*	
2.011	Higher Chemistry I	2 — 4
5.001	Engineering I	3 — 3
10.001	Mathematics I *or*	
10.011	Higher Mathematics I	4 — 2
		12 —12

SECOND YEAR*
(30 weeks day course)

		Hours per week for 3 terms lec. lab./tut.
1.112	Physics II	4 — 4
4.921	Materials Science	1 — ½
5.301	Engineering Mechanics	1 — 1
5.701	Thermodynamics	1 — 1
6.101	Electric Circuit Theory	1 — 2
8.112	Materials and Structures	1½ — 1½
10.111	Pure Mathematics II	3 — 2
26.501	English *or*	
26.571	An Introduction to Modern Drama	1 — ½
		13½—12½

THIRD YEAR—PASS COURSE
(30 weeks day course)

		Hours per week for 30 weeks lec. lab./tut.
6.064	Introduction to Computer Science	1½ — ½
5.501	Fluid Mechanics *or*	1 — 1
10.351	Statistics	1 — ½
6.102	Electric Circuit Theory	3 — 3
6.201	Electric Power Engineering	2 — 3
6.301	Electronics	3 — 3
10.033	Mathematics†	2 — 0
	General Studies Electives**	3 — 1
		15½—12

FOURTH YEAR§
(30 weeks day course)

		Hours per week for 21 weeks lec. lab./tut.
6.001S	Electrical Engineering	4 — 1½
6.322S	Electronics	2 — 3
6.911	Thesis‡	0 — 2
	General Studies Elective	3 — 0
	Plus one of the following options :—	

* This year also meets the requirements of the Second Year of the Science course for the degree of Bachelor of Science.

† Students who have taken the subjects Physics III and Mathematics III in the Science Course are exempt from this subject.

** Terms I and II (21 weeks) only.

‡ Full-time in Third Term.

§ Lectures cease at end of Second Term.

Option I—			
	Power and Control Apparatus and Systems—		
6.202S	Power Systems		2 — 2
6.212S	Electrical Machines		2 — 2
6.401S	Control Systems		2 — 2
	or		
Option II—			
	Communications—		
6.302S	Communications		2 — 2
6.312S	Communications		2 — 2
6.332S	Communications		2 — 2
			15 —12½

Optional Subjects

Students in doubt concerning optional subjects in the third and fourth years should consult the Head of the School.

Third Term of Fourth Year

In the fourth year the formal lecture work extends over twenty-one weeks (the first two terms). This is followed by a study vacation of three weeks and examinations are held during the first three weeks of the third term. The balance of this term is mainly devoted to directed laboratory and research work on an approved subject, with special reading and study associated with the preparation of a thesis; seminar work is also carried out. The thesis must be submitted by 5th December.

Additional for Honours

A full-time honours course in electrical engineering is offered, involving additional work in third and fourth years. Candidates for honours must obtain the permission of the Head of the School to enter the course.

Candidates for honours will complete the syllabus for the third and fourth years of the pass course as outlined above with the addition of:

Third Year

6.501 Electrical Engineering Honours—two hours of lectures per week for thirty weeks.

Fourth Year

6.502S Electrical Engineering Honours—three hours of lectures per week for twenty-one weeks.

6.921 Honours Thesis—two hours per week for twenty-one weeks; then full-time in third term. This replaces 6.911 Thesis, undertaken by pass course candidates.

DOUBLE DEGREE OF B.SC., B.E. IN ELECTRICAL ENGINEERING

Full-time students in Electrical Engineering may qualify for the double degree of Bachelor of Science, Bachelor of Engineering in five years of full-time study. Having completed first and second years of the Electrical Engineering course students will take a special third year consisting of two Group III Science subjects (see the Science course regulations in the University Calendar) plus two forty-five-hour General Studies Electives. In their fourth year students in the combined course will take the normal third year of the Electrical Engineering course, less the Humanities subjects taken in the special third year. In their fifth year they will complete the normal fourth year of the Electrical Engineering course.

Approval to enrol in the double degree course is granted on the recommendation of the Head of the School and requires the approval of the Dean of the Faculty of Engineering and the Dean of the Faculty of Science.

ELECTRICAL ENGINEERING—PART-TIME COURSE

The six-year part-time course in Electrical Engineering leads to the degree of Bachelor of Science (Technology).

FIRST STAGE

(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
2.001 / 2.011	Chemistry I *or* Higher Chemistry I	2 — 4
10.001 / 10.011	Mathematics I *or* Higher Mathematics I	4 — 2
		6 — 6

SECOND STAGE

(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
1.001 / 1.011	Physics I *or* Higher Physics I	3 — 3
5.001	Engineering I	3 — 3
		6 — 6

THIRD STAGE

(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
1.112/1	Physics II, Part I	2 — 2
4.921	Materials Science	1 — ½
6.101	Electric Circuit Theory	1 — 2
10.111/1	Pure Mathematics II, Part I	2 — ½
26.501	English	1 — ½
		7 — 5½

FOURTH STAGE

(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
1.112/2	Physics II, Part II	2 — 2
6.152	Electric Circuit Theory	2 — 2
6.356	Electronics	1½ — ½
10.111/2	Pure Mathematics II, Part II	2 — ½
		7½ — 5

FIFTH STAGE

(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
5.301	Engineering Mechanics	1¼ — ¾
6.251	Electric Power Engineering	1½ — 2
6.357	Electronics	1½ — 2
8.112	Materials and Structures	1 — 2
	General Studies Elective	1 — ½
		6¼ — 7¼

SIXTH STAGE

(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
5.701	Thermodynamics	1 — 1
6.052	Electrical Engineering	1 — 0
	General Studies Elective	1 — ½

Plus one of the following options :—

Option I—

Power and Control—

6.262	Electrical Machines	2 — 2
6.454	Power and Control Systems	2 — 2

Option II—

Communications—

6.352	Communications	1½— 2½
6.362	Communications	1½— 2½
		7/6 — 5½/6½

ELECTRICAL ENGINEERING— COMBINED FULL-TIME/PART-TIME COURSE

The Electrical Engineering course leading to the degree of Bachelor of Science (Technology) may be completed in three years of part-time study and two years of full-time study as follows:

Stage 1 —Part-time (as for the Stage 1 of the B.Sc. (Tech.) course in Electrical Engineering).

Stage 2 —Part-time (as for Stage 2 of the B.Sc. (Tech.) course in Electrical Engineering).

Stage 3A—Full-time (as for Second Year of the full-time course in Electrical Engineering).

Stage 4A—Full-time (as for Third Year of the full-time course in Electrical Engineering).

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

STAGE 5A

(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
6.052	Electrical Engineering	1 — 0

Plus one of the following options :—

Option I—

Power and Control—

6.262	Electrical Machines	2 — 2
6.454	Power and Control Systems	2 — 2

Option II—

Communications—

6.352	Communications	1½— 2½
6.362	Communications	1½— 2½
		5/4 — 4/5

SCHOOL OF MECHANICAL AND INDUSTRIAL ENGINEERING

The courses in this School are planned to provide the appropriate academic training for the professional engineer in the fields of aeronautical, industrial and mechanical engineering, and for the naval architect.

The study of the basic sciences—Mathematics, Physics and Chemistry—together with an introduction to Engineering, comprises the first year of study. In the second year further mathematical studies are undertaken together with a study of the Engineering Sciences—Thermodynamics, Fluid Mechanics, Engineering Mechanics, Mechanics of Solids and their application in the field of Design.

The full-time courses of Mechanical, Industrial and Aeronautical Engineering and of Naval Architecture have common subjects for the first two years. The third and fourth years contain a number of common core subjects together with specific departmental requirements. In the fourth and final year, in addition to core subjects and departmental requirements, provision is made for a limited degree of specialization in one or more elective subjects. General studies form a regular part of all courses.

Industrial experience is an integral part of the full-time courses. Industrial Engineering students must complete forty working days of approved industrial training between Years 2 and 3 and one-hundred working days between Years 3 and 4. Mechanical and Aeronautical Engineering and Naval Architecture students must complete one-hundred working days of approved industrial training between Years 3 and 4. All students irrespective of their specialization are strongly recommended to gain as much industrial training as possible between Years 1 and 2 and between Years 2 and 3. Full-time students in Naval Architecture and Aeronautical Engineering are required to attend certain part-time classes during the third term of the 3rd Year and will therefore be required to obtain their industrial experience within the metropolitan area at least during third term.

Each student is required to prepare a short paper and deliver it in the Technical Communications period and each full-time student is also required to present a thesis at the end of his final year.

The full-time courses in Aeronautical; Industrial and Mechanical Engineering and in Naval Architecture are of four years' duration and lead to the degree of Bachelor of Engineering (B.E.).

The full-time course in Mechanical Engineering is being revised by years. The first stage was the introduction of the revised second

year programme in 1967. In 1968 the revised first and third year programmes are introduced. The length of the third year programme is reduced from 24 to 21 weeks, the second year programme having been increased from 24 to 30 weeks in 1967. In 1969 the new 30-week fourth year programme will be offered; this consists of nine and a half hours per week of common core subjects, subjects for departmental requirements and from three to twelve hours per week of electives which may be chosen from a list of ten subjects. All fourth year students will in future follow the same 30-week programme, whereas previously there was a 24-week programme for pass students and a 30-week programme for students aiming at Honours. All students will now be considered for the award of Honours which will be granted for meritorious performance in the course with particular emphasis on the later years.

Part-time courses of six years' duration leading to the degree of Bachelor of Science (Technology) are offered in the same four fields as the full-time courses.

Part-time courses may also be completed by a combination of part-time and of full-time study. Full-time B.Sc. (Tech.) programmes may be arranged on a case-by-case basis with the approval of the Head of the School.

A student who has successfully completed the first two stages of any of the Bachelor of Science (Technology) courses mentioned above may transfer to the second year of any of the full-time B.E. courses offered by the School. The part-time courses are at present being revised and it is highly probably that a part-time student will be able to transfer at the end of stage 4 to the third year of the corresponding full-time course.

The award of the degree B.E. or B.Sc. (Tech.) in Mechanical Engineering is recognized by the Institution of Mechanical Engineers, London, as giving exemption from Parts I and II of the examinations required for admission to the grade of Associate Member.

The Institution of Engineers, Australia, grants full exemption from examinations for admission to the grade of Associate Member to holders of the degree of B.E. or B.Sc. (Tech.) in any of the undergraduate courses offered by the School.

Holders of diplomas issued by the department of Technical Education may be admitted to an appropriate B.Sc. (Tech.) degree course with advanced standing. Applications will be dealt with on a case-by-case basis and require the approval of the Head of the School.

MECHANICAL ENGINEERING—FULL-TIME COURSE

FIRST YEAR

(30 weeks day course)

		Hours per week for 3 terms lec. lab./tut.
1.051	Physics IE	3 — 3
2.021	Chemistry IE*	3 — 3
5.011	Engineering IA	4½— 3½
10.011 10.001	Higher Mathematics I or Mathematics I	4 — 2
		14½—11½

SECOND YEAR

(30 weeks day course)

		Hours per week		
		Term I lec. lab./tut.	Term II lec. lab./tut.	Term III lec. lab./tut.
5.061	Technical Orientation ...	1 — 0	1 — 0	1 — 0
5.111	Mechanical Engineering Design	4 — 0	2 — 2	1 — 3
5.311	Mechanics	1½— 1	1½— 1	1½— 1
5.611	Fluid Mechamics/ Thermodynamics	2 — 2½	2 — 2½	2 — 2½
6,801	Electrical Engineering ...	1 — 2	1 — 2	1 — 2
8.151	Mechanics pf Solids ...	2 — 1	2 — 1	2 — 1
8.251	Properties of Materials ...	1½— 1½	1½— 1½	1½— 1½
10.022	Mathematics	2½— 1½	2½— 1½	2½— 1½
26.501 26.571	English *or* An Introduction to Modern Drama	1 — ½	1 — ½	1 — ½
		16½—10	14½—12	13½—13

* 15 weeks only.

THIRD YEAR

(21 weeks day course)

		Honrs per week for 21 weeks lec. lab./tut.
5.071	Engineering Analysis	3 — 1
5.112	Mechanical Engineering Design	2 — 2
5.331	Dynamics of Machines	2 — 1
5.412	Mechanics of Solids	2 — 1
5.612	Fluid Mechanics/Thermodynamics	3 — 1
6.802	Electrical Engineering	1 — 1
18.011 18.021	Industrial Engineering IA or Industrial Engineering IB	2 — 1
	General Studies Elective*	3 — 1
		18 — 9

FOURTH YEAR

(30 weeks day course)

		Hours per week Terms I & II lec. lab./tut.	Term III lec. lab./tut.
5.103	Mechanical Engineering Design	0 — 3	0 — 3
5.323S	Automatic Control	2 — 1	—
5.306S	Theory of Machines	1½ — 1½	—
5.504	Fluid Mechanics	1 — 1	1 — 1
5.704	Thermodynamics	1 — 1	1 — 1
6.802S	Electrical Engineering	1½ — 1½	—
10.371 18.121	Statistics *or* Engineering Administration	1 — 1 2 — 0	1 — 1 2 — 0
5.021S	Seminar	0 — 1½	0 — 1½
5.051	Thesis	0 — 4	0 — 15
	General Studies, Elective†	3 — 0	—
		11 — 15½ or 12 — 14½	3 — 22½ or 4 — 21½

* Students will study one Elective in Term I and the corresponding Advanced Elective in Term II. They will study a second Elective in 4th Year.

† Terms I and II only.

MECHANICAL ENGINEERING—PART-TIME COURSE

This course is of six years' duration, and leads to the degree of Bachelor of Science (Technology).

FIRST STAGE
(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
1.051	Physics IE	3 — 3
10.011 / 10.001	Higher Mathematics I *or* Mathematics I	4 — 2
		7 — 5

SECOND STAGE*
(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
2.021	Chemistry IE†	3 — 3
5.011	Engineering IA	4½ — 3½
		7½ — 6½

THIRD STAGE
(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
1.212	Physics II (T)	1½ — 1½
5.201	Mechanical Technology	1 — 0
5.301	Engineering Mechanics	1½ — ¾
8.112	Materials and Structures	1½ — 1½
10.022/1	Mathematics	1½ — ½
26.501	English	1 — ½
		7¾ — 4¾

FOURTH STAGE
(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
4.911	Materials Science	1 — 1
5.101/1	Mechanical Engineering Design, Part I	0 — 2
5.203	Mechanical Technology	1 — 0
5.501	Fluid Mechanics	1 — 1
5.701	Thermodynamics	1 — 1
10.022/2	Mathematics	1½ — ½
	General Studies Elective	1 — ½
		6½ — 6

* Students who completed Stage I in 1967 will do the old Stage II in 1968. This is to be found in the 1967 Calendar.

† 15 weeks only.

FIFTH STAGE
(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
5.101/2	Mechanical Engineering Design, Part II	0 — 2
5.302	Theory of Machines	1½ — 1
5.303	Mechanical Vibrations *	1½ — 0
5.402	Mechanics and Solids	1 — 1
5.023	Seminar†	0 — 1½
6.801	Electrical Engineering	1 — 2
	General Studies Elective	1 — ½
		6 — 8

SIXTH STAGE
(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
5.102	Mechanical Engineering Design	1 — 2
5.321	Automatic Control Engineering	1 — 0
5.502	Fluid Mechanics	1 — 1½
5.702	Thermodynamics	1 — 1½
6.802	Electrical Engineering	1 — 1
		5 — 6

AERONAUTICAL ENGINEERING—FULL-TIME COURSE

Bachelor of Engineering

The first and second years of this course are identical with the first two years of the full-time course in Mechanical Engineering.

THIRD YEAR
(21 weeks day course)

		Hours per week for 21 weeks lec. lab./tut.
5.071	Engineering Analysis	3 — 1
5.331	Dynamics of Machines	2 — 1
5.412	Mechanics of Solids	2 — 1
5.811	Aerodynamics I*	2 — 1
5.822	Analysis of Aerospace Structures I**	1¼ — ¾
6.802	Electrical Engineering	1 — 1
18.011 / 18.021	Industrial Engineering IA *or* Industrial Engineering IB	2 — 1
	General Studies Elective‡	3 — 1
		16¼ — 7¾

* Term I only.
† Terms II and III only.
** 30 week subjects. Students will be required to undertake industrial training locally so that they can attend these subjects for 30 weeks part-time.
‡ Students will study one elective in Term I and the corresponding advanced elective in Term II. They will study a second elective in 4th Year.

FOURTH YEAR*

(30 weeks day course)

		Hours per week for 3 terms lec. lab./tut.
5.051	Thesis	0 — 6
5.062	Technical Communications	1 — 1
5.801	Aircraft Design	2 — 2
5.812	Aerodynamics II	2 — 1
5.823	Analysis of Aerospace Structures II	2 — 1
5.831	Aircraft Propulsion	1½— ½
	General Studies Elective	1 — ½
	Plus one technical elective from :—	
5.321	Automatic Control Engineering	
18.012	Industrial Engineering IIA	
18.022	Industrial Engineering IIB	... ... 2 — 1
18.431	Design for Production	
18.551	Operations Research	
		11½— 13

AERONAUTICAL ENGINEERING—PART-TIME COURSE

This course is of six years' duration and leads to the degree of Bachelor of Science (Technology). For outlines of the first two stages, see the Mechanical Engineering part-time course.

THIRD STAGE

(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
1.212	Physics II (T)	1½ — 1½
4.911	Materials Science	1 — 1
5.301	Engineering Mechanics	1¼— ¾
8.112	Materials and Structures	1½— 1½
10.022/1	Mathematics	1½— ½
		6¾— 5¼

* Will be offered in 1969.

FOURTH STAGE

(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
5.303	Mechanical Vibrations*	1½ — 0
5.402	Mechanics of Solids	1 — 1
5.501	Fluid Mechanics	1 — 1
5.701	Thermodynamics	1 — 1
6.801	Electrical Engineering	1 — 2
10.022/2	Mathematics	1½ — ½
26.501	English	1 — ½
		8 — 6

FIFTH STAGE

(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
5.302	Theory of Machines	1½ — 1
5.702	Thermodynamics	1 — 1½
5.811	Aerodynamics I	2 — 1
5.822	Anaylsis of Aerospace Structures I	1¼ — ¾
	General Studies Elective	1 — ½
		6¾ — 4¾

SIXTH STAGE

(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
5.801	Aircraft Design	2 — 1
5.812	Aerodynamics II	2 — 1
5.823	Analysis of Aerospace Structures II	1½ — ½
5.831	Aircraft Propulsion	2 — 0
	General Studies Elective	1 — ½
		8½ — 3

* Term I only.

NAVAL ARCHITECTURE—FULL-TIME COURSE

The first and second years of this course are identical with the first two years of the full-time course in Mechanical Engineering.

THIRD YEAR

(21 weeks day course)

		Hours per week for 21 weeks lec. lab./tut.
5.071	Engineering Analysis	3 — 1
5.331	Dynamics of Machines	2 — 1
5.412	Mechanics of Solids	2 — 1
5.911	Naval Architecture*	2½ — 2½
5.921	Ship Structures*	1½ — ½
6.802	Electrical Engineering	1 — 1
18.021	Industrial Engineering IB	2 — 1
	General Studies Elective†	3 — 1
		17 — 9

FOURTH YEAR‡

(30 weeks day course)

		Hours per week for 3 terms lec. lab./tut.
5.051	Thesis	0 — 6
5.062	Technical Communications	1 — 1
5.922	Ship Structures	1 — 0
5.931	Principles of Ship Design	2 — 1
5.932	Ship Design Project	0 — 3
5.941	Ship Propulsion and Systems...	3 — 2
	General Studies Elective	1 — ½
	Plus one technical elective from :—	
4.913	Materials Science	
5.332	Dynamics of Machines	
18.022	Industrial Engineering IIB	2 — 1
18.551	Operations Research	
		10— 14½

* 30 week subjects. Students will be required to undertake industrial training locally so that they can attend these subjects for 30 weeks part-time.

† Students will study one Elective in Term I and the corresponding Advanced Elective in Term II. They will study a second elective in 4th Year.

‡ Will be offered in 1969.

NAVAL ARCHITECTURE—PART-TIME COURSE

This course is of six years' duration and leads to the degree of Bachelor of Science (Technology). For outlines of the first two stages, see the Mechanical Engineering part-time course.

The Royal Institution of Naval Architects grants exemption from all examinations for associate membership to holders of the B.Sc. (Tech.) degree in Naval Architecture.

THIRD STAGE

(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
1.212	Physics II (T)	1½ — 1½
5.911	Naval Architecture	2½ — 2½
8.112	Materials and Structures	1½ — 1½
10.022/1	Mathematics	1½ — ½
		7 — 6

FOURTH STAGE

(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
5.412	Mechanics of Solids	2 — 1
5.501	Fluid Mechanics	1 — 1
5.701	Thermodynamics	1 — 1
5.921	Ship Structures	1½ — ½
10.022/2	Mathematics	1½ — ½
26.501	English	1 — ½
		8 — 4½

FIFTH STAGE*

(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
4.911	Materials Science	1 — 1
5.502	Fluid Mechanics	1 — 1½
5.941	Ship Propulsion and Systems	3 — 2
	General Studies Elective	1 — ½
		6 — 5

* Stages 5 and 6 as shown will be implemented in 1969. Please consult 1967 Calendar for details of Stages 5 and 6 which will operate in 1968.

SIXTH STAGE*

(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
5.922	Ship Structures	1 — 0
5.931	Principles of Ship Design	2 — 1
5.932	Ship Design Project	0 — 3
6.801	Electrical Engineering	1 — 2
	General Studies Elective	1 — ½
		5 — 6½

DEPARTMENT OF INDUSTRIAL ENGINEERING

The Department of Industrial Engineering offers a full-time and a part-time course in industrial engineering leading to the degree of Bachelor of Engineering and Bachelor of Science (Technology) respectively. These courses are designed for students with engineering ability whose interests lie in the planning, developing and control of manufacturing operations. Completion of either of these courses given full exemption from associate membership examinations of the Institution of Engineers, Australia, and the Institution of Production Engineers. Completion of the full-time B.E. course is accepted by the Institution of Mechanical Engineers, London, as giving exemption from all examinations required for associate membership; completion of the part-time B.Sc. (Tech.) course is recognized as giving exemption from Parts I and II of the examinations required for associate membership.

The first two years of the full-time course and the first four years of the part-time course provide the student with a sound foundation in the basic science and engineering subjects, and this knowledge is used and extended in the later years in the study of the industrial subjects. Finally, the problems associated with the practical economics of manufacturing operations are studied. These three fields of study provide the student with the training necessary to carry out an industrial job and to examine it critically in the light of economic efficiency.

* Stages 5 and 6 as shown will be implemented in 1969.
Please consult 1967 Calendar for details of Stages 5 and 6 which will operate in 1968.

Traditional engineering courses do not embrace the problems which are characteristic of industrial engineering. These problems include the analysis of a product to ensure satisfactory functioning with regard to methods and sequence of manufacturing operations; the disposition of buildings and of equipment in relation to buildings to permit efficient handling of materials; the avoidance or elimination of bottlenecks; the related problems of quality and cost control, testing and inspection; labour and personnel relations; and, finally, the problem of distribution and sales.

The financial and economic aspects are studied as the problem in manufacturing has not been solved until the final translation of the product into money has been accomplished successfully. While it is not intended to develop an expert in accounting practice or economics, it is intended to produce an engineer with an appreciation of the problems of cost and one who can apply considerations of ultimate economy to all industrial problems.

