1951

Mechanical Engineering: Prospectus for Day and Evening Classes 1951-52

City of Dublin Vocational Education Committee

coiste sairm-oideachais cathair bhaile átha cliath

DEPARTMENT OF

MECHANICAL ENGINEERING

TECHNICAL INSTITUTE

BOLTON STREET, DUBLIN

1951-52

PROSPECTUS

FOR DAY AND EVENING

CLASSES

CALENDAR — SESSION 1951-52

1951—SEPT.	3 MONDAY	Trade Apprentice Part-time Day Classes open for enrolment and Wholetime Day Apprentice School resumes work.
„	10 MONDAY	Trade Apprentice Part-time Day Classes commence work and Higher Technological Course opens for enrolment.
„	17 MONDAY	Higher Technological Course commences work and Evening Courses open for enrolment.
„	24 MONDAY	Evening classes commence work.
DEC.	19 WEDNESDAY	Final Class meetings before Christmas Vacation.
1952—JAN.	7 MONDAY	All Classes resume work after Christmas Vacation.
MAR.	17 MONDAY	*St. Patrick's Day.* School closed.
APR.	8 TUESDAY	Final Class meetings before Easter Vacation.
„	16 WEDNESDAY	Evening Classes resume work after Easter Vacation.
„	21 MONDAY	All Day Classes resume work after Easter Vacation.
MAY	2 FRIDAY	Final Meetings of Evening Classes, except where otherwise arranged.
JUNE	2 MONDAY	*Whit Monday.* School closed.
„	28 SATURDAY	Summer Term closes except where otherwise arranged.

Schools closed on all Bank Holidays not specified in above calendar.

An Roinn Innealtóireachta Meicniúla

DEPARTMENT OF

MECHANICAL ENGINEERING

Head of Department:
MARTIN KEADY, B.E., B.SC., A.R.C.SC.I.

Assistant Head of Department:
JOHN D. BARRY, M.SC., B.E.,
A.M.I.MECH.E., A.M.I.A.E.

CONTENTS

CITY OF DUBLIN VOCATIONAL EDUCATION COMMITTEE

Very Rev. John Canon Fitzpatrick, M.A., D.D., P.P. (Chairman). "Monte Coelio", Bray Road, Foxrock, Co. Dublin.
Alderman Dr. Cormac Breathnach, T.D., 384 Clontarf Road, Dublin.
Alderman Bernard Butler, B.A., T.D., 16 Healthfield Road, Terenure, Dublin.
Alderman John McCann, T.D., 68 Fortfield Road, Terenure, Dublin.
Councillor Joseph Barron, 10 South Circular Road, Portobello, Dublin.
Councillor Bhalter Breathnach, 58 Bannow Road, Cabra West, Dublin.
Councillor Patrick J. Cahill, P.C., 64 Aungier Street, Dublin.
Councillor Timothy J. Murray, P.C., "Cresswell", 9 St. Peter's Road, Phibsboro', Dublin.
Councillor Michael J. O'Higgins (Vice-Chairman), 11 St. Mary's Road, Ballsbridge, Dublin.
Mr. W. J. Whelan, 61 Lower Beechwood Avenue, Ranelagh, Dublin.
Mr. Eamonn Delaney, 29 Oulton Road, Clontarf, Dublin.
Micheal O Muircheartaigh (Commdt.), 56 Vernon Avenue, Clontarf, Dublin.
Mrs. M. Mulvey, P.C., Co.C., Readsdale, Main Street, Dundrum.
Micheal O Foghludha, 5 Cabra Road, Dublin.

Offices:—Town Hall, Merrion Road, Ballsbridge, Dublin.

MARTIN M. GLEESON, M.A., B.Comm., H.Dip.Ed.
Chief Executive Officer.

CITY OF DUBLIN VOCATIONAL EDUCATION SUB-COMMITTEE

(Technical Institute, Bolton Street)

Very Rev. John Canon Fitzpatrick, D.D., "Monte Coelio", Foxrock.
Alderman Martin O'Sullivan, "Kilmanaheen", Sutton Cross, Sutton.
Councillor Bhalter Breathnach, 58 Bannow Road, Cabra W.
Mr. Gerald Doyle, Dublin Operative Plasterers' Trade Society.
Mr. Robert Murphy, Master Jewellers' Association.
Mr. M. P. Rowan, 52 Capel Street, Dublin.
Mr. W. J. Whelan, Dublin Typographical Provident Society.
Mr. Hiliary Williams, Ancient Guild of Incorporated Brick and Stonelayers.
Mr. G. E. Hetherington, Master Printers' Association.
Mr. A. J. Wilson, Dublin Master Printers' Association.
Mr. P. J. Kearney, Irish Engineering Industrial Union.

Offices:—The Technical Institute, Bolton Street, Dublin.

MARTIN KEADY, B.E., B.Sc., A.R.C.Sc.I.,
Principal.

Telephone: 53443-4.

ADVISORY COMMITTEES

Mechanical Engineering

J. Cassidy, General Secretary, Irish Engineering and Foundry Union, 33 Gardiner's Place, Dublin.

J. O'Brien, General Secretary, Irish Engineering Industrial Union, 6 Gardiner's Row, Dublin.

Brian D'A. Patterson, Personnel Officer, Coras Iompair Eireann, 59 Upper O'Connell Street, Dublin.

H. Lennox, General Manager, Liffey Dockyard Co., East Wall, Dublin.

S. O'Flaherty, Managing Director, Messrs. Howard MacGarvey & Sons, 62 Townsend Street, Dublin.

George Watt, Messrs. George Watt, Ltd., Soho Engineering Works, 27 Bridgefoot Street, Dublin.

W. P. Bates, District Secretary, United Society of Boilermakers and Iron and Steel Shipbuilders, 11 Richmond Hill, Rathmines.

Motor Engineering

A. McAuley, B.Sc., Rolling Stock Engineer, Coras Iompair Eireann, Broadstone, Dublin.

Charles Warren, Society of Irish Motor Traders.

Patrick Doyle, Secretary, Irish Automobile Drivers' and Auto-Mechanics' Union, 9 Parnell Square, Dublin.

J. O'Brien, Secretary, Irish Engineering Industrial Union, 6 Gardiner's Row, Dublin.

Watchmaking

R. Murphy, G. W. Sleater — Master Jewellers' Association.

J. Ryan, Gold, Silver and Allied Trades Union.

TECHNICAL INSTITUTE, BOLTON STREET

Principal:
MARTIN KEADY, B.E., B.Sc., A.R.C.Sc.I.
Vice-Principal:
DONAL O'DWYER, B.Arch., M.R.I.A.I.

DEPARTMENT OF MECHANICAL ENGINEERING

Head of Department:
The Principal
Assistant Head of Department:
John D. Barry, M.Sc., B.E., A.M.I.Mech.E., A.M.I.A.E.
Head of Motor Car Engineering Division:
W. D. Pile, A.M.I.Mech.E., A.M.I.A.E.
Chief Instructor (Mechanical Engineering Trades):
H. Fitzgerald, Hons. Manual Instructors Cert. (Dept. of Educ.)

DEPARTMENT OF ARCHITECTURE AND BUILDING

Head of Department:
The Vice-Principal
Assistant Head of Department:
B. O'Reilly, B.Arch., A.R.I.B.A.
Chief Instructor (Building Trades):
R. Grimes, A.B.I.C.C., Full Tech. C. & G., Lond.

DEPARTMENT OF PRINTING AND BOOK PRODUCTION

Head of Department:
W. J. Fitzpatrick, Full Tech. C. & G., Lond.

SCIENCE DIVISION

Head of Division:
J. Nunan, B.Sc., H.Dip.Ed.

DAY JUNIOR TECHNICAL SCHOOL

Teacher-in-Charge:
L. Mac Amhlaoibh, B.A.

Stock-taker:
W. J. N. O'Brien, Dipl. Ing.
Clerk:
Tomas O Somachain

DEPARTMENT OF MECHANICAL ENGINEERING

TEACHING STAFF

1. Mathematics; Science; Strength of Materials, and Applied Mechanics:

J. D. Barry, M.SC., B.E., A.M.I.MECH.E., A.M.I.A.E.
J. Boylan, A.M.I.MECH.E., A.M.I.C.E.I.
E. P. Dunne, A.M.I.MECH.E., A.M.I.C.E.I.
W. S. E. Hickson, M.A., M.SC., HONS. DIP. ED.
J. J. Hughes, H.DIP.ED.
S. H. Knight, B.A.
G. Latchford, B.E., B.SC.
M. L. Niall, M.SC., B.COMM.
J. Nunan, B.SC., H.DIP.ED.
W. J. O'Doherty, B.A., H.DIP.ED.
S. O'Tuama, B.SC.
S. Rossiter.

2. Heat Engines: Applied Thermodynamics:

J. D. Barry, M.SC., B.E., A.M.I.MECH.E., A.M.I.A.E.
G. Latchford, B.E., B.SC.
S. Rossiter.

3. Machine Design; Theory of Machines:

J. D. Barry, M.SC., B.E., A.M.I.MECH.E., A.M.I.A.E.
J. C. Fitzpatrick, M.I.MECH.E., M.I.C.E.I.
G. Latchford, B.E., B.SC.

4. Machine Drawing and Construction:

B. Fee
J. Gribben.
W. Kennedy
J. F. Lawless
W. J. O'Brien, DIP.ING.
J. Roche
J. C. Slater
R. Daly

5. Automobile Electricity:

S. H. Knight, B.A.
S. O'Tuama, B.SC.

6. Motor Car Engineering:

S. Guirke.
W. D. Pile, A.M.I.MECH.E., A.M.I.A.E.
T. Giblin.

7. Physical Training:

M. Doogan

TEACHING STAFF (continued)

8. Trade:—Theory and Practice:

Boilermaking—E. Bennett.

Brassfinishing—M. O'Carroll

Brass Moulding—C. Maples

Fitting and Turning—
G. Aungier
O. W. Crotty.
H. Fitzgerald
J. Gribben.
W. Hunt
W. De Renzy
S. Rossiter.
R. Tynan
W. Daly

Iron Moulding—T. C. Smith.

Smithwork and Art Ironwork—
A. J. Ward

Garage Practice—
W. Cully.
R. J. Dowling
J. Guirke
T. Giblin.

Metalplate Work—
J. Bryan.
C. Devine.
M. Kane.
T. J. Ryan
A. O'Toole

Oxy-acetylene and Electric Welding—
J. O'Toole.
P. Cowley.

Patternmaking—E. J. Kennedy

Watchmaking—F. O'Kelly

CITY OF DUBLIN VOCATIONAL EDUCATION COMMITTEE

GENERAL REGULATIONS FOR THE SCHOOLS AND CLASSES OPERATING UNDER THE AUTHORITY OF THE COMMITTEE

1. ADMISSION AND ENROLMENT

(*a*) In general, applicants for admission to the Classes and Courses must be not less than 14 years of age, but admission to a whole-time Day Course may be granted where the applicant is over 13 years of age and has been enrolled for at least one year in the Sixth Standard of a Primary School. This Regulation does not apply to the School of Music or Colaiste Muire, Cathal Brugha Street.

(*b*) The Committee, in accordance with the means and facilities at its disposal, has provided classes for the sole purpose of supplementing the practical trade training of persons actually employed at and engaged in the various operations of the trade and whose employment as such is accepted by the recognised Unions of the trades concerned.