All full-time students must obtain industrial training for two periods, one of forty working days between Years II and III and the other of one hundred working days between Years III and IV. They are also strongly advised to obtain further experience during the long vacation between Years I and II.

The Work of the Industrial Engineer

The industrial engineer may initially be employed in any of the following major areas of industrial activity:

(a) **Industrial Economic Analysis**

One of the principal functions of industrial engineering is to analyse a product, project or process from the economic point of view to ensure that an adequate profit can be obtained from it. A general working knowledge of economics and management skill has to be directed towards the making of decisions on how to operate an enterprise most efficiently. The basis for such decisions is furnished largely by the logical application of mathematics and statistics.

(b) **Planning and Control of Production**

Manufacturing processes and operations must be planned in detail throughout an enterprise to ensure that they proceed smoothly and economically. Functions in this field include the establishment of production standards, the setting of production targets and, finally, control of quality.

The ultimate responsibility of those in charge of the planning and control of production is to ensure that the goods, as orginally specified, perform satisfactorily and are produced when required at an optimum cost. Modern electronic computers may be called upon to help achieve this.

(c) Product and Process Design

The design interest of the industrial engineer goes beyond normal mechanical design to develop a product that will not only function effectively but also have a pleasing appearance.

Further, the product has to be adapted to suit existing manufacturing equipment, or a manufacturing process has to be developed by means of which an existing product can be manufactured at the right price and of the right quality. The design work of the industrial engineer incorporates also problems of equipment selection and application for both economy and performance.

Fundamental scientific studies of manufacturing processes such as metal machining, forming and casting are continually being made to improve their efficiency.

(d) Methods Engineering

Methods engineering is particularly concerned with the coordination of men, materials and machines, so that an enterprise will run at maximum efficiency. A considerable knowledge of engineering in general, as well as an understanding of human factors and materials science, is necessary for methods engineering work. Time and motion study is part of methods engineering. In many cases the methods engineer works in close co-operation with the design department and executives engaged in industrial economic analysis.

(e) Operations Research

This is the attack of modern science on complex problems arising in the direction and management of large systems of men, machines, materials and money in industry, business, government, and defence. The distinctive approach is to develop a scientific model of the system, incorporating measurements of factors such as chance and risk, with which to predict and compare the outcomes of alternative decisions, strategies or controls. The purpose is to help management determine its policy and actions scientifically.

Employment in any of these fields may well lead to a position of responsibility in industrial management if the engineer is so inclined.

INDUSTRIAL ENGINEERING—FULL-TIME COURSE

The first and second years of this course are identical with the first two years of the full-time course in Mechanical Engineering.

THIRD YEAR
(21 weeks day course)

		Hours per week for 21 weeks lec. lab./tut.
5.071	Engineering Analysis	3 — 1
5.112	Mechanical Engineering Design	2 — 2
5.331	Dynamics of Machines	2 — 1
5.412	Mechanics of Solids	2 — 1
6.802	Electrical Engineering	1 — 1
14.061	Accounting	1 — 0
18.011	Industrial Engineering IA	2 — 1
18.021	Industrial Engineering IB	2 — 1
	General Studies Elective*	3 — 1
		18 — 9

FOURTH YEAR†—PASS COURSE
(24 weeks day course)

		Hours per week for 24 weeks lec. lab./tut.
5.306S	Theory of Machines‡...	1½— 1½
5.323S	Automatic Control Engineering‡	2 — 1
6.802S	Electrical Engineering‡	1½— 1½
14.061	Accounting	1 — 0
14.062	Accounting for Engineers	3 — 0
14.041	Industrial and Commercial Law	1 — 0
18.412S	Design for Production II	2 — 2
18.511S	Industrial Marketing	1 — 1
18.611S	Engineering Economic Analysis	1 — 1
18.031S	Minor Thesis	0 — 3
	General Studies, Advanced Elective‡	3 — 0
		17 — 11

* Students will study one Elective in Term I and the corresponding Advanced Elective in Term II. They will study a second elective in 4th Year.

† Lectures cease at the end of the 3rd week in third term. Fourth Year is being reviewed by Faculty, and it is anticipated that new subjects will be offered in 1969 and thereafter.

‡ Terms I and II only.

FOURTH YEAR—HONOURS COURSE
(30 weeks day course)

		Hours per week for 24 weeks* lec. lab./tut.
5.306S	Theory of Machines†	1½— 1½
5.325S	Automatic Control Engineering†	2 — 1
6.802S	Electrical Engineering†	1½— 1½
14.061	Accounting	1 — 0
14.062	Accounting for Engineers	3 — 0
14.041	Industrial and Commercial Law	1 — 0
18.412S	Design for Production II	2 — 2
18.511S	Industrial Marketing	1 — 1
18.611S	Engineering Economics Analysis	1 — 1
18.291S	Professional Elective	3 — 0
18.041	Thesis and Project‡	0 — 1
	General Studies, Advanced Elective†	3 — 0
		20 — 9

INDUSTRIAL ENGINEERING—PART-TIME COURSE

This course is of six years' duration and leads to the degree of Bachelor of Science (Technology).

For outline of the first two stages see the Mechanical Engineering part-time course.

THIRD STAGE
(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
1.212	Physics II (T)	1½— 1½
5.301	Engineering Mechanics	1½— ¾
8.112	Materials and Structures	1½— 1½
10.022/1	Mathematics	1½— ½
18.111/1	Industrial Administration, Part I	1 — 0
26.501	English	1 — ½
		7¾— 4¾

* 28 hours per week for the final 6 weeks of third term are occupied in work on a thesis and a project.

† Terms I and II only.

FOURTH STAGE

(30 weeks part-time course)

		Hours per week for 3 terms lec. lab./tut.
4.911	Materials Science	1 — 1
5.101/1	Mechanical Engineering Design, Part 1	0 — 2
5.501	Fluid Mechanics	1 — 1
5.701	Thermodynamics	1 — 1
10.022/2	Mathematics	1½— ½
18.111/2	Industrial Administration, Part II	1 — 0
		5½— 5½

FIFTH STAGE

(30 weeks part-time course)

		Hours per week for— Terms I & II lec. lab./tut.	Term III lec. lab./tut.
5.302	Theory of Machines	1½— 1	1½— 1
6.801	Electrical Engineering	1 — 2	1 — 2
10.381S	Statistics*	2 — 0	2 — 0
18.221	Production Control	1½— 0	2 — 1
18.421	Design for Production I	1 — 1	2 — 1
	General Studies Elective	1 — ½	1 — ½
		8 — 4½	9½— 5½

SIXTH STAGE

(30 weeks part-time course)

		Hours per week for— Term I lec. lab./tut.	Terms II & III lec. lab./tut.
5.321	Automatic Control Engineering	1 — 0	1 — 0
6.802	Electrical Engineering	1 — 1	1 — 1
18.321	Methods Engineering	1 — 1	1 — 1
18.422	Design for Production II	1 — 1	2 — 1
18.521	Industrial Marketing	1 — 0	1 — 0
18.621	Engineering Economics	2 — 1	1 — 1
	General Studies Elective	1 — ½	1 — ½
		8 — 4½	8 — 4½

* 24 weeks only.

DESCRIPTIONS OF SUBJECTS

TEXT AND REFERENCE BOOKS

SCHOOL OF CIVIL ENGINEERING

(Civil Engineering Undergraduate Subjects — For subjects taught in the Department of Surveying see p. 103).

8.011 Thesis

For students in the full-time courses in Civil Engineering.

8.081

For students in Surveying course.

8.112 Materials and Structures

Theory of Structures — Moduli of elasticity, simple stress and strain. Compound bars, temperature stresses. Thin shells. Stress at a point. Strain at a point. Principal stresses and strain. Relationship between load, shear force and bending moment. Moments of inertia, principal moments of inertia. Stresses due to axial force, bending moment shear force, and torsion. Differential equations of simple beam theory. Deflection of beams. Statically indeterminate beams. Strain energy. Deflections at a single load. Shock loads. Theory of centrally loaded column and eccentrically loaded columns.

Properties of Materials — Materials laboratory practice, types of testing machine, precision of measurement, theory of errors. Load-deformation behaviour of engineering materials under tension, compression, shear. Impact, hardness, fatigue, creep.

REFERENCE BOOKS

Axelrad, D. R. *Strength of Materials for Engineers.* Pitman, 1966.

Davis, Troxell and Wiskocil. *Testing and Inspection of Engineering Materials.* McGraw-Hill.

Richards. *Engineering Materials Science.* Chapman and Hall.

Shanley. *Strength of Materials.* McGraw-Hill.

Timoshenko and MacCulloch. *Elements of Strength Materials.*

8.121 Structures

Relation between design, analysis and proportioning. Design principles, factors of safety; load factors. Structural hazards. Factors affecting design — erection and transport, availability of materials and plant.

Design procedure — specification, drawings. Design of riveted and welded joints. Design of columns and struts. Design of beams, and plate web girders. Design of roof trusses. Reinforced concrete design applied to statically determinate structures. Simple beams and slabs, tee-beams, doubly reinforced beams, concentrically and eccentrically loaded columns. Column footings.

TEXT BOOKS

S.A.A. Interim Code Nos. 350, 351, CA8 Part 1 — 1965.

S.A.A. Code CA2 — 1963.

REFERENCE BOOKS

Bresler and Lin. *Design of Steel Structures.* Wiley.

Ferguson. *Reinforced Concrete Fundamentals.*

Gray and Others. *Steel Designer's Manual.* Lockwood.

Tall (ed.). *Structural Steel Design.* Ronald Press, 1964.

8.131 Structures

Influence lines for statically determinate structures. Strain energy theory, application to analysis of statically indeterminate framed structures, and pin-jointed trusses. Deflections by unit load method. Williot-Mohr diagram. Analysis of frames by moment distribution. Analysis of arches. Timber design, special characteristics of timber. Joints in timber. Beams and columns. Timber structures. Retaining walls and small dams. Design of continuous structures in reinforced concrete. Continuous beams and slabs, simple continuous frame. Introduction to prestressed concrete. Pre-tensioning and post-tensioning.

REFERENCE BOOKS

Ferguson. *Reinforced Concrete Fundamentals.*

Fisher Cassie. *Structural Analysis.* Longmans.

Lin, T. Y. *Design of Prestressed Concrete Structures.* Wiley.

Parul and Moorman. *Analysis of Statically Indeterminate Structures.* Wiley.

Pearson and Others. *Timber Engineering Design Handbook.* Melb., U.P.

8.132 Structures

Elastic analysis of pin-jointed and rigid-jointed plane and space structures using the force and displacement methods and extension to matrix methods. Plastic analysis of simple steel structures.

Design of retaining walls and small dams. Design of continuous structures in reinforced concrete. Introduction to ultimate load method in reinforced concrete design. The principles of prestressed concrete design with simple applications. Special characteristics of timber. The design of timber structures.

REFERENCE BOOKS

Ferguson. *Reinforced Concrete Fundamentals.*

Hoff. *The Analysis of Structures.* Wiley.

Lin, T. Y. *Design of Prestressed Concrete Structures.* Wiley.

Pearson and Others. *Timber Engineering Design Handbook.* Melb. U.P.

Winter, Urquhart and O'Rourke. *Design of Concrete Structures.* 7th ed., McGraw-Hill, 1964.

8.141 Engineering Computations

Intercept charts for three or more variables. Nomograms. Solution of algebraic and transcendental equations by simple iteration methods. Introduction to finite differences. Solution of differential and partial differential equations by using finite differences. Application to instability problems. Relaxation methods applied to solution of problems involving differential equations such as Poisson's equation.

REFERENCE BOOKS

Hall, A. S. *Construction of Graphs and Charts.* Pitman.

McCracken and Dorn. *Numerical Methods and Fortran Programming.* Wiley, 1964.

Salvadori and Baron. *Numerical Methods in Engineering.* 2nd ed., Prentice-Hall, 1962.

Shaw. *Relaxation Methods.* Dover.

8.142 Engineering Analysis

Intercept charts for three or more variables. Nomographic charts. Solution of algebraic and transcendental equations by simple iteration methods. Matrices — multiplication, inversion. Solution of linear simultaneous equations. Finite differences. The difference equation. Solution of differential and partial differential equations by using differences. Application to instability problems. Relaxation methods applied to solution differential equations such as Poisson's equation.

Introduction to probability. Random variable and standard elementary distributions. Sampling distributions. Estimation of parameters. Standard tests of hypotheses. Introduction to regression analysis.

REFERENCE BOOKS

Hall, A. S. *Construction of Graphs and Charts.* Pitman.

McCracken and Dorn. *Numerical Methods and Fortran Programming.* Wiley, 1964.

Miller, I. and Freund, J. E. *Probability and Statistics for Engineers.* Prentice-Hall, 1965.

Salvadori and Baron. *Numerical Methods in Engineering.* 2nd ed., Prentice-Hall, 1962.

Shaw. *Relaxation Methods.* Dover.

8.151 Mechanics of Solids

Statics of bars. Geometrical properties of plane figures. Stress and strain; uniaxial stress. Stresses and deformations due to bending, shear and torsion. Stress and strain at a point; combined stresses. Assemblages of bars and beams. Structural instability. Dynamic loading.

TEXT BOOK

Higdon, Chlsen, Stiles and Weese. *Mechanics of Materials.* Wiley.

REFERENCE BOOKS

Shanley. *Strength of Materials.* McGraw-Hill.

Timoshenko and MacCulloch. *Elements of Strength of Materials.* McGraw-Hill.

8.152S STRUCTURES

Introduction to structural design; design loads, safety factors and load factors; Codes of Practice. Design of metal structures; members in tension, compression and bending, connections; framed structures. Reinforced concrete design; beams and short columns; simple slabs. Structural analysis: principle of virtual work; force and displacement methods; deflections in structures; solution of statically indeterminate structures; introduction to moment distribution; influence lines; introduction to structural dynamics.

TEXT BOOKS

S.A.A. Interim Code Nos. 350, 351. CA8. Part 1 — 1965.

S.A.A. Code CA2 — 1963.

REFERENCE BOOKS

Bresler and Lin. *Design of Steel Structures.* Wiley.

Ferguson. *Reinforced Concrete Fundamentals.*

Gray and Others. *Steel Designer's Manual.* Lockwood.

Hoff. *The Analysis of Structures.* Wiley.

Pippard and Baker. *Analysis of Engineering Structures.* Arnold.

Tall (ed.). *Structural Steel Design.* Ronald Press, 1964.

8.161S Engineering Mathematics

Probability and Statistics — Introduction to probability. Random variables and standard elementary distributions. Sampling distributions. Statistical inference, hypotheses testing. Engineering applications.

Engineering Computations — Flow charts and computer programming. Error propagation. Interpolation, finite differences and regression analysis. Solution of simultaneous equations, matrix operations and eigenvalue problems. Numerical integration and solution of ordinary and partial differential equations.

Text and Reference Books as for 8.142 Engineering Analysis.

8.211 Building Science IIB (Mechanics of Materials)

An introductory course. The load-deformation behaviour of engineering materials is considered with reference to the use of materials in structures, and to materials laboratory practice. Special emphasis is made of the need for efficient utilization of materials with reference to strength, durability, appearance and economy.

Concrete Technology — Principal types of cements, their properties and simple testing; cement handling and storage. Concrete aggregates, characteristics, grading and testing. Admixtures. Factors affecting concrete properties. Basic concrete mix requirement and mix design methods. The manufacture of concrete and job control.

REFERENCE BOOKS

A.C.I. Manual of Concrete Inspection. Amer. Conc. Institute.

Concrete Manual. U.S. Bureau of Reclamations. (Latest Edition).

Troxell and Davis. *Composition and Properties of Concrete.* McGraw-Hill, 1956.

8.221 Engineering Materials

Concrete Technology — Physical and chemical properties of cements. Production, testing and selection of aggregates. Pozzolans, admixtures. Workability, strength and other properties of concrete. Target strengths and the design and proportioning of mixes.

Soil Mechanics — Physical and mechanical properties affecting capillarity and compressibility and their relevance to seepage, uplift and the settlement of buildings located above buried compressible soil strata. Shearing strength, bearing capacity and earth pressure. Soil identification and testing of physical properties.

Metallurgy — The atomic structure of metals. The grain structure of metals; effects of manufacturing processes. Structure, properties and heat treatment of commercially important alloys. The selection and properties of structural steels. Corrosion.

REFERENCE BOOKS

Terzaghi. *Theoretical Soil Mechanics.* Wiley.

U.S. Bureau of Reclamation. *Concrete Manual.*

Murdock, L. J. *Concrete Materials and Practice.* Arnold.

Terzaghi and Peck. *Soil Mechanics in Engineering Practice.* Wiley.

H.M.S.O. Publication. *Soil Mechanics for Road Engineers.*

Bishop and Henkel. *The Measurement of Soil Properties in the Triaxial Test.*

Ackroyd, T. N. W. *Concrete Properties and Manufacture.*

Fulton, F. S. *Concrete Technology.*

S.A.A. Specifications A2, A77, A100-110, CAZ.

8.222 Engineering Materials

Concrete Technology — Permeability, durability, elastic modulus, creep and other concrete properties; concrete volume changes. Design and proportioning of concrete mixes; lightweight concrete. Manufacture and field control of concrete.

Soil Mechanics — Studies of theoretical and applied sections of soil mechanics relating to foundations and earth dams. Treatments of modern soil technology studies and stabilization work.

Text and Reference Books as for 8.223.

8.223 Engineering Materials

Concrete Technology — Permeability, durability, elastic modulus, creep and other concrete properties; concrete volume change. Effect of creep and drying shrinkage on stress distribution of structural concrete; thermal effects. Design and proportioning of concrete mixes. Special concretes for high strength, mass and lightweight. Manufacture and field control of concrete.

Soil Mechanics — Advanced studies of theoretical and applied soil mechanics; foundations, mass soil behaviour, tunnels and arching, stability of slopes, earth dams. soil technology and stabilization work.

Properties of Materials — Elastic and inelastic behaviour of materials; theories of failure; design factors. Non-destructive test procedures. Experimental stress analysis methods. Structure and mechanical properties of timber. Properties of laminated sections. Properties and use of structural aluminium alloys, plastic materials and some clay products.

TEXT BOOKS

Troxell and Davis. *Composition and Properties of Concrete.* McGraw-Hill, 1956.

Wu, T. H. *Soil Mechanics.* Allyn and Bacon, 1966.

REFERENCE BOOKS

Ackroyd, T. N. W. *Concrete Properties and Manufacture.*

A.S.T.M. Standards, Part 10. Concrete and Mineral Aggregates. Amer. Soc. for Testing Materials (revised annually in Oct.) Philadelphia.

Bishop and Henkel. *The Measurement of Soil Properties in the Triaxial Test.*

BSI Specifications (current editions), B.S12 *Portland Cement (Ordinary and Rapid Hardening);*

B.S812 *Sampling and Testing of Mineral Aggregates, Sands and Fillers;*

B.S882 *Concrete Aggregates from Natural Sources;*

B.S1881 *Methods of Testing Concrete.* Br. Stands. Instit. London.

Concrete Manual. U.S. Bureau of Reclamation.

Earth Manual — 1960. U.S. Bureau of Reclamation.

Fulton, F. S. *Concrete Technology.* Portland Cement Inst., 1964, Johannesburg.

Harr, M. E. *Foundations of Theoretical Soil Mechanics.* McGraw-Hill.

Murdock, L. J. *Concrete Materials and Practice.* 3rd ed., Arnold.

Robson, T. D. *High Alumina Cements and Concretes.* Contractors Record, 1962, London.

S.A.A. Specifications (current editions). *A.2. Portland Cement;*

A.64 Ready Mixed Concrete; A77 Aggregates for Concrete;

A100-110 Methods of Testing Portland Cement Concrete;

A130 Los Angeles Test for Coarse Aggegate. Stand. Assoc. of Aust.

S.A.A. Code CA2 Concrete in Buildings. Stand. Assoc. of Aust.

Scott, R. F. *Principles of Soil Mechanics.* Addison-Wesley.

Short and Kinniborgh. *Lightweight Concrete.* Contractors Record. 1963, London.

Soil Mechanics for Road Engineers. H.M.S.O. Publication.

Taylor, W. H. *Concrete Technology and Practice.* Angus & Robertson, 1965.

Terzaghi. *Theoretical Soil Mechanics.* Wiley.

Terzaghi and Peck. *Soil Mechanics in Engineering Practice.* Wiley.

8.242S Soil Mechanics for Buildings

Determination of simple soil properties. Formation and classification of soils, classification tests. Fundamental characteristics of soils — clay mineralogy. Compaction. Permeability; stratification. Pore pressure and effective stress, seepage pressure, critical hydraulic gradient. Compression of soils. Retaining walls. Introductory foundation analysis. Principles of shear strength and application to slope stability.

TEXT BOOKS

Terzaghi and Peck. *Soil Mechanics in Engineering Practice.* Wiley, *or*
Wu, T. H. *Soil Mechanics.* Allyn and Bacon, 1966.

REFERENCE BOOKS

Bishop and Henkel. *The Measurement of Soil Properties in the Triaxial Test.*

Leonards, G. *Foundation Engineering.* McGraw-Hill, 1962.
Soil Mechanics for Road Engineers. H.M.S.O. Publication.
Teng, W. C. *Foundation Design.* Prentice-Hall, 1962.
Terzaghi. *Theoretical Soil Mechanics.* Wiley.

8.243S Soil Mechanics

History and development of soil mechanics. Determination of simple soil properties. Formation of soils. Classification tests. Soil sampling and field assessment. Clay mineralogy. Soil compaction. Permeability. Darcy's Law, laboratory determinations, seepage flow. Compression of soils, laboratory methods, consolidation phenomena, settlement analysis. Retaining walls, classical theories. Slope stability.

TEXT BOOKS

Terzaghi and Peck. *Soil Mechanics in Engineering Practice.* Wiley.
Wu, T. H. *Soil Mechanics.* Allyn & Bacon, 1966.

REFERENCE BOOKS

Grim, R. *Applied Clay Mineralogy.* McGraw-Hill, 1962.
Scott, R. F. *Principles of Soil Mechanics.* Addison-Wesley, 1963.
Soil Mechanics for Road Engineers. H.M.S.O. Publication, 1959.

8.251 Properties of Materials

Basic structure of solid materials; atomic and molecular bonds; crystal and amorphous structure. Classification and properties of solid materials; monomers and polymers; ceramics; metals and metal phases.

Mechanical behaviour of materials. Response to static loading in tension, compression, shear and bending. Use of static test data in analysis and design; variability of material properties; factors of safety. Hardness tests. Creep in solid materials. Response to dynamic loading; fatigue; impact and shock. Deterioration of engineering materials.

TEXT BOOK

Richards. *Engineering Materials Science.* Chapman & Hall.

REFERENCE BOOKS

Davis, Troxell and Wiskocil. *Testing and Inspection of Engineering Materials* McGraw-Hill.
Mann, J. Y. *Fatigue of Materials.* Melb. U.P.

8.252S Civil Engineering Materials

Concrete Technology — Properties of concrete and its applications; structure and composition. Rheological properties of fresh concrete. Mechanical properties of hardened concrete. Mix design. Methods of testing constituent materials.

Soil Mechanics — Pressure and movement of soil moisture, effective stress. Consolidation and settlement. Shear strength and testing of soils. Elastic theory of soil stress. Stability of slopes. Lateral earth pressure, retaining walls.

TEXT BOOKS

Scott, R. F. *Principles of Soil Mechanics.* Addison-Wesley, 1963.

Troxell and Davis. *Composition and Properties of Concrete.* McGraw-Hill.