(*c*) In determining whether an applicant for admission to one of these practical trade classes complies with the above conditions the Committee is guided, where necessary, by the evidence supplied by the Masters' Associations and the official Trade Unions of the trade concerned.

(*d*) Admission to a particular class or course is subject to the published regulations relative to that class or course.

(*e*) One month after the opening date of classes or courses students will be permitted to enrol only with the special permission of the School Authority.

(*f*) Pupils in attendance at Primary and Secondary Schools are not eligible for enrolment except by special permission of the School Authority.

(*g*) The educational fitness of a student to enrol in a particular course may be decided by an examination or other means considered necessary.

(*h*) A student is not entitled to enrol in a class or course which the School Authority decides is too advanced for his/her standard of knowledge.

(*i*) Enrolment procedure :—

(*i*) Intending students must enter on the Enrolment Form supplied all the information required by the School Authority.

(*ii*) The classes or courses to be taken are decided in interview with a member of the School Staff.

(*iii*) The appropriate fee is then paid to an officer of the Committee and a receipt issued therefor. A student who pays a fee must insist that he receives an official receipt for the amount of the fee paid.

(*iv*) The appropriate class ticket/tickets is then issued to the student.

(*j*) (*i*) No student may attend a class until he/she has received a class ticket.

(*ii*) On first attendance at each class the student must tender to the teacher in charge his/her appropriate class ticket, together with the receipt for fee paid.

(*k*) Students will be enrolled during the period and at the times stated in the Committee's publications.

(*l*) The School Authority is authorised to refuse an enrolment, pending a decision thereon by the Committee.

2. FEES

(*a*) The fees payable for the several classes and courses included in the Scheme of Instruction are stated in the publications of the Committee, and must be paid in full on enrolment unless otherwise stated.

(*b*) Where a course includes subjects of different stages, the total fee will be computed on the basis that the initial fee is that of the highest stage.

(*c*) For enrolments in subjects ancillary to the original enrolment, in the same or another School or Department, the additional fee will be computed on the basis that all the classes have been selected on first enrolment. Where the additional subjects are deemed not to be ancillary, the fee payable will be as for a separate enrolment.

(*d*) The School Authority is authorised to decide if the additional enrolment is ancillary to the original enrolment.

(*e*) For fee purposes, Irish and/or Physical Training will be regarded as additional subjects to any class or course.

(*f*) Fees will not be refunded except where a class does not form.

(*g*) Cheques should be crossed and made payable to the City of Dublin Vocational Education Committee.

3. TRANSFERS

An enrolment is not transferable from one student to another. Transfer from one class to another, from one School to another, from Day Classes to Evening Classes, or from Evening Classes to Day Classes, with allowance for the fees paid, will be permitted only for a satisfactory reason and by special permission of the School Authority.

4. PRODUCTION OF ORIGINAL RECEIPT

Where applications are made for additional enrolments, or for transfers, the original receipt must be produced.

5. FORMATION AND CONTINUANCE OF CLASSES

The Committee reserves the right at any time to add or delete classes or courses to or from its Scheme of Instruction; to extend the period of a class; and to close a class, or to alter the day or times of a class meeting.

6. DISCIPLINE

The School Authority may suspend any student for breach of rules and regulations; absence from classes; irregular or unpunctual attendance; disorderly conduct in the School or within the School precincts; disobedience to a member of the staff; or for any other reason deemed sufficient. The Committee reserves the right to confirm such suspension and to cancel the enrolment without refund of fee. Where immediate action is required because of indiscipline on the part of the students, any member of the School Staff has authority to take appropriate measures, pending report to the School Authority.

7. SMOKING

Smoking is not permitted in the Schools.

8. INJURY TO STUDENTS

The Committee does not accept responsibility for injury to students resulting from careless conduct or neglect or disregard of regulations.

9. STUDENT PROPERTY

The Committee does not accept any responsibility for loss or damage to any student property—bicycles, hats, coats, books, etc.

10. SCHOOL PROPERTY

Where School property is damaged wilfully or through careless conduct on the part of students, such students (or their parents or guardians) may be required, on the order of the Committee, to pay for such repairs or replacements as may be necessary.

11. CHANGE OF ADDRESS

Students should notify the School Authority of any change of address.

12. BOOKS, STATIONERY, EQUIPMENT, DRESS

Students are expected to provide themselves with such books, stationery, equipment and dress as may be required.

13. INFECTIOUS AND NOTIFIABLE DISEASES

The head of the household must inform the School Authority immediately of any infectious or notifiable disease which may occur in the house in which a student is residing. Such a student must not resume attendance until permitted to do so by a medical officer.

14. EXAMINATIONS

Permission to sit for Scholarship, Sessional or other Examinations held under the authority of the Committee, will be governed by the conditions relevant to the examinations.

15. SCHOOL AUTHORITY

The term "School Authority," as used in these Regulations, indicates the Chief Executive Officer, or an officer delegated to act on his behalf.

The above Regulations have been adopted by Resolution of the Vocational Education Committee for the City of Dublin and approved by the Minister for Education.

CONDITIONS REGULATING THE ADMISSION OF STUDENTS TO CLASSES AND COURSES

Practical Workshop Classes in Trade Subjects

These classes are provided for the sole purpose of supplementing the practical trade training of persons actually employed at and engaged in the various operations of the trade. The Committee realise that it is impossible for a person to learn a trade solely by attendance at these classes, and are further of the opinion that the admission to the classes of persons not actually engaged in the trades would be, not only of little use to such persons, but would prejudicially affect the instruction of those for whom the classes have been organised. Accordingly, the Committee reserve the right to restrict enrolment in the trade practical classes to those persons who are actually employed in the several processes and operations of the trade.