Wu, T. H. *Soil Mechanics.* Allyn and Bacon. 1966.

REFERENCE BOOKS

Ackroyd, T. N. W. *Concrete Properties and Manufacture.*

A.S.T.M. Standards, Part 10. Concrete and Mineral Aggregates. Amer. Soc. for Testing Materials (revised annually in Oct.) Philadelphia.

Bishop and Henkel. *The Measurement of Soil Properties in the Triaxial Test.*

BSI Specification (current editions) *B.S12 Portland Cement (Ordinary and Rapid Hardening); B.S812 Sample and Testing of Mineral Aggregates, Sands and Fillers; B.S882 Concrete Aggregates from Mineral Sources; B.S1881 Methods of Testing Concrete.* Br. Stand. Instit. London.

Concrete Manual. U.S. Bureau of Reclamation.

Fulton, F. S. *Concrete Technology.* Portland Cement Instit. 1964. Johannesburg.

Murdock, L. J. *Concrete Materials and Practice.* 3rd ed., Arnold.

Robson, T. D. *High Alumina Cements and Concretes.* Contractors Record 1962, London.

S.A.A. Code C.A.2 Concrete in Buildings. Stand. Assoc. of Aust.

S.A.A. Specifications (current editions) *A.2 Portland Cement*;
A.64 Ready Mixed Concrete; A77 Aggregates for Concrete;
A100-110 Methods of Testing Portland Cement Concrete;
A130 Los Angeles Test for Coarse Aggregate. Stand. Assoc. of Aust.

Soil Mechanics for Road Engineers. H.M.S.O.

Taylor, W. H. *Concrete Technology and Practice.* Angus & Robertson, 1965.

Terzaghi. *Theoretical Soil Mechanics.* Wiley.

Terzaghi and Peck. *Soil Mechanics in Engineering Practice.* Wiley.

8.261 Geotechnics

Introduction to aspects of engineering geology and rock and soil characteristics to provide a basis of subsequent work in Soil Mechanics and Concrete Technology. Main topics covered are structural geology; petrology; clay mineralogy; soil properties groundwater. Some previous study of geology is assumed. In 1968 will include a broader treatment of engineering geology than indicated above.

TEXT BOOKS

Blyth. *Geology for Engineers.* 4th ed., 1960.

Wu, T. H. *Soil Mechanics.* Allyn and Bacon, 1966.

REFERENCE BOOKS

Dapples. *Basic Geology.* Wiley, 1959.

Krynine and Judd. *Principles of Engineering Geology and Geotechnics.* McGraw-Hill, 1957.

Schultz and Cleaves. *Geology in Engineering.* Wiley, 1952.

Application of Geology to Engineering Practice. Geol. Soc. of America, N.Y., 1950.

8.521 Hydraulics

Dimensional analysis, hydraulic model theory, surface resistance in flow in pipes and channels. Pipe networks, waterhammer. Channel flow steady non-uniform flow. Flow measurement. Hydraulic machinery, characteristic curves. Graphical flow nets, percolation.

REFERENCE BOOKS

Charts for the Design of Channels. H.M.S.O. Hydraulics Research Paper No. 2.

Parmakian. *Water Hammer Analysis.* Prentice-Hall.

Resistance of Fluids Flowing in Channel Pipes. H.M.S.O. Hydraulics Research Paper No. 1.

Rouse. *Engineering Hydraulics.* Wiley.

Stepanoff. *Axial and Centrifugal Pumps.* Wiley.

Vallentine. *Applied Hydrodynamics.* Butterworth.

Van Te Chow. *Open Channel Hydraulics.* McGraw-Hill.

8.522 Hydraulics

Dimensional analysis, hydraulic model theory, scale effect, distorted models. Fluid turbulence, velocity distribution, surface resistance, in flow past plane boundaries and in pipes and channels. Pipe flow, pipe networks, waterhammer. Channel flow, steady non-uniform flow, backwater curves, hydraulic pump, unsteady flow, waves, flood routing, Flow measurement. Hydraulic machinery, radial and axial flow, characteristic curves, cavitation. Potential flow, flow nets, percolation.

Text and Reference Books as for 8.521.

8.531S Water Engineering

Hydrology — The hydrologic cycle, the runoff cycle, water balance, energy balance, circulation of atmosphere, dynamic cooling, condensation and precipitation, probability analysis of precipitation and floods, infiltration, soil water and groundwater hydrology, streamgauging, hydrograph analysis, flood estimation, yield and storage determination, evaporation, evapotranspiration.

Hydraulics — Dimensional analysis, hydraulic model theory, scale effect. Fluid turbulence, velocity distribution, surface resistance in flow past plane boundaries and in pipes and channels. Pipe flow, pipe networks, waterhammer. Channel flow, steady non-uniform flow, backwater curves, hydraulic jump, unsteady flow, waves, flood routing. Flow measurement. Hydraulic machinery, radial and axial flow, characteristic curves, cavitation.

Public Health Engineering — Elements of organic chemistry, elements of biology, process of decomposition and decay, colloids and colloidal solutions, adsorption, ionic theory and dissociation, chemical and biochemical measurement of degree of pollution, rate of biochemical oxidation, principles of water treatment, principles of sewage treatment.

TEXT BOOKS

Fair and Geyer. *Water Supply and Waste Water Disposal.* Wiley, 1954.

Linsley, R. K., Kohler, M. A. and Paulhaus, J. L. *Hydrology for Engineers.* McGraw-Hill, 1958.

REFERENCE BOOKS

Bruce, J. P. and Clark, R. H. *Introduction to Hydrometeorology*. Pergamon, 1966.

Chow, V. T. (ed.). *Handbook of Applied Hydrology*. McGraw-Hill, 1964.

Johnstone, D. and Cross, W. P. *Elements of Applied Hydrology*. Ronald, 1949.

Wisler, C. O. and Brater, E. F. *Hydrology*. 2nd ed., Wiley, 1959.

8.611 Civil Engineering

Public Health Engineering — Processes of decomposition and decay; chemical and biochemical measurement of degree of pollution; basic principles of the treatment of polluted waters. Water supply schemes; principles and practice of water treatment; sewerage systems; construction of sewers; pumping stations; sewage treatment and disposal; swimming pools; refuse disposal.

Engineering Hydrology — A basic course dealing with principles and modern techniques. Topics covered are: meteorology, climatology, evaporation, analysis of hydrologic data, stream gauging, the runoff process, infiltration, design storm synthesis, unitgraphs, synthetic unitgraphs, flood frequency studies, rational method, water balance, water losses, rainfall runoff relationships, stream flow correlations, storage determination, groundwater.

TEXT BOOKS

Fair and Geyer. *Water Supply and Waste Water Disposal*. Wiley, 1954.

Linsley, R. K., Kohler, M. A., and Paulhaus, J. L. *Hydrology for Engineers*. McGraw-Hill, 1958.

REFERENCE BOOKS

Bruce, J. P. and Clark, R. H. *Introduction to Hydrometeorology*. Pergamon, 1966.

Chow, V. T. (ed.). *Handbook of Applied Hydrology*. McGraw-Hill, 1964.

Johnstone, D. and Cross, W. P. *Elements of Applied Hydrology*.

Wisler, C. O. and Brater, E. F. *Hydrology*. 2nd ed., Wiley, 1959.

8.612 Civil Engineering

Road Engineering — Road location and surveys, road design standards, road alignment, design of curves and intersections; types and functions of pavements. Pavement thickness. Road maintenance. Urban stormwater drainage. Economic analysis of routes and schemes.

Engineering Construction and Administration — Construction plant and equipment; drilling and tunnel equipment, earthmoving plant, hoisting and conveying equipment, pumping and pile-driving plant, workshop plant. Construction methods; earthworks foundations, coffer-dams, caissons, piling, steel, timber, and concrete construction. Prestressed concrete, bridges, wharves, dams, pipeline and multi-storyed buildings. Engineering administration; contracts, tenders, contract documents, estimates, quantities, specifications, costing, financial comparison of projects, personnel, management and organization.

E

Irrigation Engineering — Sources of water, water requirements, methods of application to land. Soil deterioration. Investigation and design. Maintenance and operation of irrigation systems; water metering.

TEXT BOOKS

Antill and Ryan. *Civil Engineering Construction.* A. & R.

O'Neill, L. V. *Fundamentals of Estimating and Construction Cost Control.* Tait, 1966.

Ryan, P. W. S. *Engineering Administration.* A. & R.

REFERENCE BOOKS

Ackerman and Locher. *Construction Planning and Equipment.* McGraw-Hill.

Creager, Justin and Hynes. *Engineering for Dams.* Wiley.

Goldman. *Financial Engineering.* Wiley.

Houk. *Irrigation Engineering.* Wiley.

8.613 Civil Engineering

Roads and Railway Engineering — Road location and surveys. Road design standards, road alignment, design of curves and intersections; types and functions of pavements. Pavement thickness. Road maintenance. Urban stormwater drainage. Economic analysis of routes and schemes.

Railway engineering: Permanent way. Track ballasting, points and crossings. Signalling, special structures, rolling stock, general.

Irrigation, Hydro-electric, and Harbours and Rivers Engineering — Sources of water, water requirements, methods of application to land. Soil deterioration. Investigation and design, maintenance and operation of irrigation systems; water metering.

Hydro-electric power schemes, combined thermal and hydro systems. Hydro-electric potential, determination of storage requirements and plant capacity.

Natural and artificial harbours, training of river estuaries, tides and wave action, docks, wharves, slipways; sea-bed exploration, hydrographic surveying.

Engineering Construction and Administration — Construction plant and equipment; compressed air drilling and tunnel equipment, earthmoving plant, hoisting and conveying equipment, pumping and pile-driving plant. Construction methods; earthworks, foundations, coffer-dams, caissons, piling, steel, timber and concrete construction. Bridges, wharves, dams, pipelines and multi-storeyed buildings.

TEXT BOOKS

Ackerman and Locher. *Construction Planning and Equipment.* McGraw-Hill.

Antill and Ryan. *Civil Engineering Construction.* A. &. R.

Creager, Justin and Hynes. *Engineering for Dams.* Wiley.

Du Platt Taylor. *Docks, Wharves and Piers.* Eyre and Spottiswoode.

Fair and Geyer. *Water Supply and Waste-Water Disposal.* Wiley.

Guthrie Brown. *Hydro-Electric Engineering Practice.* Blackie.

Houk. *Irrigation Engineering.* Wiley.

O'Neill, L. V. *Fundamentals of Estimating and Construction Cost Control.* Tait, 1966.

Ryan, P. W. S. *Engineering Administration.* A. &. R.

Webb. *Railroad Constructions.* Wiley.

8.621 Engineering Construction

Construction plant and equipment; compressed air services, drilling, earth-moving, tunnelling and blasting, hoisting and conveying, pile-driving, etc.; aggregate and concrete plant. Principles of construction administration; evolution of management; objectives of management; principles of organisation; motivation and communication; project management. The role of government and local government authorities. An introduction to construction planning and scheduling; cost control and cost accounting; tenders and the preparation of estimates; scheduling of operations; linear programming, critical path and PERT techniques; contracts and specifications.

TEXT BOOKS

Antill, J. and Ryan, P. *Civil Engineering Construction*. A. & R.

O'Neill, L. V. *Fundamentals of Estimating and Construction Cost Control*. Tait, 1966.

Ryan, P. W. S. *Engineering Administration*. A. &. R.

REFERENCE BOOKS

Refer to subjects 8.612 and 8.613S.

8.711 Engineering for Surveyors

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

REFERENCE BOOKS

Bruce, J. P. and Clark, R. H. *Introduction to Hydrometeorology*. Pergamon, 1966.

Chow, V. T. (ed.). *Handbook of Applied Hydrology*. McGraw-Hill, 1964.

Linsley, R. K., Kohler, M. A. and Paulhaus, J. L. *Hydrology for Engineers*. McGraw-Hill.

Rainfall and Runoff. Standards Committee No. 2. Instit. of Engineers (Aust.), 1958.

8.712S Engineering for Surveyors

Highways: location and design. Railways: design and construction. Aerodrome design. Harbours: seabed exploration, natural and artifical harbours. Municipal engineering: water and sewage reticulation, drainage, reservoirs, dam sites, irrigation, tunnel construction.

DEPARTMENT OF SURVEYING

Undergraduate Subjects

8.801 Surveying I

Historical development of surveying methods and instruments, geodesy, cartography and astronomy. Introduction to modern aspects. Cartographic drawing and equipment. Surveying methods and instruments. Computations.

TEXT BOOK

Clark, D. *Plane and Geodetic Surveying.* Vol. I, 5th ed., Constable, 1965.

REFERENCE BOOKS

Mitchell, H. C. *Definition of Terms used in Geodetic and other Surveys.* U.S. Coast and Geodetic Survey Sp. Pub. 242, 1948.

Sandover, J. A. *Plane Surveying.* Arnold, 1961.

8.802 Surveying II

Part A: Introduction to errors of observation. Engineering surveys; investigation and setting out surveys, e.g. plane triangulation, traversing, contours, areas, volumes, horizontal and vertical curves, height determination by barometric, differential and trigonometric levelling. Hydrographic surveying.

Part B: Cartography, atlas map projections, map reproduction.

Part C: Geometrical optics, lens systems and thick lenses, aberrations of optical systems, applications.

TEXT BOOKS

Clark, D. *Plane and Geodetic Surveys.* Vol. I, 5th ed., Constable, 1965.

Clark, D. *Plane and Geodetic Surveying.* Vol. II, 5th ed., Constable, 1963.

REFERENCE BOOKS

Bannister, A. and Raymond, S. *Surveying.* Pitman, 1959.

Mitchell, H. C. *Definitions of Terms used in Geodetic and other Surveys.* U.S. Coast and Geodetic Survey Sp. Pub. 242, 1948.

8.803S Surveying III

Graduation errors, linear and angular. Optical and electronic distance measurement. Mining and tunnel surveys. Survey methods for engineering projects.

TEXT BOOKS

Clark, D. *Plane and Geodetic Surveying.* Vol. I, 5th ed., Constable, 1965.
Clark, D. *Plane and Geodetic Surveying.* Vol. II, 5th ed., Constable, 1963.

REFERENCE BOOKS

Hardy and Perrin. *The Principles of Optics.* McGraw-Hill, 1956.

Laurila, S. H. *Electronic Surveying and Mapping.* Ohio State Uni., 1960.

Mitchell, H. C. *Definitions of Terms used in Geodetic and other Surveys.* U.S. Coast and Geodetic Survey Sp. Pub. 242, 1948.

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

8.821 Geodesy I

Figure of the earth, geoid, ellipsoid. Differential geometry: Euler's Theorem, Clairaut's Theorem, properties of geodesics, curvatures on the spheroid. Legendre's Theorem, calculations for short and medium lines on the spheroid. Outline of surveyor's projections. Technique of observation,

estimates and tests of internal precision of angle, direction and distance measurements. Adjustment of control surveys, precision of adjusted values, testing of results. Approximate adjustments, braced quadrilateral.

TEXT BOOKS

Bomford, G. *Geodesy.* Oxford U.P., 1962.

Clark, D. *Plane and Geodetic Surveying.* Vol II, 5th ed., Constable, 1963.

REFERENCE BOOKS

Eisenhart, L. P. *A Treatise on the Differential Geometry of Curves and Surfaces.* Dover, 1960.

Mitchell, H. C. *Definition of Terms Used in Geodetic and other Surveys* U.S. Coast and Geodetic Survey Sp. Pub. 242, 1948.

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

8.822 Geodesy II

Calculations on the ellipsoid; longitude, latitude and reverse azimuth. Major horizontal control surveys, plumb line deviations and Laplace stations. Base lines, precise traversing, trilateration, high precision levelling.

TEXT BOOK

Bomford, G. *Geodesy.* Oxford U.P., 1962.

REFERENCE BOOKS

Laurila, S. H. *Electronic Surveying and Mapping.* Ohio State Univ., 1960.

Mueller, I. and Rockie, J. D. *Gravimetric and Celestial Geodesy — A Glossary of Terms.* Ungar, 1966, N.Y.

Reynolds, W. F. *Manual of Triangulation Computation and Adjustment.* U.S. Coast and Geodetic Survey Sp. Pub. 138, 1955.

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

Thomas, P. D. *Conformal Projections in Geodesy and Cartography.* U.S. Coast and Geodetic Survey Sp. Pub. 251, 1952.

8.831S Astronomy I

The celestial sphere and the astronomical triangle. Time. Latitude, longitude and azimuth determinations; best position, balancing, circum- and ex-meridian methods. Position lines. Sun observations.

TEXT BOOKS

Textbook of Field Astronomy. H.M.S.O., 1960.

Star Almanac for Land Surveyors for 1968. H.M.S.O.

8.832 Astronomy II

Precise time of observation. Geodetic methods for determination of precise latitude, longitude and azimuth. Astrolabes. Reduction of star-co-ordinates from Mean to Apparent Place.

REFERENCE BOOKS

Hoskinson, A. J. and Duerksen, J. A. *Manual of Geodetic Astronomy.* U.S. Coast and Geodetic Survey Sp. Pub. 237, 1952.

Roelofs, R. *Astronomy Applied to Land Surveying.* Ahrend, 1950..

8.841 Surveying Computations

Plane trigonometry formulae, use of tables, calculation of triangles, areas, roadways, subdivisions, curves. Co-ordinate and traverse computations.

TEXT BOOK

Seven Figure Mathematical Tables. Chambers, 1958.

8.842S Surveying Computations

Transformations. Resection, intersection. Error theory. Adjustment by least squares, variance-covariance matrix.

TEXT BOOKS

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

Seven Figure Mathematical Tables. Chambers, 1958.

REFERENCE BOOKS

Vega. *Seven Figure Logarithmic Tables.*

Shortrede. *Logarithms of Sines and Tangents for Every Second.* Layton.

Tables of Natural Sines, Tangents etc. to Every Ten Seconds. D.M.R., 1949.

8.851S Photogrammetry I

Photogrammetric optics, sterescopic vision. Geometry of air photo, central perspective projection. Survey cameras, photographic materials. Radial triangulation, rectification, mosaics.

REFENCE BOOK

Manual of Photogrammetry 3rd ed., Am. Soc. Photogram., 1966.

8.852 Photogrammetry II

Photogrammetric orientation; photo-interpretation. Camera calibration, focal length, principal point. Stereoscopic instruments, restitution and approximate instruments. Aerial triangulation, propagation of errors, strip and block adjustment. Flight planning, auxiliary instruments. Aerial mapping.

TEXT BOOK

Hallert, B. *Photogrammetry.* McGraw-Hill, 1960.

REFERENCE BOOK

Manual of Photogrammetry 3rd ed., Am. Soc. Photogram., 1966.

8.881S Land Law, Valuation and Utilization

Survey Law — General outline, history. Land tenure, boundaries, easements. Common law, statute law. Equity and case law. Relevant acts and regulations.

Land Valuation — General principles, unimproved and improved capital value, valuation of freehold and leasehold, depreciation. Relevant acts, regulations and court procedures. Urban and rural valuations.

Land Utilization — Climate, vegetation, soils, Erosion and conservation. Land types; classification and use. Tree identification.

TEXT BOOK

Murray, J. F. N. *Principles and Practice of Valuation.* C'wealth Inst. of Valuers, 1966.

8.882 Cadastral Surveying

Land tenure, registration and cadastral surveys in selected countries. Survey practice law, professional ethics, surveyors' rights, powers and duties. Cadastral surveys in New South Wales; searches, Torrens and Old System title surveys, identification surveys, field records and plans.

TEXT BOOK

Willis. *Survey Investigation.* Registrar-General's Dept.

REFERENCE BOOK

Dawson and Sheppard. *Land Registration.* H.M.S.O., 1956.

SCHOOL OF ELECTRICAL ENGINEERING

6.001S Electrical Engineering

Advanced circuit theory, analysis and synthesis, electrical measurements and electric and magnetic field theory.

CIRCUIT THEORY SECTION

TEXT BOOK

Van Valkenburg. *An Introduction to Modern Network Synthesis.* Wiley.

REFERENCE BOOKS

Guillemin. *Synthesis of Passive Networks.* Wiley.

Tuttle. *Network Synthesis.* Wiley.

CONTROL SECTION

No specified Text or Reference Books.

FIELD THEORY SECTION

TEXT BOOK

Reitz and Milford. *Foundations of Electromagnetic Theory.* Addison-Wesley, 1960.

REFERENCE BOOK

Fano, Chu and Adler. *Electromagnetic Fields, Energy and Forces.* Wiley.

MEASUREMENTS SECTION

TEXT BOOK

Golding and Widdis. *Electrical Measurements and Measuring Instruments.* Pitman, 1963.

REFERENCE BOOKS

Harris. *Electrical Measurements.* Wiley.

Terman and Pettit. *Electronic Measurements.* McGraw-Hill.

6.052 Electrical Engineering

Measurement methods in electrical engineering.

TEXT BOOK

Golding and Widdis. *Electrical Measurements and Measuring Instruments.* Pitman, 1963.

REFERENCE BOOKS

Harris. *Electrical Measurements.* Wiley.

Terman and Pettit. *Electrical Measurements.* McGraw-Hill.

6.064 Introduction to Computer Science

An introductory course covering basic machine organization, order codes, procedure oriented languages and problem solving.

TEXT BOOK

Nashelsky. *Digital Computer Theory.* Wiley.

PL/O — Programming Manual. (University of New South Wales Computing Centre).

REFERENCE BOOKS

Bartee. *Digital Computer Fundamentals.* McGraw-Hall.

McCluskey. *Introduction to the Theory of Switching Circuits.* McGraw-Hill.

Marcus. *Switching Circuits for Engineers.* Prentice-Hall.

6.065 Computer Science

Computer organization and programming, numerical analysis and information structures with electives from algorithmic languages and compilers, numerical analysis, logical design, digital systems, programming systems, mathematical optimization techniques, simulation and heuristics, and data processing.

6.101 Electric Circuit Theory

A first course in the basic principles of electrical engineering and their application to the solution of circuits. The rationalized MKS system of units. Solution of DC networks under steady state conditions. Characteristics of two terminal linear and non-linear components. Electrostatics. Single transients in electric circuits. Alternating voltages and currents. Components. Series RL and RC circuits. Power. Resonance.

TEXT BOOKS

Burlington. *Mathematical Tables and Formulas.* McGraw-Hill.

or

C.R.C. Standard Mathematical Tables. Chemical Rubber Publishing Co.,

Clement and Johnson. *Electrical Engineering Science.* McGraw-Hill.

REFERENCE BOOKS

Ham and Sleeman. *Scientific Basis of Electrical Engineering.* Wiley.

McGreevy. *The MKS System of Units.* Pitman.

M.I.T. *Electric Circuits.* Wiley.

Timbie and Bush. *Principles of Electrical Engineering.* 4th ed., Wiley.

6.102 Circuit Theory

General network theory. Mesh and nodal equations. Steady state and transient analysis of lumped parameter systems, Laplace transformation. Three phase circuits, balanced and unbalanced. Feedback theory, stability, Nyquist criterion, elementary compensation techniques. Fourier series analysis, Fourier integral. Transmission lines.

TEXT BOOK

No specified Text.

REFERENCE BOOKS

NETWORK ANALYSIS SECTION

Kerchner and Corcoran. *Alternating Current Circuits.* 4th ed., Wiley.

Ley, Lutz and Rehberg. *Linear Circuit Analysis.* McGraw-Hill.

Prensky. *Electronic Instrumentation.* Prentice-Hall.