In the Mechanical Engineering Department the classes to which this regulation refers in the Session 1951-52 will be :—

(*i*) Evening Trade Classes in :

Fitting and Turning; Garage Practice; Metal Plate Work; Brassfinishing; Patternmaking; Boilermaking; Smithwork; Art Iron Work; Oxy-Acetylene and Electric Welding; Foundry Work — Iron Moulding; Brass Moulding; Watchmaking.

(*ii*) Part-time Day Apprentice Workshop Classes in :

Fitting and turning; Garage Practice; Oxy-Acetylene and Electric Welding.

For admission to the trade classes as named, proof of actual employment in the several processes and operations of the trade will be certificates to that effect from the Masters' Associations and/or the official Trades Unions of the trade concerned.

DAY AND EVENING TECHNOLOGICAL COURSES

Only such students will be admitted as have attained a standard of general education that will enable them to follow all the subjects of the Course with profit. In the absence of satisfactory evidence on this point. intending students may be required to pass a qualifying examination as a condition of admission.

The above Regulations have been adopted by Resolution of the Vocational Education Committee for the City of Dublin and approved by the Minister for Education.

FEES

Course	Fees per Session £ s. d.
1. MECHANICAL ENGINEERING TECHNOLOGICAL	
DAY COURSES	2 0 0
2. PART-TIME DAY APPRENTICE COURSES :	
Mechanical Engineering—all trades ...	1 0 0
3. EVENING COURSES AND CLASSES :	
All Courses or Single Subjects	0 10 0
Additional Subjects	0 3 0

GENERAL DESCRIPTION OF THE ACTIVITIES OF THE MECHANICAL ENGINEERING DEPARTMENT

The work of the Department comprises both Day and Evening Courses and is carried out under two main sub-divisions :

(i) Mechanical Engineering Technology.

(ii) Mechanical Engineering Trades.

DAY SCHOOL ACTIVITIES

The Day School activities comprise :

(*a*) Whole-time Pre-Apprenticeship Courses. (See Day Junior Technical Course Prospectus.)

(*b*) Whole-time Apprentice Scholarship Courses.

(*c*) Part-time Apprentice Courses in :

Fitting and Turning; Motor Mechanics' Work.

(*d*) Technological Courses in Mechanical Engineering.

EVENING SCHOOL ACTIVITIES

The Evening School activities comprise :

(*a*) Technological Courses in :

Mechanical Engineering; Marine Engineering.

(*b*) Trade Courses in :

Fitting and Turning; Garage Practice; Metal Plate Work; Brassfinishing; Patternmaking; Boilermaking; Smithwork; Art Ironwork; Oxy-Acetylene and Electric Welding; Foundry Work; Watchmaking; Brass Moulding.

DESCRIPTION OF COURSES

TECHNOLOGICAL COURSES

(i.) Mechanical Engineering (Higher Technological) Day Course A.

This Course is designed to meet the requirements of the Syllabus of the Associate Membership Examination of the Institution of Mechanical Engineers.

Lectures are given on two days per week from 9.30 a.m. to 12.30 p.m., and from 2.0 p.m. to 5.0 p.m. In addition, the students attend at suitable evening school classes in those subjects in which they may require extra tuition. The lecture work is modelled directly on the requirements of the examination syllabuses and is supplemented by practical work in the mechanical and engine testing laboratories. Students must carry out all homework and drawing exercises which are set by the lecturers.

The Course is designed on a four-years' basis, and the subjects chosen from the Institution programme are as follows :

Section A : Mathematics.
Applied Mechanics.
Engineering Drawing.
Applied Heat.
Workshop Technology.

Section B : Theory of Machines and Machine Design.
Properties and Strength of Materials.
Applied Thermodynamics.

Section C : Industrial Administration.

Permission to sit for the examination must be obtained from the Council of the Institution following the sending in of Proposals for Election.

On passing the requisite examinations the students may be elected as Graduate Members, provided that they fulfil the following requirements of the Institution :

(1) That they are between the ages of 21 and 30 years; and

(2) That they satisfy the Council that they have received or are receiving such regular training as Mechanical Engineers as would, in due course, fit them for employment as Mechanical Engineers.

For enrolment in this Course, students must be at least 18 years of age and must possess such a standard of general education as would, in the opinion of the Principal, enable them to follow the instruction given.

The students must provide themselves with the specified text-books, note-books and drawing instruments.

(ii.) Mechanical Engineering Technological Day Course B.

Apprentices successful at the Department of Education elementary stage examinations in Mechanical Engineering and Mathematics at the end of the second year, Course 2, are promoted to this course and are prepared for the Intermediate and Advanced Stage Examinations of the Department of Education.

(iii.) The Evening Course in Mechanical Engineering Technology (Nos.13-18) is a 6-years' course designed for students in engineering employment who wish to qualify in the technological branches of their work. A good standard of general education is required on entrance. Apprentices to the engineering trades who enjoy full opportunity for learning all branches of their trade in the works and who have the required standard of general education, are advised to choose the technological in preference to the trade course.

The course prepares students for the Higher Technological Certificate Examinations in Mechanical Engineering of the Department of Education.

(iv) Heating, Ventilating and Air Conditioning. Course A

This Course is designed to meet the requirements of the Syllabus of the Associate Membership Examination of the Institution of Heating and Ventilating Engineers.

Lectures are given on two days per week, from 9.30 a.m. to 12.30 p.m. and from 2.0 p.m. to 5.0 p.m., for the Section A Examination. The students attend evening classes for the professional subjects of Section B Examination. The lecture work is modelled directly on the requirements of the Institution examination syllabuses and is supplemented by practical work in the laboratories. Students must carry out all homework and drawing exercises set by the lecturers.

Permission to sit for the examination must be obtained from the Council of the Institution.

For enrolment in this Course, students must be at least 18 years of age and must possess such a standard of general education as would, in the opinion of the Principal, enable them to follow the instruction given.

(v) Heating, Ventilating and Air Conditioning. Course B

This is a six-years evening Course which prepares students for the Associate Membership Examination of the Institution of Heatng and Ventilating Engineers.

(vi) The Evening Course in Marine Engineering (Nos. 13-16) is a 4-years' course designed for students who are employed in engineering works and who intend to go to sea as marine engineers. The course covers the syllabus of Part A of the Certificate of Competency Examination (2nd Class) of the Board of Trade, and examinations giving exemptoin therefrom (See p.33). Before going to sea, a student is required to have completed at least four years of approved apprenticeship, and it is a distinct advantage to have already passed Part A of the Examination. The Institute is recognised by the Board of Trade for exemption purposes and students who have attended courses satisfactorily will be entitled to claim partial exemption from the four years of approved apprenticeship specified. Further particulars may be obtained from the Head of the Department or by consulting the Board of Trade Regulations.

2. TRADE COURSES

These courses are designed for apprentices and young journeymen engaged in the several trades. Every facility is given to students who wish to enter for the Trade Certificate Examinations of the Department of Education or of the City and Guilds of London Institute, these examinations being conducted in the School at the close of the evening session.

EVENING COURSES leading to the Department of Education Examinations are provided in the following trades :

Fitters' and Turners' Work; Metalplate Work; Brass-finishing; Motor Car Engineering; Boilermaking.

Evening Courses are also provided in the following trades :

Patternmaking; Foundry Work; Smithwork and Art Ironwork; Oxy-acetylene and Electric Welding; Watchmaking; Brass Moulding.

Part-time Day Apprentice Courses. By agreement with certain employers, apprentices are allowed time off to attend this course on one day (6 hours) per week. It is a two-year course which aims at the attainment of the standard of the Elementary Technological Certificate of the Department of Education.

Part-time Day Courses: Fitters and Turners, and Motor Mechanics (Scheme A). By agreement with certain employers, apprentices are allowed time off to attend these courses on one day (6 hours) per week. The course aims at the attainment of the standard of the Junior and Senior Trade Certificates of the Department of Education.

Part-time Day Courses: Apprentice Motor Mechanics (Scheme B). By agreement with the Society of Irish Motor Traders, the apprentices of all city members of the Society are allowed off to attend this course on one half-day per week. The course is a five-year course which aims at the standard of attainment of the Junior and Senior Trade Certificates in Motor Car Engineering of the Department of Education.

3. PHYSICAL TRAINING

Evening Courses in Physical Training for men are provided.

EXAMINATIONS

The Courses are designed to prepare students for the following External Examinations :

1. Department of Education Examinations.

(*a*) *i.* Elementary, Intermediate and Advanced Technological Certificate Examinations in Mechanical Engineering.

ii. Higher Technological Certificate in Mechanical Engineering.

(*b*) Junior and Senior Trade Certificate Examinations in :

Fitters' Work; Turners' Work; Metal Plate Work; Brassfinishing; Motor Car Engineering; Boilermakers' Work.

2. Examinations of Professional Institutes.

The Institution of Mechanical Engineers.

The Institute of Marine Engineers.

The Institution of Civil Engineers of Ireland.

The Institution of Heating and Ventilating Engineers.

3. Board of Trade Examination for the Certification of Marine Engineers

4. City and Guilds of London Institute.

5. University of London.

Further particulars regarding the above Examinations may be obtained from the Head of the Department.

SCHOLARSHIPS AND PRIZES

Day Apprentice Scholarships, entitling the holders to free training for two years in the Whole-time Day Apprentice Scholarship Courses, together with a payment of twelve shillings per week during the first year and sixteen shillings per week during the second year of the Courses. On the conclusion of the Courses, students are accepted as third-year apprentices to the trades. The scholarships are awarded to candidates between the ages of 14 and 16 years who have passed a qualifying examination of Primary Leaving Certificate standard and who have been selected on the result of an interview by a board consisting of representatives of the School and of the Employers' and Operatives' Associations of the trades concerned. Examinations and interviews are generally conducted in the month of March.

The Dublin Mechanics' Institute Scholarships are provided for by the Dublin Mechanics' Institute Residuary Fund. One scholarship is awarded annually to apprentices between the ages of 16 and 19 years who have been in attendance at a Technical Course during the previous session and made a specified minimum attendance. The Scholarships are tenable for three years and are valued about £3 each per year.

The Department of Education offers the following medals and prizes annually in connection with their examinations :

(*a*) Technological Certificate Examinations. A prize of £1 in each subject of the Elementary and Intermediate Stages. A silver medal, a first prize of £2 and a second prize of £1 in each subject of the Advanced Stage.

(*b*) Trade Certificate Examinations. A prize of £1 in each of the practical and written examinations of the Junior Stage. A bronze medal and a prize of £2 in each of the practical, and a prize of £1 in each of the written, examinations of the Senior Stage.

The William Rooney Memorial Prizes are provided for by a trust fund, established in memory of William Rooney (Fear na Muinntir), the Irish poet and patriot. A sum of approximately £12 is available annually for awards to students who are apprentices to the Mechanical Engineering and Building trades. The award alternates in successive years between students of the Engineering and Building trade groups, but is not available to holders of scholarships in the Day Apprentice Courses. A competent knowledge of Irish is an essential requirement, in addition to regular attendance and proficiency.

The Union of Sheet Metalworkers' Prize, value £7 7s., is awarded annually to apprentices of the Sheet Metalwork Classes, mainly on the results of the Trade Certificate Examinations of the Department of Education.

EQUIPMENT

The equipment of the School can be briefly described under seven heads: (1) Laboratories, (2) Drawing Offices and Art Room. (3) Workshops. (4) Classrooms and Lecture Rooms, (5) Gymnasium, (6) Surveying and Levelling Equipment, (7) Models and Specimens, (8) Visual Aids.