Roe. *Networks and Systems.* Addison-Wesley.

FEEDBACK THEORY SECTION

Kuo. *Automatic Control Systems.* 2nd ed., Prentice-Hall.

TRANSMISSION LINES SECTION

Magnusson. *Transmission Lines and Wave Propagation.* Allyn and Bacon.

ELECTRIC CIRCUIT THEORY

TEXT BOOK

No specified Text.

REFERENCE BOOKS

Clement and Johnson. *Electrical Engineering Science.* McGraw-Hill.

Edminister. *Electric Circuits.* Schaum.

Johnson. *Transmission Lines and Network.* McGraw-Hill, 1950.

Le Page and Seely. *General Network Analysis.* McGraw-Hill.

Ley, Lutz and Rehberg. *Linear Circuit Analysis.* McGraw-Hill.

Scott. *Linear Circuits — Parts I and II.* Addison-Wesley.

Skilling. *Electrical Engineering Circuits.* Wiley, 1965.

6.152 Circuit Theory

Syllabus as for 6.102 except feedback theory.

TEXT BOOKS

No specified Text.

6.201 Electric Power Engineering

Introduction to the principles of steady state operation of transformers and rotating machines used for the conversion of energy. Generalized machines. DC machines. Metadynes. Transformers. Three phase and single phase synchronous and induction machines.

TEXT BOOKS

Fitzgerald and Kingsley. *Electric Machinery.* 2nd ed., McGraw-Hill. (for 6.201).

Hindmarsh. *Electrical Machines.* Pergamon. (for 6.251).

REFERENCE BOOKS

Clayton. *Design and Performance of D.C. Machines.* Pitman.

M.I.T. *Magnetic Circuits and Transformers.* Wiley.

Say. *Design and Performance of A.C. Machines.* Pitman.

6.202S Power Systems

The performance of power systems under steady load and fault conditions. Transformers. Transmission line parameters. Steady state and unbalanced loads and faults. Voltage surges. System stability. System protection. The laboratory work is part of the co-ordinated course serving this subject and 6.401S Control Systems and 6.212S Machines.

TEXT BOOK

Stevenson. *Elements of Power System Analysis.* 2nd ed., McGraw-Hill.

REFERENCE BOOKS

Kimbark. *Power System Stability. Vols. I, II and III.* Wiley.

Starr. *Generation Transmission and Utilization of Electrical Power.* Pitman.

Westinghouse Electric Corp. *Electrical Transmission and Distribution Reference Book.*

6.212S Machines

Aspects of machine operation will be developed from the basic treatment of 6.201, to include cross-field machines, parallel operation of synchronous machines, developments on induction machines, both individually and in combination with A. C. commutator machines for power factor and speed control. Transient operation, saturation, harmonics, saliency, and unbalanced conditions will be considered. The laboratory work is part of the co-ordinated course serving this subject and 6.401S Control Systems and 6.202S Power Systems.

TEXT BOOK

Brosan and Hayden. *Advanced Electrical Power and Machines.* Pitman.

REFERENCE BOOKS

Adkins. *The General Theory of Electrical Machines.* Chapman and Hall.

Clayton. *Performance and Design of D.C. Machines.* Pitman.

Draper. *Electrical Machines.* Longmans.

Kimbark. *Power System Stability. Vol. III.* Wiley.

Say. *Performance and Design of A.C. Machines.* Pitman.

Taylor. *Performance and Design of A.C. Commutator Motors.* Pitman.

Tustin. *Direct Current Machines for Control Systems.* Sporn.

Veinott. *Theory and Design of Small Induction Motors.* McGraw-Hill.

White and Woodson. *Electromechanical Energy Conversion.* Wiley.

Wood. *Theory of Electrical Machines.* Butterworth.

6.251 Electric Power Engineering

Syllabus and Book List as for 6.201.

6.262 Electrical Machines

Covers aspects of rotating machines as components of power and control systems.

Book List as for 6.212S.

6.301 Electronics

An introduction to the physical basis of electronics and electronic circuits, Topics include solid state, vacuum, and gas-filled devices, rectifiers, amplifiers, oscillators and an introduction to radio communications.

TEXT BOOK

Gibbons. *Semiconductor Electronics.* McGraw-Hill.

REFERENCE BOOKS

Semiconductor Electronics Education Committee Series. Wiley.

Adler et al. *Introduction to Semiconductor Physics. Vol. I.*

G. E. *Silicon Controlled Rectifier Manual.*

Gray et al. *Physical Electronics and Circuit. Vol. II.*

Harris. *Digital Transistor Circuits. Vol. VI.*

Hunter. *Handbook of Semiconductor Electronics.* 2nd ed., McGraw-Hill.

Joyce and Clarke. *Transistor Circuit Analysis.* Addison-Wesley.

Nussbaum. *Semiconductor Device Physics.* Prentice-Hall.

Phillips. *Transistor Circuit Engineering.* McGraw-Hill.

Searle et al. *Elementary Circuit Properties of Transistors. Vol. III.*

Terman. *Electronic and Radio Engineering.* 4th ed., McGraw-Hill.

Thornton et al. *Characteristics and Limitations of Transistors. Vol. IV.*

Thornton et al. *Multistage Transistor Circuits. Vol. V.*

Thornton et al. *Handbook of Basic Transistor Circuits. Vol. VII.*

Texas Instruments Inc. *Transistor Circuit Design.* McGraw-Hill.

Van de Ziel. *Solid State Physical Electronics.* Prentice-Hall.

DATA HANDBOOKS

R.C.A. *Semiconductor Products Handbook H.B.L.O.*

Mullard. *Technical Handbook.*

Fairchild. *Semiconductor Products Manual.*

6.302S Communications A

Theory and practice of certain aspects of communications engineering. Topics include modulation theory, demodulation, calculation, use and measurement of noise factor, oscillators, tuned amplifiers, transmitters and receivers. An integrated laboratory course is provided to serve the subjects 6.302S Communications A, 6.312S Communications B and 6.332S Communications C.

6.312S Communications B

Topics generally include guided propagation, information theory and noise, transmission lines, telephone networks, line communication equipment.

6.332S Communications C

Topics include propagation radiation, aerials, radar, navigational aids, radio astronomy, acoustics, vision, TV systems and equipment.

The Text and Reference Book list for these *three subjects* combined is the same as the combined list for the *two* subjects 6.352 and 6.362.

The Text and Reference Book lists for the three subjects combined, 6.302S Communications A, 6.312S Communications B, and 6.332S Communications C, is the same as the combined list for the two subjects, 6.352 and 6.362, with the following additional Reference Books for 6.312S:

Huxley. *The Principles and Practice of Wageguides.* Cambridge, 1947.

Marcuvitz. *Waveguide Handbook, M.I.T. Vol. 10.* McGraw-Hill, 1950.

Montgomery et al. *Principles of Microwave Circuits. M.I.T. Vol. 8.* McGraw-Hill.

Additional Reference Books for 6.332S.

Beranek. *Acoustics.* McGraw-Hill.

Jasik. *Antenna Engineering Handbook.* McGraw-Hill.

6.322S Electronics

A co-ordinated presentation of the theory and practice of semiconductors and thermionic devices. Topics include rectification and inversion, amplification, modulation and demodulation, switching circuits and square loop magnetics.

TEXT BOOK

No specified Text.

REFENCE BOOKS

Dean. *An Introduction to Counting Techniques and Transistor Circuit Logic.* Chapman and Hall.

G. E. *Silicon Controlled Rectifier Manual.*

Joyce and Clarke. *Transistor Circuit Analysis.* Addison-Wesley.

Landley, Davis and Aibrecht. *Electronic Designers Handbook.* McGraw-Hill.

Millman and Taub. *Pulse, Digital and Switching Waveforms.* McGraw-Hill.

Mortorola. *Power Transistor Handbook.*

Motorola. *Silicon Zener Diode and Rectifier Handbook.*

Motorola. *Switching Transistor Handbook.*

Schaefer, *Rectifier Circuits.* Wiley.

Texas Instruments Inc. *Transistor Circuit Design.* McGraw-Hill.

6.352 Communications

Syllabus as for 6.302S.

TEXT BOOK

Terman. *Electronic and Radio Engineering.* 4th ed., McGraw-Hill.

REFERENCE BOOKS

Semiconductor Electronics Education Committee Series. Wiley.

Ghausi. *Principles and Design of Linear Active Circuits.* McGraw-Hill. 1965.

Goldman. *Frequency Analysis, Modulation and Noise,* McGraw-Hill, 1948.

Gray, De Witt, Boothroyd and Gibbons. *Physical Electronics and Circuit Models of Transistors. Vol. 2.*

Joyce and Clarke. *Transistor Circuit Analysis.* Addison-Wesley.

Millman and Taub. *Pulse, Digital and Switching Waveforms.* McGraw-Hill, 1965.

Phillips. *Transistor Engineering.* McGraw-Hill.

Schwartz. *Information, Transmission, Modulation and Noise.*

Searle et al. *Elementary Circuit Properties of Transistors. Vol 3.*

Sevin. *Field-Effect Transistors.* McGraw-Hill, 1965.

Sturley. *Radio Receiver Design.* Chapman and Hall.

Thornton et al. *Characteristics and Limitations of Transistors. Vol. 4.*

Thornton et al. *Multistage Transistor Circuits. Vol. 5.*

Tucker. *Modulators and Frequency Changers.* McDonald, 1953.

6.356 Electronics

An introduction to the physical basis of electronics and of electronic circuits. Topics include principles of operation of solid state, vacuum and gas-filled devices. Basic types of electronic amplifiers.

TEXT BOOK

Gibbons. *Semiconductor Electronics.* McGraw-Hill.

REFERENCE BOOKS

Hunter. *Handbook of Semiconductor Electronics.* 2nd ed., McGraw-Hill. 1962.

Joyce and Clarke. *Transistor Circuit Analysis.* Addison-Wesley.

Lindmayer and Wrigley. *Fundamentals of Semiconductor Devices.* Van Nostrand, 1965.

Myers, Wong and Gordy. *Reliability Engineering for Electronic Systems.* Wiley.

Phillips. *Transistor Engineering.* McGraw-Hill.

6.357 Electronics

An extension of 6.356 with topics including rectifiers, amplifiers, oscillators, modulation and demodulation and switching circuits.

TEXT BOOK

Gibbons. *Semiconductor Electronics.* McGraw-Hill.

REFERENCE BOOKS

Alley and Attwood. *Electronic Engineering.* Wiley.

Angelo. *Electronic Circuits.* McGraw-Hill.

Fitchen. *Transistor Circuit Analysis and Design.* Van Nostrand.

Hakim and Barrett. *Transistor Circuits in Electronics.* Iliffe.

Joyce and Clarke. *Transistor Circuit Analysis.* Addison-Wesley.

Pierce. *Transistor Circuit Theory and Design.* Merrill.

6.362 Communications

Syllabus as for 6.312S.

TEXT BOOK

No specified Text.

REFERENCE BOOKS

Glazier and Lamont. *Transmission and Propagation.* Her Majesty's Stationery Office, 1958.

Hallen. *Electromagnetic Theory.* Chapman and Hall.

Hancock. *An Introduction to the Principles of Communication Theory.* McGraw-Hill.

Javid and Brenner. *Analysis, Transmission and Filtering of Signals.* McGraw-Hill.

Jordan. *Electromagnetic Waves and Radiating Systems.* Constable.

Karbowiak. *Trunk Waveguide Communication.* Chapman and Hall, 1965.

Kimbark. *Electrical Transmission of Power and Signals.* Wiley.

Krauss. *Electromagnetics.* McGraw-Hill.

Ramo, Whinnery and Van Duzer: *Fields and Waves in Communication Electronics.* Wiley, 1965.

Lovering. *Radio Communication.* Longmans Green.

Russell. *Modulation and Coding in Information Systems.* Prentice-Hall.

Skilling. *Electric Transmission Lines.* McGraw-Hill.

Starr. *Telecommunications.* Pitman.

6.401S Control Systems

Stability and performance, including compensation of linear control systems using frequency response and root locus techniques. Use of analogue computers. Process control. Control system components. The laboratory work is part of the co-ordinated course serving this subject and 6.202S Power Systems and 6.212S Machines.

TEXT BOOK

No specified Text.

REFERENCE BOOKS

Bower and Schultheiss. *Introduction to Servomechanism.* Wiley.

Elgerd. *Control Systems Theory.* McGraw-Hill.

Gilbert. *The Design and Use of Electronic Analogue Computers.* Chapman and Hall.

Gille, Pelegrin and Decauline. *Feedback Control Systems.* McGraw-Hill.

6.454 Power Systems and Control

Power Systems — Performance of transformers and power systems under steady load and fault conditions. *Control* — A study of the performance and analysis of automatic control systems.

TEXT BOOKS

Stevenson. *Elements of Power System Analysis,* 2nd ed., McGraw-Hill, 1962.

REFERENCE BOOKS

Bewley. *Travelling Waves on Transmission Systems.* Dover.

Goldman. *Transformation Calculus and Electrical Transients.* Constable, London.

Kimbark. *Power System Stability — Vols. I, II and III.* Wiley.

M.I.T. *Magnetic Circuits and Transformer.* Wiley.

Westinghouse Electric Corp. *Electrical Transmission and Distribution Reference Book.*

Control — A study of the performance and analysis of automatic control systems.

TEXT BOOKS

Elgerd. *Control Systems Theory.* McGraw-Hill.

Shinners. *Control System Design.* Wiley.

REFERENCE BOOKS

Bower and Schultheiss. *Introduction to Servomechanisms.* Wiley.

Raven. *Automatic Control Engineering.* McGraw-Hill.

Stockdale. *Servomechanisms.* Pitman.

6.501 Electrical Engineering (Honours)

Material will be selected from the following:

Engineering differential equations; Laplace and Fourier transforms; complex variables; generalized feedback theory; stability criteria; statistical methods of analysis; analogous system simulation; signal flow and matrix methods in electrical engineering.

TEXT BOOK

Faddeeva. *Computational Methods of Linear Algebra.* Dover.

REFERENCE BOOKS

Cunningham. *Introduction to Nonlinear Analysis.* McGraw-Hill.

Hohn. *Elementary Matrix Alegbra.* Macmillan.

Varga. *Matrix Iterative Analysis.* Prentice-Hall.

6.502S Electrical Engineering (Honours)

Material will be selected from the following:

Machine matrix equations; the primitive electrical machine; root locus applications; pulse techniques; sampled data; analysis of linear and non-linear systems containing noise; information theory; circuit synthesis; applications of electromagnetic theory; combinational and sequential switching theory.

TEXT BOOKS

Merriam. *Optimization Theory and the Design of Feedback Control Systems.* McGraw-Hill, 1964.

Reitz and Milford. *Foundations of Electromagnetic Theory.* Addison-Wesley, 1960.

Shercliff. *A Textbook of Magnetohydrodynamics.* Pergamon.

REFERENCE BOOKS

Caldwell. *Switching Circuits and Logical Design.* Wiley.

Cowling. *Magnetohydrodynamics.* Interscience.

Marcus. *Switching Circuits for Engineers.* Prentice-Hall.

Phister. *Logical Design of Digital Computers.* Wiley.

Spiegel. *Theory and Problems of Vector Analysis.* Interscience.

6.801 and 6.801S Electrical Engineering

A special course for metallurgists and engineers not intending to follow electrical engineering as a profession. Presentation of the fundamental principles of electric and magnetic circuits and vacuum tubes and the application of these principles to the theory, performance and control of electrical equipment.

6.802 Electrical Engineering

More advanced work on circuits, electrical and electronic equipment following on 6.801 and applications. Electrical and electronic measurement techniques, with emphasis on the instrumentation required for the electrical measurement of non-electrical quantities.

TEXT BOOK (for 6.801, 6.801S, 6.802 and 6.802S).

Smith. *Circuits, Devices and Systems.* Wiley.

REFERENCE BOOKS (for 6.801, 6.801S, 6.802 and 6.802S)

Del Toro. *Principles of Electrical Engineering.* Prentice-Hall.

Sutcliffe. *Electronics for Students of Mechanical Engineering.* Longmans.

6.811 Electronic Instrumentation for Surveys

Measurement of time, frequency and distance, Propagation of electromagnetic waves affecting the accuracy of tellurometry, time measurement, position finding and navigational aids.

TEXT BOOK

No specified Text.

REFERENCE BOOKS

Del Toro. *Principles of Electrical Engineering.* Prentice-Hall.

Smith. *Circuits, Devices and Systems.* Wiley.

Terman and Petitt. *Electronic Measurements.* McGraw-Hill.

6.841 Electronic Instrumentation

Fundamentals of electronic instrumentation, in particular the operation and use of equipment at audio and sub-audio frequencies for the measurement and recording of small signals in the presence of noise. The laboratory course comprises mainly demonstration experiments. Up to four weeks of field instruction will be included in the course.

6.901S Seminar

6.911 Thesis

For pass degree students in the fourth year of the full-time course.

6.921 Thesis

For honours degree students in the fourth year of the full-time course.

SCHOOL OF MECHANICAL AND INDUSTRIAL ENGINEERING

5.001 Engineering I

A. *Introduction to Engineering*

(i) *Engineering Technology*: *Materials.* Classification of materials in common use, occurrence of raw materials, processing of raw materials, refinements and properties of materials. *Manufacture.* Description and appraisal of the processes classified as; forming from liquid or solid, material removal, material joining. *Machines.* Analysis of the primary functions of the machine tools and an appraisal of their limitations. Principles of operation of common machine tools and illustration of their use.

(ii) *Computers — Introduction and Concepts*: Introduction to computers to follow the computer work in Mathematics I. To develop:—(a) familiarity with algorithms; (b) the use of procedure oriented languages; and (c) an introduction to computing equipment.

(iii) *Introduction to Engineering Design*: Engineering method, problem identification, creative thinking, mathematical modelling, materials and processes, communication of ideas, the place of engineering in society, *or*

Systems — Introduction and Concepts: Concepts and Introduction to Systems. To give students an appreciation of some of the concepts used in engineering, to relate the concepts to phenomena within their experience, and to illustrate them by case histories and engineering examples. Quantities. Concepts. Components. Systems.

TEXT BOOK

De Garmo, E. P. *Materials and Processes in Manufacturing.* Macmillan.

REFERENCE BOOKS

Harrisberger, L. *Engineeringmanship.* Wadsworth.

Dixon, J. R. *Design Engineering.* McGraw-Hill.

B. 1 *Engineering Mechanics*: Two and three dimensional force systems, composition and resolution of forces, laws of equilibrium. Statics of rigid bars, pin-jointed frames. Shear force, axial force, bending moment. Simple states of stress. Kinematics of the plane motion of a particle. Kinetics of the plane motion of a particle; equations of motion, dynamic equilibrium, work and energy.

TEXT BOOKS

Beer, F. P. and Johnston, E. *Mechanics for Engineers.* (Vector ed.), McGraw-Hill.

Hall, A. S. *Construction of Graphs and Charts.* Pitman.

REFERENCE BOOKS

Rule, J. T. and Watts, E. F. *Engineering Mechanics.* McGraw-Hill.

Timoshenko, S. and Young, D. H. *Engineering Mechanics.* McGraw-Hill.

C. *Engineering Drawing*: Fundamental concepts of descriptive geometry, including reference systems, representation of point, line and plane; fundamental problems of position and of measurement. Application of descriptive geometry to certain problems arising in engineering practice. Special emphasis on ability to visualize problems and processes involved in their solution. Instruction in the correct use of drawing instruments and the application of drawing standards. Measurements and dimensioning. Orthographic and isometric projections.

TEXT BOOKS

Robertson, R. G. *Descriptive Geometry.* Pitman.

Australian Standard Engineering Drawing Practice. I.E. Aust., 1966.

REFERENCE BOOK

Abbott, W. *Practical Geometry and Engineering Graphics.* Blackie.

5.001/1 Engineering I, Part I

For students in Year 2 of the Applied Geology course. It consists of Section B. I (Engineering Mechanics) and Section C (Engineering Drawing) of 5.001 Engineering I.

5.001 Engineering I

A. *Introduction to Engineering*

As for 5.001 Engineering I.

B. 2 *Engineering Mechanics*: Two and three dimensional force systems, composition and resolution of forces, laws of equilibrium. Statics of rigid bars, pin-jointed frames. Virtual work. Cables and cartenaries. Shear force, axial force, bending moment. Simple states of stress, geometric properties of plane figures. Kinematics of the plane motion of a particle. Kinetics of the plane motion of a particle and of systems of particles; equations of motion, dynamic equilibrium, work

and energy, impulse and momentum. Rotation of a rigid body about a fixed axis. Construction of graphs, line charts, linearization, logarithmic graphs. Graphical differentiation and integration.

C. *Engineering Drawing*

As for 5.001 Engineering I.

5.011/1 — Engineering 1A Part 1

A. *Introduction to Engineering*
As for 5.011 Engineering IA.

5.011/2 — Engineering 1A Part 2

B. *Engineering Mechanics*
As for 5.011 Engineering IA.

C. *Engineering Drawing*
As for 5.011 Engineering IA.

5.021S Seminar

For students in the full-time course in Mechanical Engineering.

5.023 Seminar

For students in the B.Sc (Tech.) course in Mechanical Engineering.

5.041 Thesis

For students in the part-time course in Mechanical Engineering.

5.051 Thesis

For students in the full-time course in Mechanical Engineering.

5.061 Technical Orientation

Designed to inform students of the art and technique of technical communication, the forms of engineering professional work and the nature of the courses of instruction. A major objective is to bring staff and students together in an atmosphere of discussion and enquiry. May include one or two visits to special establishments.

5.062 Technical Communications

A review of oral, written and graphical methods of conveying technical information in relation to the nature of the topic.—Methods of preparing and presenting technical lectures and engineering reports in their various forms. Reproduction and storage of printed, duplicated and graphical material. Systems of information retrieval: library searching; computerized data storage; personal libraries.

5.071 Engineering Analysis

Digital Computer Programming: *Numerical Methods* — Roots of non-linear equations. Systems of linear equations. Finite differences; numerical differentiation and integration. Solution of ordinary differential equations — series and stepwise methods. Solution of partial differential equations — finite difference and iterative methods. Emphasis to be placed on the use of digital computers. *Statistics* — An introduction to probability theory.

Random variables and distribution functions; the binomial, Poisson and normal distributions in particular. Standard sampling distributions, including those of χ^2, t and F. Estimation by moments and maximum likelihood; Confidence interval estimation. The standard tests of significance based on the above distributions, with a discussion of power where appropriate. An introduction to linear regression. Least squares adjustment of data.

TEXT BOOKS

Freund, J. E. *Mathematical Statistics.* Prentice-Hall.

Southworth and De Leeuw. *Digital Computation and Numerical Methods.* McGraw-Hill.

Statistical Tables.

REFERENCE BOOKS

Derman, C. and Klein, M. *Probability and Statistical Inference for Engineers.* Oxford U.P.

Freeman, H. *Introduction to Statistical Inferences.* Addison-Wesley.

Hald, A. *Statistical Theory with Engineering Applications.* Wiley.

Nielsen. *Methods in Numerical Analysis.* Macmillan.

Plumb. *Introduction to Fortran Programming.* McGraw-Hill.

Salvadori and Baron. *Numerical Methods in Engineering.* Prentice-Hall.

5.101/1 Mechanical Engineering Design, Part I

Design procedures, loadings and factors of safety, standards. Stresses in bolts. Discussion of problems involving simple stresses. Design of shafts and bearings, belt drives, friction clutches, springs and screws for power applications.