Laboratories

The Laboratories, covering a floor area of 7,500 sq. feet, are five in number:

(*a*) Physics and Chemistry Laboratory with Preparation Rooms and Stores equipped with the usual apparatus required for general courses in Science.

(*b*) Applied Mechanics and Materials Testing Laboratory well equipped with apparatus for demonstrating the laws of statics and dynamics and with machines for testing engineering and building materials in compression, tension, shear, bending and torsion, and for measuring deflections and extensions under load. The equipment includes an Avery vertical single-lever testing machine capable of applying tension or compression up to 5 tons; a vertical-screw testing machine for deflection and cross-breaking tests; a torsion testing machine; a cement testing machine of the compound lever type; a beam testing apparatus; a Searle extensometer and several wire extensometers and compression and tension testing machines for springs; strut apparatus; Fletcher's trolley; experimental flywheels; gyroscope; balancing machine; whirling speed apparatus; fatigue testing machine; various apparatus for determining the moduli of elasticity, etc.

(*c*) Applied Heat Laboratory with equipment for experimental work on Heat and Heat Engines, including Jünker and Bomb Calorimeters; flashpoint and viscosity apparatus;

Orsat apparatus; pyrometer (Whipple's Heat Recorder); equipment for the study of the gas laws (including temperature-pressure apparatus for high pressures); steam pressure gauges; Peugeot Engine and the Davidson apparatus demonstrating the principles of domestic hot-water installations, etc. Several engine and boiler models including the principal steam engine valve mechanisms, etc.

(*d*) An Electricity Laboratory fitted with equipment for experimental work on magnetism, static electricity and D.C., including M.C. Ammeters; Voltmeters; Galvanometers; Metre Bridges; P.O. Box; 1½ K.W. Canning Motor Generator Set feeding through bus-bars to work benches. Special equipment for use in connection with courses in Automobile Electricity include Newton Test Bench for 6 V. and 12 V. Automobile equipment; Davenset; two-circuit metal Rectifier Battery Charger (2V-60V., 3A. and 10A outputs). Varied selection of motors, dynamos and associated electrical apparatus.

(*e*) An Engine Testing Laboratory fully equipped for Experimental work on Petrol, Oil, Gas and Steam Engines.

The plant includes:

A 4-cylinder Wolseley petrol engine fitted with Hopkinson Indicator for photographing the indicator diagrams; a water-cooled Prony brake; calorimeters for measuring heat loss in jacket water and exhaust gases and measuring tank for finding petrol consumption.

A 50 B.H.P. Diesel oil engine by Mirrlees, Bickerton and Day fitted with motor-driven compressor; Froude dynamometer; indicator; Orsat apparatus; etc., for engine and heat balance tests.

A 28 B.H.P. gas engine by Crossley Bros. fitted with the usual apparatus for making B.H.P. and I.H.P. tests, etc.

Three experimental steam engines with apparatus for making B.H.P. and I.H.P. tests.

Experimental apparatus for the study of the properties of steam, including throttling calorimeter; injectors; steam traps; apparatus for illustrating relative conductivity of lagging materials, etc.

Note:—Senior Students specialising in advanced experimental work must obtain permission of the Head of the Department before proceeding with engineering investigations.

Drawing Offices and Art Room

There are six well equipped and well lighted Drawing Offices and an Art Room covering in the aggregate a floor area of 7,000 sq. ft. The Art Room is provided with a good selection of models and plaster casts, while the Drawing Offices are stocked with a large number of engineering models for machine construction and design purposes.

Workshops

Trade workshops, having an aggregate floor area of over 30,000 sq. ft., are individually equipped for each of the trades covered by the activities of the Institute.

The Fitting and Turning Workshops are well provided with modern machine tools, including: fourteen power driven screw-cutting surfacing lathes, seven drilling machines, one vertical and one horizontal universal milling machine, a 3-ft. planer, two shaping machines, a universal grinding machine, a power saw and grinders for twist drills and lathe tools. There are five smiths hearths.

The Garage is equipped with the usual small tools for repairing British and American cars and with an hydraulic hoist; portable electric drilling machine; hydraulic press; boring bars for big-end and main bearings and for cylinder reconditioning; connecting rod

and steering aligning tools; battery-charging equipment; stenor tyre vulcanizer; air meter for tyre inflation; Stromberg engine test apparatus and Weston electrical fault-finding instruments.

Other fully equipped workshops are provided in the Mechanical Engineering Department as follows :

Boilermaking; Foundry; Patternmaking; Metal-plate Work; Oxy-acetylene and Electric Welding; Smithwork and Art Ironwork; Watchmaking.

Classrooms and Lecture Rooms

There are a number of well-lighted classrooms equipped on modern lines and covering in the aggregate a floor area of over 6.000 sq. ft., and a Cinema Theatre with seating for 200 students.

Gymnasium

A large Gymnasium covering a floor area of 2,200 sq. ft. is provided for Physical Training.

Surveying and Levelling Equipment for class work and field work includes 100-ft. and Gunter's chains and accessories; two improved Dumpy levels and one Crooke Throughton level; theodolite; levelling staffs; plane-table clinometer; prismatic compass; planimeter; the usual scales, computing scales, proportional dividers, protractors, etc.

Models and Specimens

A large collection of Mechanical Engineering models has been acquired and is constantly being added to. These include : models of machine tool parts; sectioned models of engine parts and of all common types of valve gears; structural engineering details; boilers and mountings; engine cylinders; hydraulic details, etc.

Visual Aids

The following visua aids are provided :—
35 mm. silent film projector; 16 mm. sound film projector; film strip projector; slide projectors and epidiascope.