Text and Reference Books as for 5.112, together with:

TEXT BOOKS

Eder, W. G. and Gosling, W. *Mechanical System Design.* Pergamon.

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

REFERENCE BOOKS

A.S. Z5. Welding Terms and Definitions. S.A.A.

A.S. Z6. Symbols for Welding. S.A.A.

Berry, W. R. *Spring Design.* Emmott.

B.S. 46 Part 1. Keys and Keyways. B.S.I. 1958.

Eschman, Hasbargen, and Weigand. *Ball and Roller Bearings.* Oldenbourg.

Palmgren, A. *Ball and Roller Bearing Engineering.* S.K.F.

Phelan, R. M. *Fundamentals of Mechanical Design.* 2nd ed., McGraw-Hill.

Slaymaker, R. R. *Mechanical Design and Analysis.* Wiley.

Wahl, A. M. *Mechanical Springs.* McGraw-Hill.

Additional Standard Specifications and Codes may be referred to from time to time.

5.101/2 Mechanical Engineering Design, Part 2

Design of spur gear drives in accordance with BSS 436, introduction of worm gear design in accordance with BSS 721. Design of band brakes and shoe brakes. Crane design.

Text and Reference Books as for 5.101/1, together with:

TEXT BOOKS

A.S. CB2. Crane and Hoist Code. S.A.A. 1960.

Broughton, H. H. *Electric Cranes.* Spon.

B.S. 302 and 621. Wire Ropes for Cranes and Excavators. B.S.I. 1957.

B.S. 436. Machine Cut Gears — Helical and Straight Spur. B.S.I. 1940.

Merritt, M. E. *Gears.* Pitman.

REFERENCE BOOKS

B.S. 545. Bevel Gears. B.S.I. 1949.

B.S. 721. Worm Gears. B.S.I. 1963.

B.S. 2573 Part I. Permissible Stresses in Cranes. B.S.I. 1960.

Buckingham, E. *Analytical Mechanics of Gears.* McGraw-Hill.

Dudley, D. W. *Gear Handbook.* McGraw-Hill.

Additional Standard Specifications and Codes may be referred to from time to time.

5.102 Mechanical Engineering Design

Lectures — Advanced application of strength of materials with respect to the design of reciprocating machinery. Balancing of rotating and reciprocating masses. Flywheel determination. Governors.

Drawing Office — Design of elements encountered in reciprocating machinery. Crankshafts, connecting rods, pistons, cams, governors, etc.

Text and Reference Books as for 5.112, together with:

TEXT BOOK

Purday, H. F. P. *Diesel Engine Designing.* Constable, 1963.

REFERENCE BOOKS

A.S. B215. Rating and Testing Internal Combustion Engines. S.A.A., 1966.

Howarth. *Design of High Speed Diesel Engines.*

Mackerle. *The Air Cooled Engine.*

Richardo, H. *High Speed Internal Combustion Engines.* Blackie.

Roark, R. J. *Formulae for Stress and Strain.* 1965 ed., McGraw-Hill.

5.103 Mechanical Engineering Design

Lectures — Advanced application of strength of materials with respect to various design problems.

Drawing Office — Major design project and relevant engineering investigations.

TEXT BOOKS

Faires, V. M. *Design of Machine Elements.* 4th ed., Collier Macmillan.

Matousek, R. *Engineering Design.* Blackie.

Pippenger, J. and Koff, R. M. *Fluid Power Controls.* McGraw-Hill.

REFERENCE BOOKS

As for 5.101/1 together with:—

Marin, J. *Mechanical Behaviour of Engineering Materials.*

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

Spotts, M. F. *Mechanical Design Analysis.* Prentice Hall.

5.111 Mechanical Engineering Design

Introductory lectures illustrating the interdependence of design and technology. Mechanical technology. Introduction to workshop metrology. Philosophy and technique of design. Simple creative design assignments. Basic engineering elements.

TEXT BOOK

Australian Standard Engineering Drawing Practice. I.E. Aust. 1966.

Faires, V. M. *Design of Machine Elements.* Collier Macmillan.

Puttock, M. J. *Introduction to Engineering Metrology.* W. Brook Publishing Co. Sydney.

REFERENCE BOOKS

Asimow, M. *Introduction to Design.* Prentice-Hall.

B.S. 1916, Parts I and II. Limits and Fits for Engineering. B.S.I. 1953.

Dixon, J. R. *Design Engineering.* McGraw-Hill.

Edel, D. H. *Introduction to Creative Design.* Prentice-Hall.

Parker, S. *Drawing and Dimensions.* Pitman.

5.112 Mechanical Engineering Design

Design for Production — Principles of tolerance specification, standard procedures for gauging, dimensioning and surface finish specification. *Design of Machine Elements* — Application of fundamental principles to the design of common machine elements, such as shafts, springs, bearings, power transmission devices.

Text and Reference Books as for 5.111, together with:

TEXT BOOKS

B.S. 1916, Parts I and II. Limits and Fits for Engineering. B.S.I. 1953.

Matousek, R. *Engineering Design.* Blackie.

REFERENCE BOOKS

B.S. 2517. Definitions for Use in Mechanical Engineering. B.S.I., 1959.

Dobrovolsky, V. et al. *Machine Elements.* Foreign Language Publications Moscow.

Kent,, R. T. *Mechanical Engineer's Handbook — Design and Production.* Wiley.

Marks, *Mechanical Engineer's Handbook.* McGraw-Hill.

Obey and Jones. *Machinery Handbook.*

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

5.113 Mechanical Engineering Design

Design Theory and Technique — Fundamental concepts of the design process, decision theory. Process and technique of optimization. Principles of material selection. Special analytical and experimental techniques of engineering design. *Design Practice* — Minor and major creative design projects, application of sophisticated design techniques in major fields of mechanical engineering.

5.201 Mechanical Technology

General principles. Geometry of machine parts. Kinematics of machine tools. Action of metal-cutting tools. Mechanisms used in machine tools. Machine tool components. Actual machine tools. Centre lathes. Drilling and tapping. Milling. Lathes retaining tool settings. Semi- and fully-automatic lathes. Boring, boring mills. Horizontal boring machines. Jig-boring. Reciprocating machine tools. Planer, shaper, slotter. Broaching.

TEXT BOOK

De Garmo, E. P. *Materials and Processes in Manufacturing.* Macmillan.

REFERENCE BOOK

Wright-Baker, J. *Modern Workshop Technology.*

5.203 Mechanical Technology

Gear-cutting. Grinding. Complex surfaces, profiling, automated machines. Dimensional accuracy, surface finish. Finishing processes, lapping, honing, super-finishing, gear-shaving. Plastic yielding of metals. Blanking and shearing. Bending. Hollow-ware. Forging. Casting. Rolling. Welding.

5.301 Engineering Mechanics

Fundamentals of vector algebra. Kinematics of the plane motion of a particle. Dynamics of the plane motion of a particle. Unconstrained motion of a particle. Constrained motion of a particle. Satellites. Systems of connected particles. Kinematics of the plane motion of a rigid body.

Text and Reference Books as for 5.311.

TEXT BOOK

De Garmo, E. P. *Materials and Processes in Manufacturing.* Macmillan.

REFERENCE BOOKS

Crane. *Plastic Working in Metals.*

Town. *Machine Shop Technology.*

Wright-Baker, J. *Modern Workshop Technology.*

5.302 Theory of Machines

Kinematics of simple mechanisms. Dynamics of simple mechanisms; Principle of virtual work. Kinematics of cams (analysis, synthesis). Dynamics of cams (springs). Kinematics of toothed gearing (involutometry, non-standard gears, cutter-setting corrections). Gear trains (simple, compound, epicyclic).

TEXT BOOKS

Hirschhorn, J. *Dynamics of Machinery.*

Hirschhorn, J. *Kinematics and Dynamics of Plane Mechanisms.* McGraw-Hill.

REFERENCE BOOKS

Buckingham, E. *Analytical Mechanics of Gears.* McGraw-Hill.

Holowenko, A. R. *Dynamics of Machinery.* Wiley.

Mabie, H. H. and Ocvirk, F. W. *Mechanisms and Dynamics of Machinery.* Wiley.

Rosenauer, N. and Willis, A. H. *Kinematics of Mechanisms.* Associated Gen. Pub.

Rothbart, H. A. *Cams.* Wiley.

5.303 Mechanical Vibrations

Periodic motions; Fourier analysis; simple harmonic motion. One-degree-of-freedom system (free undamped, free damped, forced undamped, forced damped). Some vibration-measuring instruments. Vibration isolation. Whirling speeds of shafts (Rayleigh's method. Dunkerley's formula). Free torsional vibrations of shafts (two and three rotors only).

TEXT BOOKS

Church, A. H. *Mechanical Vibrations.* 2nd ed., Wiley.

Hirschhorn, J, *Dynamics of Machinery.*

REFERENCE BOOKS

Den Hartog, J. P. *Mechanical Vibrations.* McGraw-Hill.

Burton, R. *Vibration and Impact.* Addison Wesley.

5.306S Theory of Machines (Transition Subject)

Kinematics of complex mechanisms. Dynamic motion analysis. Advanced Kinematics of the plane motion. Mechanical vibrations. Inertia effects in machinery. Flywheel analysis.

TEXT BOOKS

Church, A. H. *Mechanical Vibrations.* 2nd ed., Wiley.

Holowenko, A. R. *Dynamics of Machinery.* Wiley.

Hirschhorn, J. *Kinematics and Dynamics of Plane Mechanisms.* McGraw-Hill.

Hirschhorn, J. *Dynamics of Machinery.*

REFERENCE BOOKS

Burton, R. *Vibrations and Impact.* Addison Wesley.

Den Hartog, J. P. *Mechanical Vibrations.* McGraw-Hill.

Mabie and Ocvirk, F. W. *Mechanisms and Dynamics of Machinery.* Wiley.

Tse, Morse and Hinkle. *Mechanical Vibrations.*

5.311 Engineering Mechanics

Kinematics of Particle, rectilinear and curvilinear motions, Coriolis acceleration. Kinetics of Particle, Newton's laws, d'Alembert's principle, work, energy, impulse, momentum. Kepler's laws, satellites. Kinematics of Rigid Body, translation, fixed-axis rotation, general plane motion. Kinetics of Rigid Body, Moment of inertia, Steiner's law, centre of percussion, equivalent two-mass system, work, energy, impulse, momentum. Kinetics of Rigid Body in three-dimensional space, steady precession of gyroscope.

TEXT BOOK

Beer, F. P. and Johnston, E. *Mechanics for Engineers.* Vector ed., McGraw-Hill.

REFERENCE BOOKS

Higdon, A. and Stiles, W. B. *Engineering Mechanics.* Prentice-Hall, 1949.
Timoshenko, S. and Young, D. H. *Engineering Mechanics.* McGraw-Hill.

5.321 Automatic Control Engineering

Block diagrams and Laplace transform methods for system analysis. Transfer functions. The general criterion for stability. Routh's criterion. Electronic Analogue Computer and its use in system simulation. Nyquist criterion and Nyquist diagrams. Bode diagrams and frequency response analysis. Root locus methods. Types of controller action and their effects on system response. Optimum settings, ultimate period method and maximum gain method. Analysis of several types of pneumatic controllers and other control system components. Application of automatic control to typical mechanical systems.

REFERENCE BOOKS

Chestnut, H. and Mayer, R. W. *Servomechanisms and Regulating System Design, Vol. 1.* Wiley.

Eckman, B. P. *Automatic Process Control.* Wiley.

Raven, F. H. *Automatic Control Engineering.* McGraw-Hill.

Young. *An Introduction to Process Control System Design.*

5.323S Automatic Control Engineering

Block diagrams and Laplace transform methods for system analysis. Transfer functions. Response functions. The general criterion for stability. Routh's criterion. Electronic Analogue Computer. Nyquist criterion. Bode diagrams. Types of controller action and their effects on system response. Optimum settings. Analysis of pneumatic controllers, correcting units and measuring units.

TEXT BOOK

Raven, F. H. *Automatic Control Engineering.* McGraw-Hill.

REFERENCE BOOKS

Chestnut, H., and Mayer, R. W. *Servomechanisms and Regulating System Design. Vol. I.* Wiley.

Eckman, D. P. *Automatic Process Control.* Wiley.

Langhill, A. W. *Automatic Control Systems Engineering. Vol. I.* Prentice-Hall.

Nixon, F. E. *Principles of Automatic Control.* Prentice-Hall.

Young. *An Introduction to Process Control System Design.*

5.331 Dynamics of Machines I

Kinematics and Dynamics of Simple Plane Mechanisms — Velocity and acceleration analysis. Forces in mechanisms. *Toothed Gearing* — Kinematic requirements for gear teeth profiles, motion of meshing teeth. Meshing at non-standard centre distance. Gear trains. *Mechanical Vibrations* — Simple harmonic motion. One degree of freedom systems, free vibrations, forced vibrations, transmissibility and motion isolation. Whirling of shafts.

TEXT BOOKS

Hirschhorn, J. *Dynamics of Machinery.*

Hirschhorn, J. *Kinematics and Dynamics of Plane Mechanisms.* McGraw-Hill.

REFERENCE BOOKS

Buckingham, E. *Analytical Mechanics of Gears.* McGraw-Hill.

Holowenko, A. R. *Dynamics of Machinery.* Wiley.

Mabie, H. H. and Ocvirk, F. W. *Mechanics and Dynamics of Machinery.* Wiley.

Rosenauer, N. and Willis, A. H. *Kinematics of Mechanisms.* Associated Gen. Pub.

5.332 Dynamics of Machines II

Advanced Kinematics — Velocity and acceleration analysis of complex mechanisms, inflection circle, Euler-Savary equation. *Dynamic Motion Analysis* — Energy distribution, rate of change of energy methods. *Disc Cams* — Analysis. Synthesis. Follower offset. Spring determination. *Mechanical Vibrations* — Two-three-and multi-degree of freedom systems; natural modes, forced vibrations, Whirling of shafts with many degrees of freedom. *Inertia Effects in Machinery* — Balancing of rotating and reciprocating masses Flywheels.

5.402 Mechanics of Solids

Statically indeterminate beams. Oblique bending; bending of unsymmetrical and of composite beams. Shear stresses in thin- walled sections due to bending; shear centre. Stress distribution in curved beams. Torsion —membrane analogy. Thin-walled sections; solid non-circular sections.

Analysis of stress and strain—elastic strain energy, strain energy of distortion, theories of failure. Applications in design. Analysis of thick-walled and compound cylinders.

Energy methods and applications; statically indeterminate cases. Buckling of columns. Axial load and bending interaction. Tangent modulus; inelastic column curves. Local buckling. Strength under combined loadings—analysis of various modes of failure; interaction method.

TEXT BOOK

Shanley. *Strength of Materials.* McGraw-Hill.

REFERENCE BOOK

Seely and Smith. *Advanced Mechanics of Materials.* Wiley.

5.412 Mechanics of Solids

Stress and strain components, principal values, equilibrium and compatibility. Theories of failure. Unsymmetrical bending of beams, composite beams. Analysis of statically indeterminate systems. Energy methods of analysis. Buckling of columns, combined loadings. Torsion of prisms and thin-walled sections. Stress distribution in thick-walled cylinders. Axisymmetric loading of circular plates and shells of revolution. Experimental stress analysis, photoelasticity, strain gauges, analogues.

TEXT BOOK

Seely and Smith. *Avanced Mechanics of Materials.* Wiley.

REFERENCE BOOKS

Den Hartog, J. P. *Advanced Strength of Materials.* McGraw-Hill.

Shanley, F. R. *Mechanics of Materials.* McGraw-Hill.

Timoshenko, S. *Strength of Materials. Vols. I and II.* Van Nostrand. ....

5.413 Mechanics of Solids II

Continuum Mechanics — Stress and strain, equilibrium and compatibility, constitutive equations. *Materials Science* — Dislocation theory for crystalline materials. Structure and deformation of polymers. Composite materials.

Together with a selection from:—

Applied Elasticity — Plates and shells, rotating discs, contact stresses, torsion. *Plane Stress Analysis* — Airy stress function, solution by polynomials, complex variable, strain energy methods. *Inelastic Response* — Non-linear response of materials, analysis of structural elements, pressure vessels etc. *Theory of Plasticity* — Slip line field theory, velocity fields, stress fields, upper and lower bounds. *Applied Plasticity* — Analysis of forming and machining processes.

5.501 Fluid Mechanics

Fluid properties: statics of liquids and gases; statics of moving systems; forces on surfaces. One-dimensional flow of inviscid incompressible fluid: streamlines; continuity, Euler and Bernoulli equations: energy equation. Introduction to dimensional analysis. Physical concept of boundary layer. Laminar and turbulent motion. Flow in pipes and conduits. Fluid measurements. Elementary study of unsteady flows. Linear and angular momentum theorems and elementary applications to turbomachines.

TEXT BOOKS

Barna. *Fluid Mechanics for Engineers.* Butterworth, London, *or*

Streeter. *Fluid Mechanics.* 4th ed., McGraw-Hill.

Vennard. *Elementary Fluid Mechanics.* 4th ed., Wiley.

REFERENCE BOOK

B.S. 1042. *Flow Measurement.*

5.502 Fluid Mechanics

Dimensional analysis. Theory of models. Boundary layer theory on flat plates. Resistance of bodies. One-dimensional gas dynamics; isentropic, adiabatic flows. Flow of gases and vapours in nozzles. Theory of centrifugal pumps, axial flow pumps and turbines: similitude laws: cavitation.

TEXT BOOKS

Barna. *Fluid Mechanics for Engineers.* Butterworth, London, *or*
Shepherd. *Principles of Turbomachinery.* Macmillan.

REFERENCE BOOKS

Addison. *Centrifugal and Other Rotodynamic Pumps.* 3rd ed., Chapman & Hall, 1965, London.

Shapiro. *Dynamics and Thermodynamics of Compressible Fluid Flow, Vol. I, Parts 1 and 2.* Ronald Press, 1953.

Streeter. *Fluid Mechanics,* 4th ed., McGraw-Hill.

5.504 Fluid Mechanics

Three topics will be selected from:—

1. Dynamics of Fluid Flow: general form of conservation equations; kinematics, dilatation, rotation, circulation. Navier-Stokes equations, general equations of energy, entropy and vorticity; boundary layer solutions, laminar and turbulent: potential flow theory, airfoils, wings and propellers. 2. One dimensional gasdynamics: adiabatic, diabatic and isothermal flows in constant and variable area ducts; shock waves; combustion, detonation; generalised theory, simple combined solution. 3. Hydraulics turbines: characteristics and performance, selection and design problems. 4. Surges and water hammer. 5. Centrifugal and axial flow compressors, and gas turbines: design and performance criteria.

REFERENCE BOOKS

Shapiro. *Dynamics and Thermodynamics of Compressible Fluid Flow, Vol. I, Parts 1 and 2.* Ronald Press, 1953.

Cole, G. H. A. *Fluid Dynamics.* Methuen, 1962.

Other books will be prescribed by the lecturers.

5.511 Fluid Mechanics

Introduction to dynamics together with the subject matter shown under 5.501 Fluid Mechanics.

Text and Reference Books as for 5.501 above.

5.611 Fluid Mechanics/Thermodynamics

Dimensional systems, units, dimensional analysis, properties of substances. Statics of Fluids. One dimensional flow. Mass, energy and momentum equations. Laminar and turbulent motion. Flow in pipes. Elementary boundary layer theory Drag. Fluid measurements. Angular momentum equation. Turbomachines. Concepts and conservation principles of thermodynamics. First and second laws of thermodynamics. Properties of ideal gases, liquids and vapours. Non-flow and flow processes. Ideal cycles. Factors limiting performance of real cycles.

Text and Reference Books as for 5.501 and 5.701.

5.612 Fluid Mechanics/Thermodynamics II

Dimensional Analysis, similitude and modelling. Fields, Mass and momentum equations. Vorticity, deformation, dilatation. Existence conditions for stream and potential functions. One dimensional gas dynamics. Nozzle flows, normal shock wave, constant area flow with friction and heat addition. Isothermal flow. Non-reactive mixtures. Refrigeration and air conditioning processes. Design considerations. Steady and unsteady state conduction heat transfer. Convective heat transfer. Radiant heat transfer. Combined modes of heat transfer.

TEXT BOOKS

Kreith. *Principles of Heat Transfer.* International Textbook Co.

Shapiro. *Dynamics and Thermodynamics of Compressible Fluid Flow, Vol. I, Parts 1 and 2.* Ronald Press, 1953.

Streeter. *Fluid Mechanics,* 4th ed., McGraw-Hill.

Van Wylen and Sonntag. *Fundamentals of Classical Thermodynamics.* Wiley.

5.613 Fluid Mechanics/Thermodynamics II

Cartesian tensors. Compressible flows. Navier-Stokes and energy equations. Turbulent motion. Reynolds stresses. Boundary layer theory. Forced convection in laminar and turbulent flows. Free convection. Diffusion. Mass transfer. Radial flow and axial flow turbomachinery. Design considerations. Cavitation. Matching of component characteristics. General thermodynamics relations. Statistical mechanics. Quantum mechanics. Monatomic gases and solids. Diatomic and polyatomic gases. Chemical equilibrium. Statistical mechanics of dependent particles. Real gases and solids. Irreversible processes.

5.701 Thermodynamics

Fundamental thermodynamic concepts. First and second laws and corollaries. Reversibility. General thermodynamic relations. Properties of a perfect gas, liquids and vapours. Non-flow and flow processes. Multistream steady flow processes. Carnot cycle. Rankine cycle, reheat and regenerative feed heating. Boilers and boiler auxiliaries. Otto, Diesel and mixed cycles. Cycles having Carnot efficiency.

TEXT BOOK

Van Wylen and Sonntag. *Fundamentals of Classical Thermodynamics.* Wiley.

REFERENCE BOOKS

Lee and Sears. *Thermodynamics.* 2nd ed., Addison-Wesley.

Mooney. *Introduction to Thermodynamics and Heat Transfer.* Prentice-Hall.

5.702 Thermodynamics

Heat pump and refrigeration cycles. Vapour compression, absorption and compressed air systems. Properties of non-reactive mixtures of gases and vapours. Gibbs-Dalton law. Psychrometry. Hygrometric chart. Thermodynamic charts. Reciprocating engines and compressors, criteria of performance. Axial and radial flow, turbines and compressors. Gas turbine cycles with heat exchange, inter-cooling and reheat. Steady heat conduction through composite wall cylinders. Three-dimensional steady heat conduction in homogeneous materials. Relaxation processes. Unsteady one-dimensional heat conduction. Electrical analogy. Heat transfer by free and forced convection. Similarity parameters. Heat exchangers. Radiation heat exchange between black and non-black surfaces. Radiation geometric factors. Reciprocity theorem. Radiation from gases and flames.

TEXT BOOKS

Kreith. *Principles of Heat Transfer.* International Textbook Co.

Rogers and Mayhew. *Engineering Thermodynamics, Work and Heat Transfer.* Wiley.

Soo. *Thermodynamics of Engineering Science.* Prentice-Hall.

5.704 Thermodynamics

Thermodynamic relations. Equations of state for real substances. Unsteady state heat conduction. Mass, momentum and energy transport in fluids. Hydrodynamic and thermal boundary layers. Forced and free convection. Gas turbine cycle analysis. Analysis of flow through gas turbine components, matching of components. Air conditioning processes, components and systems. Reacting Mixtures.

REFERENCE BOOKS

Cohen and Rogers. *Gas Turbine Theory.* Longmans.

Eckert and Drake. *Heat and Mass Transfer.* McGraw-Hill.

Openshaw Taylor. *Nuclear Reactors for Power Generation.* Newnes.

Rogers and Mayhew. *Engineering Thermodynamics, Work and Heat Transfer.* Longmans.

Rohsenow and Choi. *Heat Mass and Momentum Transfer.* Prentice-Hall.

Schlichting. *Boundary Layer Theory.* McGraw-Hill.

Threlkeld. *Thermal Environmental Engineering.* Prentice-Hall.

5.711 Thermodynamics

Fundamental thermodynamic concepts. First and Second laws of Thermodynamic and corollaries. Reversibility. General thermodynamics relations. Properties and pure substances. Equations of State. Non-flow and flow processes.

TEXT BOOK

El Saden. *Engineering Thermodynamics.* Van Nostrand, Princeton, 1966.

5.801 Aircraft Design

(*a*) *Aerodynamic Design* — Design authorities, criteria, flight envelope, design cases. Airloads. Weight and Balance. Performance and stability estimation. Aerodynamic design of an aircraft.

(*b*) *Design of Aircraft Structures* — Significance of design requirements: proof and ultimate load, load and safety factors, interpretation of V-g diagram, Stressing cases. Detailed structural and mechanical design of airframe, controls, joints; choice of materials; use of structures data sheets. Practical design of a simple aircraft structural component.

TEXT BOOK

Royal Aeronautical Society. *Handbook of Aeronautics No. 1, Structural Principles and Data.* Pitman.

REFERENCE BOOKS

Australian Department of Civil Aviation. *Air Navigation Orders, Section 101.* D.C.A.

Bruhn. *Analysis and Design of Flight Vehicle Structures.* Tri-State Offset Co., 1965.

Royal Aeronautical Society. *Data Sheets.* R.Ae.S.

Shanley. *Weight-Strength Analysis of Aircraft Structures.* 2nd ed., Dover, 1965.

U.K. Air Registration Board. *British Civil Airworthiness Requirements. Section D.* A.R.B.

U.S. Federal Aviation Agency. *Airplane Airworthiness.* F.A.A.

5.811 Aerodynamics I

Navier-Stokes equations; elementary boundary layer theory; turbulence, convection, friction and form drag; airfoil characteristics. Vorticity and circulation; Prandtl wing theory, induced drag, spanwise lift distribution, wing characteristics. Static longitudinal stability and control. Manoeuvrability. Standard atmosphere, performance calculations. One-dimensional gas dynamics, isentropic, adiabatic and nozzle flow; rocket equation.

TEXT BOOKS

Kuethe and Schetzer. *Foundations of Aerodynamics.* 2nd ed., Wiley.

Martinov. *Practical Aerodynamics.* Pergamon Oxford, 1965.

Perkins and Hage. *Airplane Performance Stability and Control.* Wiley.

REFERENCE BOOKS

Houghton and Brock. *Aerodynamics for Engineering Students.* London, Arnold.

Streeter. *Fluid Dynamics.* McGraw-Hill.

5.812 Aerodynamics II

Potential theory of an ideal fluid, conformal Kutta-Joukowski transformation. Vortex streets. Aircraft dynamic stability. Advanced performance calculations. Normal oblique and conical shock and expansion waves. High speed wing theory.

TEXT BOOKS

Bonney. *Engineering Supersonic Aerodynamics.* McGraw-Hill.

Perkins and Hage. *Airplane Performance Stability and Control.* Wiley.

REFERENCE BOOKS

Kaufmann. *Fluid Mechanics.* McGraw-Hill.

Ransher. *Introduction to Aeronautical Dynamics.* Wiley.

Royal Aeronautical Society. *Aerodynamics and Performance Data Sheets.* R.Ae.S.

5.822 Analysis of Aerospace Structures I

Equilibrium of forces, plane frames, space frames; inertia forces, load factors; beams — two moment equation, shear and bending stress distribution in various thin webbed beams, tapered beams, beams with variable flange areas. Semi-monocoque structures. Deflection of structures — Maxwell's and Castigliano's theorems, Williot diagram. Statically indeterminate structures — beams, trusses, stiff-jointed frames, using methods of superposition, energy, moment distribution, elastic centre; shear distribution in two-cell beam. Aircraft materials, physical properties and their measurement. Dimensionless stress-strain data.

TEXT BOOKS

Peery. *Aircraft Structures.* McGraw-Hill. *or*

Niles and Newell. *Airplane Structures. Vol. 1.* Wiley.

REFERENCE BOOK

Timoshenko. *Strength of Materials.* Part 1. Van Nostrand.

5.823 Analysis of Aerospace Structures II

Warping—open and closed sections; shear lag—simple cases; torsion of tube with root restraint cut-outs in monocoque structures. Beam columns —analytical and graphical methods. Buckling—columns with various end conditions, initial eccentricity; energy solution for columns, solution of non-uniform columns. Thin plates, buckling in compression, shear, bending. Stringers, various forms of instability. Tension field beams: complete and incomplete. Plasticity effects in compression, bending and torsion. Strain gauges—theory use of rosettes. Mechanical testing of aircraft structures. Fatigue. Creep. Aero-elasticity.

TEXT BOOKS

Gerard. *Introduction to Structural Stability Theory.* McGraw-Hill.

Peery. *Aircraft Structures.* McGraw-Hill.

REFERENCE BOOKS

Hendry. *Elements of Experimental Stress Analysis.* Pergamon.

Kuhn. *Stresses in Aircraft and Shell Structures.* McGraw-Hill.

Timoshenko and Goodier. *Theory of Elasticity.* McGraw-Hill.

Williams. *Theory of Aircraft Structures.* St. Martins.

5.831 Aircraft Propulsion

Aircraft power plant and propulsion systems. Basic thrust equations; propulsive efficiency. Propeller theory, characteristics and performance. Power plant thermodynamics. Fuels and combustion. Internal aerodynamics. Compressors and turbines, subsonic and supersonic intake diffusers, nozzles. Design and performance of aircraft reciprocating internal combustion engine and gas turbine systems. Ramjets, Rockets.

TEXT BOOK

Hesse. *Jet Propulsion.* Pitman.

REFERENCE BOOKS

Hill and Peterson. *Mechanics and Thermodynamics of Propulsion.* Addison-Wesley.

Schmidt. *The Internal Combustion Engine.* Chapman & Hall.

Shapiro. *Dynamics and Thermodynamics of Compressible Fluid Flow, Vol. 1.* Ronald Press, 1953.

Shepherd. *Introduction to the Gas Turbine.* London, Constable.

Sutton. *Rocket Propulsion Elements.* 3rd ed., Wiley.

Zucrow. *Principles of Jet Propulsion and Gas Turbines.* Wiley, N.Y.

5.911 Naval Architecture

Hydrostatic calculations. Stability at small angles. Free surface effects. Inclining experiment. Trim due to weights and flooding. Grounding. Effects of permeability. Stability at large angles. Stability after flooding. Dynamic stability. Floodable length. Requirements of damaged-stability. Trochoidal wave theory. Wave patterns. Rolling, heaving and pitching. Launching.

TEXT BOOK

Comstock. *Principles of Naval Architecture.* Soc. of Naval Architects & Marine Engineers.

REFERENCE BOOK

Robb. *Theory of Naval Architecture.* Griffin & Co.

5.921 Ship Structures

Longitudinal strength of ship's structure: load diagram, bending moment, section modulus. Framing systems. Stress distribution. Superstructure. Transverse strength: structural analysis of bulkheads and side shell. Design of laterally loaded panels. Stiffened plating.

Connections, Derricks. Consideration of fatigue and brittle failure.

TEXT BOOK

Comstock. *Principles of Naval Architecture.* Soc of Naval Architects & Marine Engineers.

REFERENCE BOOKS

Arnott. *Design and Construction of Steel Merchant Ships.* Soc. of Naval Architects & Marine Engineers.

Lloyd's Register of Shipping. *Rules and Regulations for the Construction and Classification of Steel Ships.* Published Annually.

Muckle. *The Design of Aluminium Alloy Ships Structures.* Hutchinson.

5.922 Ship Structures

Frame analysis. Brackets. Buckling of stiffened panels: edge loading; combined loading. Midship section design synthesis.

Text and reference books as for 5.921.

5.931 Principles of Ship Design

Theory and technique of ship design. Development of ship's lines. Design criteria and data. Criteria of statutory bodies relating to design. Details of ship's structure. Rudders and steering arrangements. Structural design requirements of classification societies. Ship types, arrangements and equipment. Specifications. Modern shipbuilding methods and prefabrication. Launching arrangements.

TEXT BOOK

Munro-Smith. *Merchant Ship Design.* Hutchinson.

REFERENCE BOOKS

Arnott. *Design and Construction of Steel Merchant Ships.* Soc. of Naval Architects & Marine Engineers.

Board of Trade. *Instruction as to the Survey of Passenger Steamships, Vols. I and II.* H.M.S.O.

Board of Trade. *Instructions as to the Tonnage Measurement of Ships.* H.M.S.O.

Board of Trade. *Measurements of Vessels for the Panama Canal.* H.M.S.O.

The Commonwealth of Australia Navigation Act.

Manning. *The Theory and Technique of Ship Design.* Wiley.

Schokker, Neuerburg and Vossnack. *The Design of Merchant Ships.* Arkenbout-Schokker.

Todd. *Ship Hull Vibration.* Arnold.

5.932 Ship Design Project

Design of a vessel to provide characteristics of hull form, preliminary general arrangement, lines plan, hydrostatic curves, investigation of stability and trim, structural profile and midship section, capacity, freeboard, tonnage, floodable length (if applicable), power requirements, propeller design and final general arrangement.

Text and reference books as for 5.931.

5.941 Ship Propulsion and Systems

Hydrodynamics. Model testing. Determination of resistance and power requirements of hull form from statistical data. Optimum form characteristics. Propulsion systems. Propeller theory and design. Trials and analysis of data. Steering. Design of rudders. Prime movers and auxiliaries. Ship systems — ventilation, air-conditioning, refrigeration, pumping, flooding and draining.

TEXT BOOK

Comstock. *Principles of Naval Architecture.* Soc. of Naval Architects & Marine Engineers.

REFERENCE BOOKS

Barnaby. *Basic Naval Architecture.* 5th ed., Hutchinson.

Bullen. *Ventilation and Heating of Ships.* 3rd ed., Birchall, Liverpool, 1950.

O'Brien. *The Design of Marine Screw Propellors.* Hutchinson.

Robb. *Theory of Naval Architecture.* Griffin & Co.

Van Lammeren. *Resistance, Propulsion and Steering of Ships.* Technical Publishing Co. Holland.

18.011 Industrial Engineering IA

Technology of Manufacturing — Work materials: mechanical tests, stress-strain curves, work hardening. Important physical properties in manufacture. Tool materials: iron-carbon system, hardening and heat treatment, T.T.T. curves. Plain carbon, alloy and high speed steel. Sintered tool materials. Theories of machining, Cutting forces and power consumption. Tool wear, life, and failure, tool performance. Surface finish. Servicing of tools. Machinability. Economics of machining. Electrical machining processes.

Metrology — Principles of measurement and measuring systems. Basic design concepts, accuracy and precision, linear and angular measurements, screwthread measurements, gear measurement.

TEXT BOOKS

Alexander, J. M. and Brewer, R. C. *Manufacturing Properties of Materials.* Van Nostrand, 1963.

Hume, K. J. *Engineering Metrology.* 2nd ed., Macdonald.

REFERENCE BOOKS

Datsko, J. *Material Properties and Manufacturing Processes.* Wiley, 1966.

Dieter, G. D. *Mechanical Metallury.* Int. ed., McGraw-Hill, 1961.

Wilson, F. W. (ed.). *Tool Engineers Handbook.* 2nd ed., McGraw-Hill, 1959.

18.012 Industrial Engineering IIA

Technology of Manufacturing — Theories of deformation processes; extrusion, tube making, forming and deep drawing. Introduction to industrial experimentation; prediction of tool performance; design and analysis of shop trials.

Design for Production — Interchangeable manufacture; standardisation, selective assembly; design presentation. Design analysis, geometrical tolerancing; linear and non-linear loop equations.

Metrology — Measuring system — optical, pneumatic and electrical; straightness, flatness; surface texture and machine tool testing.

Theory of errors — quality control by variables.

18.021 Industrial Engineering IB

Engineering Economics — The structure of the Australian economy. The theory of the firm. The selection and replacement of processes and equipment. Construction and optimisation of particular economic models e.g. inventory. *Industrial Applications of Probability* — Tutorial problems from the fields of sampling inspection, quality control, control charts — simple economic models, e.g. newsboy problem, length of steel bars.

TEXT BOOK

Barish, N. N. *Economic Analysis.* McGraw-Hill, 1962.

REFERENCE BOOKS

Bowman, E. H. and Fetter, R. B. *Analysis for Production and Operations Management.* 3rd ed., Irwin, 1967.

Karmel, P. H. and Brunt, M. *The Structure of the Australian Economy.* Cheshire, 1966.

Samuelson, P. A. *Economics: An Introductory Analysis.* Int. ed., McGraw-Hill, 1961.

18.022 Industrial Engineering IIB

Design of manufacturing facilities — Product and objectives, equipment selection, plant location, factory layout.

The use of human and physical resources — Motion and time study, financial incentives, applications to machine controlled processes, work sampling and data collection.

Production Control — The detailed mechanics of control of jobbing production, and its extension to batch and continuous production. Manufacturing organisations, functions, inter-relationships and information flow. Application of data processing and control systems.

18.031S Minor Thesis

For pass students in the full-time course in Industrial Engineering.

18.041 Major Thesis

For honours students in the full-time course in Industrial Engineering.

18.111/1 and 18.111/2 Industrial Administration

An examination of the principles and practices used in the development of an organization so that it can attain an industrial objective. The completion of the organization with job specifications. The use of operation instructions. An analysis of the principal functions of general management, production, engineering, sales, finance and personnel, followed by that of the subsidiary functions, their location in the organization and the use of common industrial techniques in their performance. Problem cases relating to the subsidiary functions are analysed and solved.

TEXT BOOKS

Buffa, E. S. *Modern Production Management.* 2nd ed., Wiley, 1965.

Factories, Shops and Industries Act Regulations. Govt. Printing Office, 1962.

Moroney, M. S. *Facts from Figures.* Pelican, 1965.

REFERENCE BOOK

Carson, G. B. *Production Handbook.* 2nd ed., Ronald Press, New York, 1958.

18.121 Engineering Administration

Introduction to scientific management. Economic efficiency in the use of resources and facilities in manufacturing operations. Value engineering. Organization and the control function. Introduction to the use of mathematical techniques in the planning of production, in quality control,

and batch control. The control of men in production and distribution, Fitting the workplace to the man. The use of incentives. Some aspects of industrial legislation. Arbitration and conciliation. Contracts and awards.

18.221 Production Control

The detailed mechanics of control of jobbing production in a metal working factory with variations on this basic system to cover repetitive batch production, and then continuous line production with flow control. Control of other types of manufacturing activity. Includes basic functions of each section of the manufacturing organization and the inter-relations and necessary information flow between them. Cost considerations and implications of various policies. Requirements for automation. Application of fluid duplicator, punched card, and computer systems of control. Introduction to operations research in inventory and production control covering building of mathematical models of relevant situations, and their manipulation to yield decision rules. Replenishment rules. Linear programming applications, and the simplex method of solution. The transportation method. Total value and incremental value analysis under conditions of certainty and uncertainty.

TEXT BOOKS

Bowman, E. H. and Fetter, R. B. *Analysis for Production and Operations Management.* 3rd ed., Irwin, 1967.

Magee, J. F. *Production Planning and Inventory Control.* Int. ed., McGraw-Hill, 1958.

REFERENCE BOOKS

Moore, F. G. *Production Control.* Int. ed., McGraw-Hill, 1959.

Wilson, F W. (ed.). *Manufacturing Planning and Estimating Handbook.* McGraw-Hill, 1963.

18.291S Production Control

For honours students in Industrial Engineering.

18.321 Methods Engineering

Planning and installation of manufacturing plants; location and site analysis; buildings and facilities; process and equipment selection; plant layout; maintenance problems. Ergonomics; work and effort; the dimensions of the workplace; workplace layout; the working environment and performance efficiency; fitting the job to the worker. Work measurement; motion and time study; recording and charting; work sampling; estimates for pre-determined motion times. Process analysis for production efficiency. Incentives: methods, improvement and work simplification.

Laboratory Work — Application of the laws of motion economy; workplace layout; the sequencing of manufacturing operations, time study; operation analysis and charting; the normal range of human movements and application to design of machine controls. Parameters and manifestations of physical fatigue.

TEXT BOOKS

Barnes, R. M. *Motion and Time Study.* 5th ed., Wiley, 1963. *or*

Niebel, B. W. *Motion and Time Study.* 4th ed., Irwin, 1967.

REFERENCE BOOKS

Carson, G. B. (ed.). *Production Handbook*. 2nd ed., Ronald, 1958.

Maynard, H. B. (ed.). *Industrial Engineering Handbook*. 2nd ed., McGraw-Hill, 1963.

18.411S Design for Production I (Materials and Processes)

Divided into two sections: (i) *Theory—General,* Growth of mass production and its influence on product design. Economic considerations. Product and process development. Materials and processes—Broad considerations in selecting materials and processes. (ii) *Laboratory*—A study of some of the fundamentals of metal, tool life, chip formation, and press tool application.

18.412S Design for Production II (Interchangeable Manufacture)

Theory — Interchangeable manufacture: manufacturing, assembly and servicing costs; advantages and disadvantages of pursuing interchangeable principle. The use of standards. Tolerancing and the determination of accumulated tolerances. Design for interchangeable or unit assembly: design, dimensioning and tolerancing to fulfil functioning and manufacturing and inspection requirements. Metrology: basic principles of precision measurement, metrological practice in measurement, principles of construction, care and use of measuring equipment.

Laboratory — Metrology: assignments associated with gauging and tooling. Surface finish, inspection: non-destructive testing, quality control and sampling inspection.

18.422 Design for Production II (Interchangeable Manufacture)

Subject matter similar to 18.412S Design for Production II.

TEXT BOOKS *18.412S and 18.422 Design for Production II.*

Gladman, C. A. *Manual of Geometric Analysis of Engineering Designs.* Aust. Trade Pub. 1966.

Parker, S. *Drawings and Dimensions.* Pitman, 1956.

REFERENCE BOOK *18.412S and 18.422 Design for Production II.*

Wilson, F. W. (ed.). *Manufacturing, Planning and Estimating Handbook.* McGraw-Hill, 1963.

18.431 Design for Production

Interchangeable manufacture; standardisation; unit and selective assembly; preferred sizes. Presentation and interpretation of geometric tolerances; grouping — analysis of non-linear loop equations, Economic allocation of tolerances; application of probability theory to tolerance allocation. Gauge design effect of gauge tolerances on interchangeability.

18.511S Industrial Marketing

Marketing in the Economy — The basic tasks of marketing. The economic environment of the market. Considerations of demand and supply. *Nature and Organization of Buying and Selling* — The sales practices and problems

of manufacturers and distributors. Standardization differentiation and non-price competition. *Specialization and Integration* — Channels of distribution. Transfer of ownership between manufacturers, wholesalers, and retailers. Agents and distributors. Stability and change in marketing channels. *Pricing and Product Policy* — Established and new product policy. Mechanism of pricing. Pricing problems and policies. Price structures. *Marketing Efficiency and Control* — Objectives and form of control. Market research. Budgeting and accounting control. Measures of efficiency and performance. Sales aids. Selection and training of personnel. Government regulations. Characteristics of regional markets. Planning of marketing areas. Transportation economics.

18.521 Industrial Marketing

Subject-matter similar to 18.511S Industrial Marketing.

TEXT BOOK *18.511 and 18.521 Industrial Marketing.*

Alexander, R. S., Cross, J. S. and Cunningham, R. M. *Industrial Marketing.* 2nd ed., Irwin, 1961.

REFERENCE BOOK *18.511 and 18.521 Industrial Marketing.*

Ferber, R. *Statistical Techniques in Market Research.* McGraw-Hill.

18.551 Operations Research

The formulating and optimisation of mathematical models. The development of decision rules. Some techniques of operations research such as mathematical programming, queueing theory, inventory models, replacement and reliability models, and simulation will be introduced. These techniques will be applied to situations drawn from industrial fields, e.g. production planning and inventory control. Practical problems of data collection, problem formulation and analysis will be included.

18.611S—Engineering Economic Analysis

The Australian Economic Structure—National Income, role of Government, Australian labor structure, international trade. Economics of Industrial Organisation—Competition, profit maximization, demand and cost analysis, prices and pricing. Theory of investment—Interest, depreciation, choice between alternatives, economic life of capital equipment and replacement policy.

18.621 Engineering Economics

Subject matter the same as for 18.611S, but also includes an introduction to accounting and accounting controls.

TEXT BOOK

18.611S Engineering Economic Analysis and 18.621 Engineering Economics.

Barish, N. N. *Economic Analysis.* McGraw-Hill, 1962.

REFERENCE BOOKS

18.611S Engineering Economic Analysis and 18.621 Engineering Economics.

Karmel, P. H. and Brunt, M. *The Structure of the Australian Economy.* Cheshire, 1966.

Samuelson, P. A. *Economics: An Introductory Analysis.* Int. ed., McGraw-Hill, 1961.

NON-ENGINEERING SUBJECTS

1.001 Physics I

Kinematics—Non-uniformly accelerated systems. Centrepetal and coriolis acceleration. Laws of motion. Momentum. Impulse. Potential and kinetic energy. Power. Conditions of equilibrium. Elasticity. Young's, bulk and shear moduli. Poisson's ratio. Strain energy. Hydrodynamics. Bernouilli's equation. Motion in resistive medium. Moments of inertia. Rotational dynamics. Simple harmonic motion. Pendulums. Motion about free axis. Progressive and stationary waves. Energy current. Superposition of waves. Doppler effect. Resonance. Huygens' principle. Reflection, refraction, interference and diffraction of waves. Electromagnetic spectrum. Polarization.

Electrostatics. Gauss' theorem. Electric intensity and induction. Capacitance. Electromagnetism. Biot-Savart and Ampere's circuital laws. Force on moving charge and on conductor. Torque on coil. D.C. instruments. Electromagnetic induction. Faraday's and Lenz' laws. Self and mutual inductance. Magnetic materials. D.C. circuits. Kirchhoff's rules and Thevenin's theorem. Growth and decay of current. A.C. circuits. Resonance. Diode. Triode. Amplifiers and oscillators. Electronic measuring instruments.

1.011 Higher Physics I

Subject matter same as 1.001, but in greater depth.

Text and Reference Books for 1.001 and 1.011 (for students taking two full years of Physics.

TEXT BOOKS

Halliday, D. and Resnick, R. *Physics for Students of Science and Engineering. Vols. I and II,* or combined volume, Wiley, 1960.

Krackhardt, R. H. *Vacuum Tube Electronics.* Merrill Books, Inc., 1966.

REFERENCE BOOKS

Stephenson, R. J. *Mechanics and Properties of Matter.* 2nd ed., Wiley, 1960.

Starling, S. G. and Woodall, A. J. *Physics.* Longmans Green, 1950.

Feynman, R. P., Leighton, R. B. and Sands, M. *The Feynman Lectures on Physics.* Vols. I and II, Addison-Wesley.

(For 1.011 only)

Tomboulian, D. H. *Electric and Magnetic Fields.* Harcourt, Brace and World, Inc., 1965, New York.