Day Courses

MECHANICAL ENGINEERING TECHNOLOGICAL COURSE A

FIRST YEAR

Course No.	Day	Time	Subject	Teacher	Room	Syllabus No.
1	Tuesday ...	9.30–11.00	Mathematics	——	B 10	3
		11.00–12.30	Applied Mechanics	——	B 10	9
		2.00–3.30	Applied Heat	——	A 11	15
		3.30–5.00	Applied Heat ...	——	A 11	15
	Thursday	9.30–11.00	Workshop Technology ...	Mr. Gribben	B 11	—
		11.00–12.30	Engineering Drawing ...	Mr. Gribben	B 11	21
		2.00–3.30	Mathematics	——	B 10	3
		3.30–5.00	Applied Mechanics	——	A 5	9

SECOND YEAR

2	Monday ..	9.30–11.00	Workshop Theory	Mr. Gribben	B 11	36A
		11.00–12.30	Engineering Drawing ...	Mr. Gribben	B 11	21A
		2.00–3.30	Applied Mechanics ...	Mr. Latchford	A 5	10A
		3.30–5.00	Applied Mechanics	Mr. Latchford	A 5	10A
	Wednesday	9.30–11.00	Applied Heat	Mr. Latchford	A 11	16A
		11.00–12.30	Applied Heat	Mr. Latchford	A 11	16A
		2.00–3.30	Mathematics	Mr. Latchford	B 10	4A
		3.30–5.00	Mathematics	Mr. Latchford	B 10	4A

THIRD YEAR.

3	Monday ...	9.30–11.00	Heat Engines	Mr. Latchford	B.10	18A
		11.00–12.30	Heat Engines	Mr. Latchford	B.10	18A
		2.00– 3.30	Heat Engines Laboratory ...	Mr. Latchford	A.11	—
		3.30– 5.00	Heat Engines Laboratory ...	Mr. Latchford	A.11	—
	Wednesday	9.30–11.00	Applied Mechanics	Mr. Barry	B.10	12A
		11.00–12.30	Applied Mechanics	Mr. Barry	B.10	12C
		2.00– 3.30	Mechanical Engineering ...	Mr. Barry	A.5	6
		3.30– 5.00	Mechanical Engineering ...	Mr. Barry	A.5	23

FOURTH YEAR.

4	Tuesday ...	9.30–11.00	Applied Mechanics	Mr. Barry	A.5	12D
		11.00–12.30	Applied Mechanics	Mr. Barry	A.5	12B
		2.00– 3.30	Mechanical Engineering ...	Mr. Barry	A.5	6A
		3.30– 5.00	Mechanical Engineering ...	Mr. Barry	A.5	24
	Thursday	9.30–11.00	Applied Mechanics	Mr. Barry	B.10	12D
		11.00–12.30	Applied Mechanics	Mr. Barry	B.10	12B
		2.00– 3.30	Heat Engines	Mr. Latchford	A.11	18B
		3.30– 5.00	Heat Engines	Mr. Latchford	A.11	18B

Note:—Applied Mechanics includes: Strength and Properties of Materials, Theory of Machines.

Mechanical Engineering includes: Mathematics, Machine Design, Laboratory work and lectures on General Mechanical Engineering.

HEATING, VENTILATING and AIR CONDITIONING — COURSE A

PART I—FIRST YEAR.

Course No.	Day	Time	Subject	Teacher	Room	Syllabus No.
5	Tuesday ...	9.30–11.00	Mathematics	Mr. Latchford	B.10	3
		11.00–12.30	Applied Mechanics	Mr. Rossiter	B.10	9
		2.00– 3.30	Applied Heat	Mr. Latchford	A.11	15
		3.30–5.00	Applied Heat	Mr. Latchford	A.11	15
	Thursday	9.30–11.00	Workshop Technology ...	Mr. Gribben	B.11	—
		11.00–12.30	Engineering Drawing ...	Mr. Gribben	B.11	21
		2.00– 3.30	Mathematics	Mr. Latchford	B.10	3
		3.30– 5.00	Applied Mechanics	Mr. Rossiter	A.5	9

PART I—SECOND YEAR

Course No.	Day	Time	Subject	Teacher	Room	Syllabus No.
6	Monday ...	9.30–11.00	Workshop Theory	Mr. Gribben	B.11	36A
		11.00–12.30	Engineering Drawing ...	Mr. Gribben	B.11	21A
		2.00– 3.30	Applied Mechanics	Mr. Latchford	A.5	10
		3.30–5.00	Applied Mechanics	Mr. Latchford	A.5	10
	Wednesday	9.30–11.00	Applied Heat	Mr. Latchford	A.11	16
		11.00–12.30	Applied Heat	Mr. Latchford	A.11	16
		2.00– 3.30	Mathematics	Mr. Latchford	B.10	4
		3.30– 5.00	Mathematics	Mr. Latchford	B.10	4

PART II—THIRD AND FOURTH YEARS

Course No.	Day	Time	Subject	Teacher	Room	Syllabus No.
17A	——	7.30–9.30	Heating and Hot Water Service	——	—	80
18A	——	7.30–9.30	Ventilation and Air Conditioning	——	—	79
19A	——	7.30–9.30	Mechanics of Fluids... ...	——	—	81
20A	——	7.30–9.30	Boiler House Work ...	——	—	82

ENGINEERING APPRENTICES COURSE

FIRST YEAR—GROUPS A AND B

Course No.	Day	Time	Subject	Teacher	Room	Syllabus No.
7	Friday ...	9.30–11.00	Mathematics 1 A	Mr. Rossiter ...	A 5	1
			Heat 1 B	Mr. Nunan ...	A 11	19
		11.00–12.30	Heat 1 A	Mr. Nunan ...	A 11	13
			Mathematics 1 B	Mr. Rossiter ...	A 5	1
		2.00–3.30	Mechanics 1 A	Mr. Rossiter ...	A 5	7
			M/c. Drawing 1 B ...	Mr. Gribben ...	B 11	19
		3.30–5.00	M/c. Drawing 1 A... ...	Mr. Gribben ...	B 11	19
			Mechanics 1 B	Mr. Rossiter ...	A 5	7