1.041 Physics IC

For students in the Faculty of Science, Department of Surveying, and Industrial Arts course; also available as an elective in the Faculty of Arts. Consists of Units 1-9.

1.051 Physics IE

For students in the Aeronautical, Civil, Industrial and Mechanical Engineering and Naval Architecture courses. Consists of Units 1, 3-5, 7-11.

UNITS

1. *Mechanics I* Kinematics. Centripetal acceleration. Newton's laws of motion. Momentum. Impulse. Work, energy and power. Friction. Conditions of equilibrium. Simple harmonic motion.

2. *Mechanics II* Collisions. Coefficient of restitution. Moment of Inertia. Rotational dynamics. Conservation of angular momentum. Gravitation. Kepler's laws. Planetary motion.
3. *Wave Motion.* Equation of wave motion. Longitudinal and transverse waves. Sound waves. Superposition of waves. Energy current. Stationary waves. Resonance. Beats, Doppler effect.
4. *Physical Optics* Nature of light. Velocity of light. Interference. Interference in thin films. Interferometer. Huygens' principle. Fraunhofer diffraction by slit. Diffraction grating. Polarized light.
5. *Introduction to Modern Physics* Measurement of e and e/m. The neutron. Natural and artificial radioactivity. Quantum properties of radiation. The Bohr atom. Wave properties of matter. The uncertainty principle. Nuclear fission and fusion.
6. *Properties of Matter* Hydrostatics. Pressure. Pascal's and Archimedes' principles. Hydrodynamics. Bernouilli's theorem. Viscosity. Surface tension. Elasticity. Young's, bulk and shear moduli. Poisson's ratio.
7. *Electrostatics and Electrodynamics* Electrostatics charge. Electric field and potential. Gauss' theorem. Capacity. Dielectrics. Magnetic fields. Biot-Savart and Ampere's circuital laws. Electromagnetic induction. Magnetic circuit.
8. *D.C. Circuits* Conductance. E.M.F. Resistivity and temperature coefficient. Power. Kirchhoff's rules and Thevenin's theorem. D.C. measurements. D.C. transients in RL and RC circuits.
9. *A.C. Circuits* Series LRC circuits. Reactance and impedance. Power factor. Phase amplitude diagram and complex notation. Series and parallel resonance, Transformer. A.C. instruments.
10. *Physical Acoustics* Vibration of strings, bars and plates. Acoustical measurements. Room acoustics. Ultrasonics.
11. *Electronics* Diode as rectifier. Filters. Triodes, and triode parameters, Load line. Triode as amplifier and oscillator. Transistor amplifier. Instruments.
12. *Heat* Temperature measurement. Heat capacity. First law of thermodynamics. Calorimetry. Atomic heat of solids. Kinetic theory. Non-ideal gases. Van de Waals' equation. P-V isotherms. Conduction and radiation of heat. Pyrometers.

Text and Reference Books for 1.041 Physics IC and 1.051 Physics IC (for students taking one year of Physics only).

TEXT BOOK

Halliday, D. and Resnick, R. *Physics for Students of Science and Engineering. Vols. I and II,* or combined volume, Wiley, 1960.

REFERENCE BOOKS

Richards, J. A., Sears, F. W., Wehr, M. R. and Zemansky, M. W. *Modern University Physics.* Addison-Wesley, 1960.

Starling, S. G. and Woodall, A. J. *Physics.* Longmans Green, 1950.

Stephenson, R. J. *Mechanics and Properties of Matter.* 2nd ed., Wiley,

Wiedner, R. T. and Sells, R. L. *Elementary Modern Physics.* Allyn and Bacon, 1960.
1960.

1.112 Physics II

Mechanics and Physical Optics — Harmonic oscillations. Coupled vibrations. Wave motion. Group velocity. Interference. Diffraction. Resolving power. Mechanics of a system of particles. Generalized co-ordinates, D'Alembert's Principle and Lagrange's Equations. Hamilton's Principle. Two-body central forces.

Electricity and Magnetism — Electrostatic field theory. Dielectric media. Magnetostatics. Maxwell's electromagnetic equations. Magnetic materials. Transient and alternating currents. Power. Resonance. Transformers. Thermionic emission. Diodes. Triodes. Amplifiers.

Thermodynamics and Kinetic Theory of Gases — Second law of thermodynamics. Thermodynamic temperature scale. Entropy. Maxwell's law of velocity distribution. Theory of non-ideal gas. Thermodynamic functions. Phase change.

Modern Physics — Relativity. Photoelectric effect. The origin of spectra. Excitation and absorption. Wave mechanics. Schrödinger equation. Uncertainty principle. Quantum states. One electron atom. X-ray spectra. Radioactivity, detectors, nuclear spectra. Nuclear reactions.

1.112/1 and 1.112/2 PHYSICS II—PARTS 1 and 2

Part-time students in Electrical Engineering will take 1.112 Physics II in two parts over two years.

TEXT BOOKS

Bleaney, B. I. and Bleaney, B. *Electricity and Magnetism.* O.U.P., 1959.

Jenkins, F. A. and White, H. E. *Fundamentals of Optics.* 3rd ed., McGraw-Hill, 1957.

Richtmyer, F. K., Kennard, E. H. and Lauritsen, T. *Introduction to Modern Physics.* 5th ed., McGraw-Hill.

Stephenson, R. J. *Mechanics and Properties of Matter.* 2nd ed., Wiley, 1960.
or
Symon, K. R. *Mechanics* 2nd ed., Addison-Wesley, 1960. (Recommended for those proceeding to Physics III.)

Sears, F. W. *Thermodynamics.* Addison-Wesley, 1959, *or*

Zemansky, M. W. *Heat and Thermodynamics.* McGraw-Hill.

1.212 Physics IIT

Electricity and Magnetism — Electrostatics and magnetostatics. Kirchhoff's laws. Growth and decay of current in LR and CR circuits. Oscillations in LCR circuits. Steady state alternating currents in series LRC circuits.

Physical Optics — SHM and wave motion. Interference. Diffraction. Polarization.

Modern Physics — Photoelectric effect. Atomic model. X-rays. Elementary particles. Radioactivity. Semiconductors. Fission and fusion.

TEXT BOOKS

Halliday, D. and Resnick, R. *Physics for Students of Science and Engineering.* Vol. II, Wiley, 1960.

Wehr, M. R. and Richards, J. A. *Physics of the Atom.* Addison-Wesley, 1960.

REFERENCE BOOK

Jenkins, F. A. and White, H. E. *Fundamentals of Optics*. 3rd ed., McGraw-Hill, 1957.

2.001 Chemistry I

Classification of matter and theories of the structure of matter. Atomic structure, the periodic table and chemical behaviour. Chemical bonds and molecular structure. Equilibrium and change in chemical systems. The structure, nomenclature and properties of organic compounds. Reactions of organic compounds.

2.011 Higher Chemistry I

Subject-matter same as 2.001, but treated in greater depth.

TEXT BOOKS

Ander and Sonnessa. *Principles of Chemistry*. Collier-Macmillan, 1966.

Aylward and Findlay (ed.). *Chemical Data Book*. Wiley, 1966.

First Year Chemistry Laboratory Course. University of New South Wales, 1968.

Hart and Schuetz. *Organic Chemistry*. Houghton Mifflin, 1967.

Sanderson. *Principles of Chemistry*. Wiley, 1967.

REFERENCE BOOKS

Barrow, Kenney, Lassila, Litle and Thompson. *Programmed Supplements for General Chemistry. Vols. I and II*. Benjamin, 1963.

Benfey. *The Names and Structures of Organic Compounds*. Wiley, 1966.

C.H.E.M. Study Project. *Chemistry, an Experimental Science*. Freeman, 1963.

Gray and Haight. *Basic Principles of Chemistry*. Benjamin, 1967.

Sanderson. *Chemical Periodicity*. Reinhold, 1961.

Snyder. *Chemistry, Structure and Reactions*. Holt, Rinehart and Winston, 1966.

2.001/1 Chemistry I, Part I

Not operating in 1968.

2.001/2 Chemistry, I, Part II

TEXT BOOKS

Aylward and Findlay (ed.). *Chemical Data Book*. Wiley, 1966.

English and Cassidy. *Principles of Organic Chemistry*. McGraw-Hill, 1961.

Glasstone and Lewis. *Elements of Physical Chemistry*. Macmillan, 1962.

Sienko and Plane. *Chemistry*. McGraw-Hill, 1961.

REFERENCE BOOKS

Barrow, Kenney, Lassila, Litle and Thompson. *Programmed Supplements for General Chemistry. Vols.I and II*. Benjamin, 1963.

Benfey. *The Names and Structures of Organic Compounds.* Wiley, 1966.

C.H.E.M. Study Project. *Chemistry, an Experimental Science.* Freeman, 1963.

Sanderson. *Chemical Periodicity.* Reinhold, 1961.

2.021 Chemistry IE

A terminating subject for students in the Aeronautical, Civil, Industrial and Mechanical Engineering, Naval Architecture, and Applied Geography courses.

Classification of matter and theories of the structure of matter. Atomic structure, the periodic table and chemical behaviour. Chemical bonding and the nature and properties of chemical substances. Equilibrium and change in chemical systems.

TEXT BOOKS

Chemical Data Book. Wiley, 1966.

Sanderson. *Principles of Chemistry.* Wiley, 1967.

4.913 Materials Science

Will be offered in 1969.

4.921 and 4.921S Materials Science

The atomic structure of metals. The crystalline nature of metals and its significance. The solidification of metals. Plastic deformation of crystalline materials and its effect on properties. Phase equilibria in metallic alloys. The heat treatment of some ferrous and non-ferrous alloys. Corrosion. The electron theory of metals. Conductors, semi-conductors and insulators. Magnetic materials—structure and properties.

TEXT BOOKS

Guy. *Elements of Physical Metallurgy.* Addison-Wesley.

Hayden, Moffatt and Wulff. *Structure and Properties of Materials, Vol. 3.* "Mechanical Behaviour of Materials". Wiley.

Moffatt, Pearsall and Wulff. *Structure and Properties of Materials. Vol. 1.* "Structure of Materials". Wiley.

Rose, Shepard and Wulff. *Structure and Properties of Materials, Vol. 4.* "Electronic Properties". Wiley.

10.001 Mathematics I

Calculus, analysis, analytic geometry, linear algebra, an introduction to abstract algebra, elementary computing.

TEXT BOOKS

Beaumont, R. A. and Pierce, R. S. *The Algebraic Foundations of Mathematics.* Addison-Wesley.

Purcell, E. J. *Calculus with Analytic Geometry.* Appleton-Century-Crofts.

REFERENCE BOOKS

Ball, R. W. *Principles of Abstract Algebra.* Holt, Rinehart & Winston.

Coulson, A. E. *An Introduction to Matrices.* Longmans.

Keane, A. and Senior, S. A. *Complementary Mathematics.* Science Press.
McCoy, N. H. *Introduction to Modern Algebra.* Allyn and Bacon.
Rose, I. H. Algebra: *An Introduction to Finite Mathematics.* Wiley.
Shanahan, P. *Introductory College Mathematics.* Prentice-Hall.
Smith, W. K. *Limits and Continuity.* Collier-Macmillan, (Paperback).
Taylor, H. E. and Wade, T. L. *University Freshman Mathematics.* Wiley.
Whitesitt, J. E. *Principles of Modern Algebra.* Addison-Wesley.

SUPPLEMENTARY READING LIST

Adler, I. *The New Mathematics.* Mentor Press.
Allendoerfer, C. B. and Oakley, C. O. *Principles of Mathematics.* McGraw-Hill.
Courant, R. and Robbins, H. *What is Mathematics?* Oxford University Press.
Sawyer, W. W. *A Concrete Approach to Abstract Algebra.* Freeman.
Sawyer, W. W. *Prelude to Mathematics.* Pelican.

10.011 Higher Mathematics I

Calculus, analytic geometry, linear algebra, an introduction to abstract algebra, elementary computing.

TEXT BOOKS

Beaumont, R. A. and Pierce, R. S. *The Algebraic Foundations of Mathematics.* Addison-Wesley.
Blank, A. A. *Problems in Calculus and Analysis.* Wiley.
Courant, R. and John, F. *Introduction to Calculus and Analysis.* Wiley.

REFERENCE BOOKS

As for 10.001 Mathematics I.

SUPPLEMENTARY READING LIST

As for 10.001 Mathematics I.

10.021 Mathematics IT

Calculus, analysis, analytic geometry, algebra, probability theory, elementary computing.

TEXT BOOK

Purcell, E. J. *Calculus with Analytic Geometry.* Appleton-Century-Crofts.

REFERENCE BOOKS

Allendoerfer, C. B. and Oakley, C. O. *Fundamentals of College Algebra.* McGraw-Hill.
Fine, N. J. *Introduction to Modern Mathematics.* Rand McNally & Co.
Johnson, W. G. and Zaccaro, L. N. *Modern Introductory Mathematics.* McGraw-Hill.
Nahikian, H. M. *Topics in Modern Mathematics.* Macmillan.

10.022S Mathematics

Differential equations. Laplace transform. Functions of several variables. Multiple integrals. Improper integrals. Fourier series. Three dimensional analytic geometry. Vector algebra. Matrix algebra.

10.022/1 and 10.022/2 Mathematics, Parts 1 and 2

10.022S for part-time students in Engineering over two years.

TEXT BOOKS

Ayres, F. Jr. *Theory and Problems of Matrices.* Schaum, N.Y.

Gere, J. M. and Weaver, W. (Jr.). *Matrix Algebra for Engineers.* Van Nostrand Engineering Paperback.

Keane, A. and Senior, S. A. *Complementary Mathematics.* Science Press.

Keane, A. and Senior, S. A. *Mathematical Methods.* Science Press.

REFERENCE BOOKS

Birkhoff, G. and Maclane, S. *A Brief Survey of Modern Algebra.* Macmillan, New York.

Kaplan, W. *Advanced Calculus.* Addison-Wesley.

Rainville, E. D. *The Laplace Transform.* Collier-Macmillan, Paperback.

10.033 Mathematics

Selections from the following topics:—Inversion theorem for Laplace transforms. Step and pulse functions and their transforms. Fourier transforms. Transmission line problems. Potential theory. Electromagnetic theory. Wave equations, orthonormal functions. Calculus of variations. Lagrangian and Hamiltonian mechanics.

TEXT BOOKS

Carslaw, H. S. and Jaeger, J. C. *Operational Methods in Applied Mathematics.* Dover.

Pipes, L. A. *Applied Mathematics for Engineers and Physicists.* 2nd ed., McGraw-Hill.

Slater, J. C. and Frank, N. H. *Electromagnetism.* McGraw-Hill, *or*

Tralli, N. *Classical Electromagnetic Theory.* McGraw-Hill.

REFERENCE BOOKS

Churchill, R. V. *Fourier Series and Boundary Value Problems.* 2nd ed., McGraw-Hill.

Danese, A. E. *Advanced Calculus, Vol. I.* Allyn & Bacon.

Hague, B. *An Introduction to Vector Analysis.* Methuen.

Tranter, C. J. *Integral Transforms.* Methuen.

10.111 Pure Mathematics II

Real and complex analysis. Differential equations. Linear algebra. Vector analysis. Fourier analysis. Special functions.

TEXT BOOKS

Churchill, R. V. *Introduction to Complex Variables and Applications.* McGraw-Hill, International Students Edition.

Protter, M. H. and Morrey, C. B. *Modern Mathematical Analysis.* Addison-Wesley.

REFERENCE BOOKS

Burkill, J. C. *Theory of Ordinary Differential Equations.* Oliver & Boyd.

Churchill, R. V. *Modern Operational Methods in Engineering.* McGraw-Hill.

Keane, A. *Integral Transforms.* Science Press.

Paige, L. J. and Swift, J. D. *Elements of Linear Algebra.* Ginn.

Pierce, B. O. *A Short Table of Integrals.* Ginn.

Silverman, R. A. *Introductory Complex Analysis.* Prentice-Hall.

10.341 Statistics

An introduction to probability theory. Random variables and distribution functions; the binomial, Poisson and normal distributions in particular. Standard sampling distributions, including those of χ^2, t and F. Estimation by moments and maximum likelihood; confidence interval estimation. The standard tests of significance based on the above distributions, with a discussion of power where appropriate. An introduction to linear regression. Least squares adjustment of data.

10.351 Statistics

An introduction to probability theory, with finite, discrete and continuous sample spaces. Random variables: the standard elementary distributions including the binomial, Poisson and normal distributions. Sampling distributions, with emphasis on those derived from the normal distribution: t, χ^2 and F. Estimation of parameters: the methods of moments and maximum likelihood, and confidence interval estimation. The standard tests of statistical hypotheses, and, where appropriate, the powers of such tests. An introduction to regression and the bivariate normal distribution.

10.371S Statistics

Subject matter same as 10.341.

10.381 Statistics

Subject matter same as 10.351.

TEXT BOOKS (for 10.341, 10.351, 10.371S and 10.381.)

Freund, J. E. *Mathematical Statistics.* Prentice-Hall.

Statistical Tables

11.011H History of Fine Arts

An outline of the development of nineteenth and twentieth century painting and sculpture. Follows the movements concerned in the development of modern art from the stylistic background of the European

tradition to contemporary works. Development of some phases of painting and sculpture during the Ancient, Medieval and Renaissance epochs. The influence of religious, economic and social factors on the more important works of the period.

TEXT BOOKS

Lake, C. and Maillard, R. *A Dictionary of Modern Painting.* Methuen, 1964, London.

Newton, E. *European Painting and Sculpture.* Penguin U.K. (Pelican Books A.82).

Read, H. *The Meaning of Art.* Penguin U.K., 1951. (Pelican Books, A.213).

REFERENCE BOOKS

Berenson, B. *Italian Painters of the Renaissance.* Phaidon, 1952, London.

Brion, M. *Art Since 1945.* Thomas & Hudson, ed., 1959, London.

Burchhardt, J. *The Civilisation of the Renaissance in Italy.* Phaidon, 1944, London.

De Wald, E. T. *Italian Painting 1200-1600.* Holt, Rinehart & Winston, 1962, New York.

Gardner, Helen. *Art Through the Ages.* G. Bell & Sons, 1953, London.

Goldscheider, L. *The Painting and Sculpture of Michaelangelo.* Phaidon, ca. 1960, London.

Mathey, F. *The World of the Impressionists.* Thomas & Hudson, 1961, London.

Ragnar, M. *Modern Painting.* Skira, 1960.

Seuphor, M. *A Dictionary of Abstract Painting.* Methuen, 1963, London.

Seuphor, M. *The Sculpture of this Century.* Zwemmer, 1959, London.

Vasari, G. *Lives of the Painters, Sculptors and Architects.* Dent & Sons, 1949, London, (Everymans Library).

Vivas, E. and Krieger, M. *The Problems of Aesthetics.* Holt, Rinehart & Winston, 1960, New York.

Reading lists are issued progressively during the course.

11.021H History of Architecture

The role of the architect; architecture as an art, a science, and a profession; the origins of architectural form in ancient civilizations, and the development of these forms throughout the Middle Ages and the Renaissance; the effects of the Industrial Revolution and its aftermath, and the growth of modern architecture; the development of an Australian idiom in architecture and building.

TEXT BOOKS

Boyd, Robin. *The Walls Around Us.* F. W. Cheshire, 1962, Melbourne.

Persher, Nikolaus. *An Outline of European Architecture.* Pelican Books, 1963, London.

Richards, J. M. *An Introduction to Modern Architecture.* Pan Books, 1963, London.

REFERENCE BOOKS

A list will be issued early in the lecture series.

11.031H History of Fine Arts and Architecture

An introduction to the history and aesthetics of the visual arts of the Western world, i.e. architecture, paintings, sculpture, design and craftsmanship. Lectures are illustrated by slides and films.

TEXT AND REFERENCE BOOKS

Section 1

Berenson, B. *Italian Painters of the Reniassance.* Phaidon, 1952, London.

Brion, M. *Art Since 1945.* Thomas & Hudson, ed., 1959, London.

Burchhardt, J. *The Civilisation of the Renaissance In Italy.* Phaidon, 1944, London.

De Wald, E. T. *Italian Painting 1200-1600.* Holt, Rinehart & Winston, 1962, New York.

Gardner, Helen. *Art Through the Ages.* G. Bell & Sons, 1953, London.

Goldscheider, L. *The Painting and Sculpture of Michaelangelo.* Phaidon, 1960, ca. London.

Lake, C. and Maillard, R. *A Dictionary of Modern Painting.* Methuen, 1964, London.

Mathey, F. *The World of the Impressionists.* Thomas & Hudson, 1961, London.

Newton, E. *European Painting and Sculpture.* Penquin U.K. (Pelican Books A82).

Ragnar, M. *Modern Painting.* Skira, 1960.

Read, H. *The Meaning of Art.* Penquin, U.K., 1951. (Pelican Books, A213).

Seuphor, M. *A Dictionary of Abstract Painting.* Methuen, 1963, London.

Seuphor, M. *The Sculpture of this Century.* Zwemmer, 1959, London.

Vasari, G. *Lives of the Painters, Sculptors and Architects.* Dent & Sons 1949, London. (Everymans Library).

Vivas E. and Krieger, M. *The Problems of Aesthetics.* Holt, Rinehart & Winston, 1960, New York.

Section II

Boyd, Robin. *The Walls Around Us.* F. W. Cheshire, 1962, Melbourne.

Pevsher, Nikolaus. *An Outline of European Architecture.* Pelican Books, 1963.

Richards, J. M. *An Introduction to Modern Architecture.* Pelican Books, 1963, London.

11.411 Town Planning

The study of factors influencing the direction of the development and use of land in the public interest. Objectives of town and regional planning; historical background; contemporary planning techniques; New South Wales planning law and administration; parks and playing fields; housing

and neighbourhood planning; traffic and transport; the central area; elements of civic design; the city of the future. Studio work in the design and layout of residential areas.

TEXT BOOKS

Brown, A. J. and Sherrard, H. M. *Town and Country Planning.* Melbourne U.P., 1951.

REFERENCE BOOKS

Abercrombie, P. *Town and Country Planning.* 3rd ed., Oxford U.P., 1959.

Gibberd, F. *Town Design.* 3rd ed., Architectural P. 1959.

H.M.S.O. *Design in Town and Village.* 1953.

H.M.S.O. *Traffic in Towns* 1963

Howard, E. *Garden Cities of Tomorrow.* Faber & Faber, 1955.

Mumford, L. *The City in History.* Secker & Warburg, 1961.

Winston, D. *Sydney's Great Experiment.* Angus & Robertson, 1957.

14.061 Accounting

An examination of basic accounting theory and its application to the accounting needs of various types of business enterprise. The preparation, analysis and interpretation of accounting reports. An introduction to the use of accounting in the area of management decision making.

TEXT BOOK

Bierman, H. *Financial and Managerial Accounting: An Introduction.* 2nd ed., Macmillan, 1963.

REFERENCE BOOKS

Anthony, R. N. *Management Accounting: Text and Cases,* 3rd ed., Irwin, 1964.

Gordon, M. J. and Shillinglaw, G. *Accounting A Management Approach,* 3rd ed., Irwin, 1964.

14.062 Accounting for Engineers

Problems related to industrial situations will be examined and consideration given to their relevance in decision making. This will involve a broad study of such matters as manufacturing and cost accounts, budgeting and budgetary control, cost analysis and control and profit planning.

TEXT BOOKS

Anthony, R. N. *Management Accounting: Text and Cases.* 3rd ed., Irwin, 1964.

Burke, W. L. and Smyth, E. B. *Accounting for Management.* Law Book Co., 1966.

REFERENCE BOOKS

Barish, N. *Economic Analysis.* McGraw-Hill, 1962.

Bierman, H. *Financial and Managerial Accounting: An Introduction.* 2nd ed., Macmillan, 1963.

25.101 Geology for Engineers

An introduction to geology with emphasis on the mechanical properties of rock and soil. Rock-forming minerals, clay minerals and the classification of rocks. The properties of rock. An introduction to the processes of orogenesis, epeirogenesis, denudation and weathering of rocks, vulcanicity, intrusion of plutonic rocks, sedimentation and metamorphism. Groundwater, the formation of soils, landforms and the stability of slopes. Review of the application of geology and geophysics in engineering practice. Laboratory work consists of the examination and the identification of common rock-forming minerals and rock types, and the preparation and interpretation of simple geological maps and sections. Two geological field tutorials of one day duration are a compulsory part of the course, and satisfactory field tutorial reports are to be submitted.

TEXT BOOK

Blyth. *Geology for Engineers.* 4th ed., 1960.

REFERENCE BOOKS

Application of Geology to Engineering Practice. Geol. Soc. of America. N.Y., 1950.

Dapples. *Basic Geology.* Wiley, 1959.

Krynine and Judd. *Principles of Engineering Geology and Geotechnics.* McGraw-Hill, 1957.

Schultz and Cleaves. *Geology in Engineering.* Wiley, 1952.

25.303 Geophysics for Surveyors

As for 25.003/3 Part III, Geophysics.

25.003/3 Part III, Geophysics

Geophysics — Physics, shape, structure and constitution of the earth; geotectonics, seismology, gravity, geodesy, geothermy, geomagnetism, palaeomagnetism, geoelectricity, aeronomy and geochronology. Practical work includes a one day field tutorial.

Mineral Deposits — Principles and theories of ore deposition; ore magmas — synmagmatic, epimagmatic and post-magmatic processes. Submarine exhalative deposits. Sedimentary biogenetic deposits. Alluvial and residual deposits. Nonmetallic ores. *Practical*: Macroscopic study of ores and country rock. Study of ores and associated rocks in thin and polished section.

Fuels — Nature and origin of coal and coal seams and of petroleum and petroliferous strata. Coal petrography. Techniques of petroleum geology.

Field work — will be done during the year. This includes a geological survey camp which may be held before the first term, at least one tutorial of approximately one week, and such short trips as may be arranged. Attendance is compulsory.

Geophysics

TEXT BOOK

Howell. *Introduction to Geophysics.* McGraw-Hill, 1959.

REFERENCE BOOKS

Bullen. *Introduction to Theory of Seismology.* Cambridge, 1963.

Chapman. *The Earth's Magnetism.* Methuen, 1951.

Garland. *The Earth's Shape and Gravity.* Pergamon, 1964.

Gutenberg. *Physics of the Earth's Interior.* Academic, 1959.

Heiskanen and Vening Meinesz. *The Earth and its Gravity Field.*

Hill. *The Sea, Vol. 3.* Wiley, 1963.

Irving. *Paleomagnetism.* Wiley, 1964.

Jacobs. *The Earth's Core and Geomagnetism.* Pergamon, 1963.

Ore Deposits

REFERENCE BOOKS

Edwards. *Textures of the Ore Minerals.* 2nd ed., 1954.

Fiftieth Anniversary Volume of Economic Geology. Vols. I and II. Society of Economic Geologists, Urbana, Illinois.

Geology of Australian Ore Deposits. 2nd ed., Aust. Inst. Min. and Met. Melbourne, 1965.

Coal

TEXT BOOK

Raistrick and Marshall. *The Nature and Origin of Coal and Coal Seams.* 1952.

REFERENCE BOOK

Francis. *Coal, its Formation and Composition.*

Oil

TEXT BOOK

Levorsen. *Petroleum Geology.* 1954

REFERENCE BOOK

Le Roy. *Subsurface Geologic Methods.*

26.121 and 26.121S Psychology

An introduction to general Psychology by way of a course centred upon issues related to the study of personality motivation, perception, learning, the nature of personality development and of social behaviour.

TEXT BOOKS

Lindgren, H. C., Byrne, D. and Petrinovich, L. *Psychology: An Introduction to a Behavioural Science, or*

Morgan, C. T. *An Introduction to Psychology.* 2nd ed., McGraw-Hill, 1961.

REFERENCE BOOK

Gabriel, J. *Children Growing Up. The Development of Children's Personalities.* University of London Press, 2nd ed., 1965.

26.122S Psychology

The theme of this advanced elective is man in society, his strivings, satisfactions, and values. The course examines what psychology has to say about personality, the roles which people adopt, the groups people form and the nature of group relations, the effect of group interaction, the importance of attitudes, the influence of propaganda and the function of conformity, conventions and customs.

TEXT BOOKS

Baughman, E. E. and Welsh, G. *Personality, a Behavioural Science.* Prentice-Hall, 1962.

Krech, D. and Crutchfield. *The Individual and Society.* McGraw-Hill, 1962.

26.151 and 26.151S Economics

An introductory examination of the working of a modern economic system, with some reference to Australian economic institutions.

TEXT BOOKS

Carter, C. F. *The Science of Wealth.* Edward Arnold. Oxford, 1963.

McB. Grant J. and Hagger, A. F. *Economics — An Australian Introduction.* F. W. Cheshire, Melbourne, Canberra, Sydney 1964 or 1965.

26.152 and 26.152S Economics

Follows 26.151 Economics. A more penetrating study of central fields of economic theory and includes such topics as the history of economic thought and different economic systems. Particular attention paid to relating economic theory to such subjects as the population explosion, economic growth, and the role of international trade and economic integration. Further studies of the economic structure and economic policy of Australia.

TEXT BOOKS

Fusfeld, D. *The Age of the Economist.* Scott Foresman, 1966—softback.

Gill, R. F. *Evolution of Modern Economics.* Prentice-Hall, 1967—softback.

Samuelson, P. A. *Economics.* 7th ed., McGraw-Hill. (Available in hardback and softback). Study Guide and Workbook to Samuelson.

26.301 and 26.301S Music

A brief survey of music from the earliest times of documented history to the present day in the context of particular societies and periods. Many of the recorded examples used will be European music of a kind normally heard in the concert hall, but wherever possible European art music will be presented in juxtaposition with the practice of traditional or folk music of all continents (including the music of the Australian Aborigines) and with the high art music of Asian countries .Includes continuity of improvisational methods from early periods to the development of jazz, and samples of the latest developments in contemporary music (including electronic music). Musical training is not a prerequisite.

TEXT BOOKS

Covell, R. *Australia's Music: Themes of a New Society.* Sun Books, Melbourne, 1967.

Harman, A. and Mellers, W. *Man and His Music: The Story of Musical Experience in the West.* Barrie and Rockliff, 1962, London.

REFERENCE BOOKS

Chailley, J. *40,000 Years of Music.* Macdonald, 1964, London.

Dart, T. *The Interpretation of Music.* Hutchinson, 1960, London.

Hartod, H. (ed.). *European Music in the Twentieth Century.* Penguin, 1961, London.

Lang, P. H. *Music in Western Civilisation.* Dent, 1942, London.

Mellers, W. *Music in a New Found Land.* Barrie and Rockliff, 1964, London.

Nettl, B. *Folk and Traditional Music of the Western Continents.* Prentice-Hall, 1965, New Jersey.

Sachs, C. *The Wellsprings of Music.* McGraw-Hill, 1965, New York.

26.501 English

Aims at stimulating an interest in literature through a study of twentieth century texts having a more or less common theme—"the human condition". The tutorials will be used in the main for an examination of the informative, persuasive, and imaginative uses of the English language, and for group discussions of the set texts.

TEXT BOOKS

Bolt, Robert. *A Man For All Seasons.*

Camus, Albert. *The Outsider.*

Warren, Robert Penn and Erskine, Albert. *Short Story Masterpieces.*

Golding, William. *Lord of the Flies*

Hemingway, Ernest. *A Farewell to Arms*

Lawrence, D. H. *Sons and Lovers.*

McCullens, Carson. *The Ballad of the Sad Cafe* (the ballad only).

Malraux, A. *Man's Estate.*

Miller, Arthur. *Death of a Salesman.*

O'Neill, Eugene. *The Emperor Jones.*

Three Australian Plays. Penguin.

Williams, Tennessee. *A Streetcar named Desire.*

Williams, Tennessee. *The Glass Menagerie.*

All the texts are available in paperback editions, but any complete edition will do.

The Emperor Jones and the *Glass Menagerie* may be available in the one paperback (Modern Library) with the title Six Modern American Plays.

26.502 and 26.502S English

Centred upon outstanding works of literature of the nineteenth and the twentieth centuries. Includes discussion of the sorts of pressure arising from preceding literary achievements, society and philosophical concerns, which have helped in moulding the form of each of the works and in bringing about changes of literary form.

TEXT BOOKS

Eliot, T. S. *Selected Poems.* Faber & Faber.

Keats, John. *Selected Poems.* Signet Classics.

26.511 and 26.511S History—The World in the Twentieth Century

A general study of the main aspects of the world history in the twentieth century. Beginning with a review of a relatively settled world in the 1890s, it covers in particular the causes and effects of the two World Wars, the growth of nationalism and the decline of colonialism, the Russian and Chinese revolution, experiments in international and regional co-operation (League of Nations, UNO, NATO, Colombo Plan, etc.) and the Cold War.

TEXT BOOKS

Crozier, Brian. *South East Asia in Turmoil.* Penguin Books, 1966.

Fitzgerald, C. P. *The Birth of Communist China.* Penguin Books, 1965.

Henderson, James L. (ed.). *Since 1945, Aspects of Contemporary World History.* Methuen, 1966.

Thomson, David. *England in the Twentieth Century.* Penguin Books, 1965.

von Laue, T. *Why Lenin? Why Stalin? A Reappraisal of the Russian Revolution 1900-1930.* Lippincott, 1964, New York.

Wiskemann, Elizabeth. *Europe of the Dictators 1919-1945, Fontana History of Europe.* Collins, 1966.

26.512 and 26.512S History—The World since 1919

Prerequisite 26.511. A survey of events since 1919 to give an historical understanding of the world today. Its main topics are: the Peace Settlement after World War I; the growth of Communist Russia; dictatorship in Europe; U.S.A. between the wars and the abandonment of isolationism; an outline of World War II, its causes and effects; the Cold War; the role of UNO; the changing British Commonwealth; the decline of colonialism; African nationalism; communism in China; and the place of Australia in the modern world.

Crozier, Brian. *South East Asia in Turmoil.* Penguin Books, 1966.

Davidson, Basil. *Which Way Africa.* Penguin.

Dulles, Foster Rhea. *America's Rise to World power 1898-1954.* Harper Torch.

Henderson, J. L. *Since 1945, Aspects of Contemporary World History.* Methuen, 1966.

Sibram, Stuart. *Mao Tse Tung.* Penguin.

Snyder, L. L. *The World in the 20th Century.* Anvil Books.

von Laue, T. *Why Lenin? Why Stalin? A Reappraisal of the Russian Revolution 1900-1930.* Lippincott, 1964, New York.

Wiskemann, Elizabeth. *Europe of the Dictators 1919-1945.* Fontana Library.

26.521 and 26.521S—Philosophy

An introduction to formal logic and to problems and methods of philosophy. Elementary logic is taught in tutorial classes where students are encouraged not only to understand formal features of Aristotelian and modern logic, but also to apply what they have learnt to thought and language of the everyday world. Elementary philosophy is taught by means of lectures and tutorials, and deals firstly, with the nature and methods of philosophy as contrasted with other forms of inquiry, and secondly, with some of the major problems of philosophic interest, such as the relation between language and the world; the nature of knowledge and truth; the concepts of *determinism* and *free-will;* the relation between the mental and the physical parts of Man; and the existence of God.

TEXT BOOKS

Hamblin, C. L. *Elementary Formal Logic.* Hicks, Smith & Sons, Sydney, 1966. (revised printing 1967).

Hospers, John. *An Introduction to Philosophical Analysis.* 2nd ed., Prentice-Hall, 1967, London.

26.522 and 26.522S Philosophy

Prerequisite 26.521 Philosophy. Available in either of two forms.

Syllabus A: Contemporary Philosophy — Current trends in philosophy. Special attention is paid to techniques of philosophic scholarship, and students are required to prepare a short dissertation embodying results of original research on a subject chosen in consultation with the Department of General Studies.

Syllabus B: Symbolic Logic — By arrangement with the School of Philosophy, students in General Studies may take, as their advanced elective in Philosophy, a course in symbolic logic, normally offered to students of Philosophy II (Arts). Provides further training in modern logic.

TEXT BOOK *Syllabus A*: *Contemporary Philosophy*

Passmore, J. A. *A Hundred Years of Philosophy.* 2nd ed., Duckworth, 1966, London.

TEXT BOOK: *Syllabus B*: *Symbolic Logic*

Copi, I. M. *Symbolic Logic.* 2nd. ed., Macmillan, 1965, New York.

26.531 Sociology

Students may select either Part A or Part B of 53.111 Sociology I.

53.111 Sociology I

There will be three sections of the course:

Part A: *The Scope and Content of Sociology* — An introduction to the subject matter of sociology. Concepts and methods of social analysis. Theories of society.

Part B: *Methods of Social Research* — An introduction to the problems of social research design and the practical techniques developed by social scientists.

PRELIMINARY READING *Part A: The Scope and Content of Sociology*

Fyvel, T. R. (ed.). *The Frontiers of Sociology*. Cohen & West, 1964.

Merton, R. K., Broom, L., & Cottrell, L. S. (eds.). *Sociology Today*. Basic Books, 1959.

TEXT BOOKS

Berger, P. L. *Invitation to Sociology*. Penguin, 1963.

Cotgrove, S. *The Science of Society*. Allen & Unwin, 1967.

MacKenzie, N. (ed.). *A Guide to the Social Sciences*. Weidenfeld & Nicolson, 1966.

REFERENCE BOOKS

Bottomore, T. B. *Sociology*. Unwin University Books, 1962.

Bredemeier, H. C. and Stephenson, R. M. *The Analysis of Social Systems*. Holt, Rinehart & Winston, 1962.

Firth, R. *Elements of Social Organization*. 3rd ed., Watts, 1961.

Homans, G. C. *The Human Group*. Harcourt, Brace & World, 1950.

Johnson, H. M. *Sociology: A Systematic Introduction*. Harcourt, Brace & World, 1960.

McIver, R. M. and Page, C. H. *Society*. Macmillan, 1950.

Mayer, K. B. *Class and Society*. Random House, 1955.

Olmsted, M. S. *The Small Group*. Random House, 1959.

PRELIMINARY READING *Part B: Methods of Social Research*

Huff, D. *How to Lie with Statistics*. Gollancz, 1954.

Lerner, D. (ed.). *The Human Meaning of the Social Sciences*. Meridian Books, 1959.

TEXT BOOKS

Elzey, F. E. *A First Reader in Statistics*. Wadsworth Publishing Co., 1957.

Madge, J. *The Tools of Social Science*. Longmans, 1953.

REFERENCE BOOKS

Ackoff, R. L. *The Design of Social Research*. University of Chicago, 1953.

Abrams, M. *Social Surveys and Social Action*. Heinemann, 1951

Backstrom, C. and Hursh, G. D. *Survey Research*. Northwestern University, 1963.

Bartlett, F. C. et al. *The Study of Society*. Kegan Paul, 1946.

Hyman, H. H. *Survey Design and Analysis*. Free Press, 1960.

Kuhn, A. *The Study of Society*. Social Science Paperbacks, 1966.

Madge, C. and Harrisson, T. *Britain by Mass-Observation*. Penguin, 1939.

Moser, C. A. *Survey Methods in Social Investigation*. Heinemann, 1958.

Parten, M. *Surveys, Polls and Samples: Practical Procedures*. Harper, 1950.

Payne, S. L. *The Art of Asking Questions*. Princeton University, 1954.

Stephan, F., McCarthy, J. and P. J. *Sampling Opinions*. Wiley, 1963.

Young, P. V. *Scientific Social Surveys and Research*. Prentice-Hall, 1949.

26.532 Sociology

Students must select two of the specialized topics under Part B of 53.112 Sociology II.

53.112 Sociology II

Part B — Students may select, subject to approval, two course units drawn from a variety of fields, not all of which may be available in any one year. These include the following: Comparative Sociology; Criminology; Small Groups; Social Change in Papua-New Guinea; Social Policy; Social Stratification A and B; Social Structure and Personality; Sociology of Medicine; Sociology of Religion; Urban Sociology.

For Text and Reference Books please see Faculty of Arts Handbook.

26.541 and 26.541S Political Science

An introduction to the advanced elective, 26.542, and a unit in its own right for students not proceeding further in Political Science.

About ten lectures will be on general questions on politics—what politics is about, the meaning of a political system, concepts such as state, law, government, rights, etc. The remaining twenty lectures will deal with three major political systems—Great Britain, U.S.A., and Australia. Both the common and distinct characteristics of each will be discussed, and these examples will be used to illustrate some general questions about political institutions and ideas.

TEXT BOOKS

Griffith, J. *The Australian System of Government.* Uni. paperback, 1967.

Miller, J. D. B. *The Nature of Politics.* Penguin. 1966.

Moodie, G. *The Government of Britain.* University Paperback, 1965.

Sawer, G. *Australian Government To-day.* Melbourne, 9th ed., 1967, (paperback).

REFERENCE BOOK

Birch, A. H. *Representative and Responsible Government: An Essay on the British Constitution.*

26.542 and 26.542S Political Science

Will be conducted in first and second terms and by following on from 26.541 will extend the student's acquaintance with modern political systems. Three sections, of about twenty lectures each, dealing with (*a*) established communist regimes (U.S.S.R., the East European Peoples' Democracies, and China); (*b*) two Asian political systems; and (*c*) the international political system.

TEXT BOOKS

Barnett, A. D. *Communist China in Perspective.* Praeger, 1962.

Frankel, J. *International Relations.* Oxford, 1964.

Grant Bruce. *Indonesia.* Penguin 2nd ed., 1966.

Schapiro, L. B. *The Government and Politics of the Soviet Union.* Hutchinson Uni. Library 2nd ed., 1967, (paperback).

Von der Mehden, F. *Politics of the Developing Nations.* Prentice-Hall, 1964.

REFERENCE BOOKS

Crankshaw, E. *The New Cold War.* Pelican, 1963.

Deutscher, I. *Stalin.* Oxford Paperback, 1961.

Fitzgerald, C. P. *The Birth of Communist China.* Pelican, 1964.

Kochan, L. *The Making of Modern Russia.* Pelican, 1964.

Meyer, A. G. *Communism.* 2nd ed., Random House, 1963.

Mills, C. W. *The Marxists.* Pelican, 1964.

Tinker, H. *Ballot Box and Bayonet.* O.U.P., 1964.

26.561 Introduction to French Civilisation

Intensive work in the French language. Aspects of French civilisation (conducted in French). In the treatment of French cultural life, emphasis will be placed on painting and architecture.

TEXT BOOKS

Harrap's Shorter French and English Dictionary. (recommended for purchase if possible).

Brée, G. and Dufau, M. *Voix d'aujourd'hui.* Harcourt, Brace & World.

Gerard, P. and Meras, M. *Cathédrales de France.* Fernand Nathan.

Michaud, G. *Guide France.* Hachette.

Politzer, R. L. and Hagiwara, M. P. *Active Review of French.* Blaisdell Publishing Co. 1963.

Romier, L. *A History of France.* Macmillan, Paperback edition.

Thoraval, J. et al. *Les Grandes Etapes de la Civilisation francaise.* Bordas.

REFERENCE BOOKS

Duby, G. and Mandrou, R. *Histoire de la civilisation francaise.* A-Colin, Paris, edited by the Documentation francaise.

Heron de Villefosse, R. *Paris.* Hachette.

Leroy, A. *Evolution de la peinture francaise des origines â nos jours.* Horizons de France.

Read, H. *Art Now.* Faber & Faber.

Robert, P. *Le Petit Robert.* Dictionnaire alphabétique et analogique de la langue francaise. Société de Nouveau Lettré.

Petit Larousse, "Dictionnaire encyclopédique pour tous". Larousse.

26.562/1 German Literature and Civilisation

Conducted in English. General aspects of German civilisation, Johann Wolfgang von Goethe, *Faust I,* Thomas Mann, *Buddenbrooks,* Bertolt Brecht, *Mother Courage* and *Sezuan.*

TEXT BOOKS

Brecht, B. *Plays. Vol. II.* Methuen, 1962

Goethe, J. W. v. *Faust.* Part I. Dual Language Edition. Bantam Classics.

Mann, T. *Buddenbrooks.* English Edition, Penguin.

26.562/2 German Literature and Civilisation

Conducted in English. General survey of German literature, Johann Wolfgang von Goethe; *Wilhelm Meister* Part I, Franz Kafka; *The Castle*, and Friedrich Dürrenmatt; *Romulus* and Max Frisch; *The Fire Raisers.*

TEXT BOOKS

Dürrenmatt, F. *Romulus the Great.* Grove Press, 1965.

Frisch, M. *The Fire Raisers.* Methuen, 1962.

Goethe, J. W. *Wilhelm Meister's Apprenticeship.* Collier-Macmillan, 1962.

Kafka, F. *The Castle.* Penguin (Modern Classics).

26.563/1 Spanish and Spanish American Literature

A selection of modern and contemporary Spanish and Spanish American writers. While these are mostly novelists and dramatists, there is some poetry included (as in case of Lorca) where adequate translations are available.

26.563/2 Spanish and Spanish American Literature

The Medieval period in Spain, and the Colonial era in Spanish America. Emphasis is on the short story, the novel and theatre, though some great poetry is included.

26.571 An Introduction to Modern Drama

An introduction to modern drama through the study of plays of Ibsen, Chekhov and other writers, covering the range of dramatic activity from Naturalism to the Absurd.

Students, through a critical examination of plays in performance at the Old Tote Theatre (situated in the grounds of the University), also have an opportunity to enjoy the direct experience of theatre. Directors of current Old Tote productions take part in the course.

TEXT BOOKS

Absurd Drama. Penguin.

Barmet. (ed.). *Genius of the Early English Theatre.* Mentor.

Chekhov. *Plays.* Penguin.

Ibsen. *Last Plays.* (trans. Paulson). Bantam.

New American Drama. Penguin.

Sokel. (ed.). *Anthology of German Expressionist Drama.* Doubleday Anchor.

Sophocles. *Theban Plays.* Penguin.

Strindberg. *Six Plays.* (trans. Sprigge). Doubleday Anchor.

Three German Plays. Penguin.

Plus other plays to be prescribed.

26.601 History of Technology

Shows that the development of the human race is closely linked with technological change. Every major development is to be seen against the historical background of the times and the changing socio-economic

pattern. The subject will be dealt with in the following historical periods: Prehistoric Times; the early civilisations of Mesopotamia, Egypt, India, and China; Classical Antiquity; Islamic Times and the Middle Ages; Renaissance and the Age of Enlightenment; and the beginning of the Industrial Revolution.

REFERENCE BOOKS

Agricola, G. *De Re Metallica.* (Trans. E. G. Hoover).

Forbes, R. J. *Studies in the History of Ancient Technology. Vols. 1-10.* Brill, Leyden, Holland.

Semler. (ed.). *Engineering Heritage.* 2 vols. Institute of Mechanical Engineers.

Singer, C. et al. (eds.). *A History of Technology.* 4 vols. Oxford U.P.