SECOND YEAR—GROUPS A AND B

Course No.	Day	Time	Subject	Teacher	Room	Syllabus No.
8	Wednesday	9.30–11.00	Mechanics 2 A	Mr. Rossiter ...	A 5	8
			Machine Drawing 2 B ...	Mr. Gribben ...	B 11	20
		11.00–12.30	Machine Drawing 2 A ...	Mr. Gribben ...	B 11	20
			Mechanics 2 B	Mr. Rossiter ...	A 5	8
		2.00–3.30	Mathematics 2 A ...	Mr. Rossiter ...	A 8	2
			Heat 2 B	Mr. Nunan ...	A 11	14
		3.30–5.00	Heat 2 A	Mr. Nunan ...	A 11	14
			Mathematics 2 B ...	Mr. O. Tuama ...	A 8	2

FITTERS AND TURNERS

THIRD YEAR

Course No.	Day	Time	Subject	Teacher	Room	Syllabus No.
9	Thursday	9.30–11.00	Fitting and Turning ...	Mr. Hunt	D 7	44 A
		11.00–12.30	Fitting and Turning ...	Mr. Hunt	D 7	
		2.00–3.30	Fitting and Turning ...	Mr. Hunt	D 7	
		3.30–5.00	Fitting and Turning ...	Mr Hunt	D 7	

FOURTH YEAR

Course No.	Day	Time	Subject	Teacher	Room	Syllabus No.
10	Monday ...	9.30–11.00	Fitting and Turning ...	Mr. Hunt	D 7	45 A
		11.00–12.30	Fitting and Turning ...	Mr. Hunt	D 7	
		2.00–3.30	Fitting and Turning ...	Mr. Hunt	D 7	
		3.30–5.00	Fitting and Turning ...	Mr. Hunt	D 7	

FIFTH YEAR

Course No.	Day	Time	Subject	Teacher	Room	Syllabus No.
11	Tuesday ...	9.30–11.00	Fitting and Turning	Mr. Hunt	D.7	46A
		11.00–12.30	Fitting and Turning	Mr. Hunt	D.7	
		2.00– 3.30	Fitting and Turning	Mr. Hunt	D.7	
		3.30– 5.00	Fitting and Turning	Mr. Hunt	D.7	

PART-TIME DAY COURSE IN FITTING AND TURNING

Course No.	Day	Time	Subject	Teacher	Room
12	Friday ...	9.30–11.00	Fitting and Turning ...	Mr. Hunt	D 7
		11.00–12.30	Fitting and Turning ...	Mr. Hunt	D 7
		2.00–3.30	Fitting and Turning ...	Mr. Hunt	D 7
		3.30–5.00	Fitting and Turning ...	Mr. Hunt	D 7

MECHANICAL ENGINEERING TECHNOLOGICAL COURSE B

THIRD YEAR

Course No.	Day	Time	Subject	Teacher	Room	Syllabus No.
13	Tuesday ...	9.30–11.00	Mathematics	—	B.10	3
		11.00–12.30	Applied Mechanics	—	B.10	9
		2.00– 3.30	Heat and Heat Engines ...	—	A.11	15
		3.00– 5.00	Heat and Heat Engines ...	—	A.11	15
	Thursday	9.30–11.00	Machine Drawing and Construction ...	Mr. Gribben	B.11	21
		11.00–12.30	Machine Drawing and Construction ...	Mr. Gribben	B.11	21
		2.00– 3.30	Mathematics	—	B.10	3
		3.30– 5.00	Applied Mechanics	—	A.5	9

FOURTH YEAR

Course No.	Day	Time	Subject	Teacher	Room	Syllabus No.
14	Monday ...	9.30–11.00	M/c Construction and Design	Mr. Gribben	B.11	22
		11.00–12.30	M/c Construction and Design	Mr. Gribben	B.11	22
		2.00– 3.30	Applied Mechanics	—	A.5	10
		3.30– 5.00	Applied Mechanics	—	A.5	10
	Wednesday	9.30 11.00	Heat Engines	—	A.11	16
		11.00–12.30	Heat Engines	—	A.11	16
		2.00– 3.30	Mathematics	—	B.10	4
		3.30– 5.00	Mathematics	—	B.10	4

Evening Courses

TECHNOLOGICAL CERTIFICATE COURSES

ELEMENTARY STAGE

Class No.	Subject	Day	Hour	Room	Teacher	Syllabus No.
	FIRST YEAR:					
1	Machine Drawing	Wednesday	7.30–9.30	B 11	B. E. Fee R. Daly	19
2	Heat	Tuesday	7.30–9.30	A 11	M. Niall	13
3	Mechanics	Monday ...	7.30–9.30	A 5	E. P. Dunne	7
4	Mathematics	Friday ...	7.30–9.30	B 26	W. J. O'Doherty	1
	SECOND YEAR:					
5	Machine Drawing	Thursday	7.30–9.30	B 11	B. E. Fee J. Lawless	20
6	Heat	Friday ...	7.30–9.30	A 11	S. O Tuama	14
7	Mechanics	Tuesday ...	7.30–9.30	A 5	E. P. Dunne	8
8	Mathematics	Wednesday	7.30–9.30	B 26	W. J. O'Doherty	2

INTERMEDIATE STAGE

	THIRD YEAR:					
9	Machine Drawing and Construction	Tuesday ...	7.30–9.30	B 11	B. Fee, R. Daly	21
10	Heat and Heat Engines ...	Friday ...	7.30–9.30	A 8	S. Rossiter	15
11	Applied Mechanics	Thursday	7.30–9.30	A 5	E. P. Dunne	9
12	Mathematics	Monday ...	7.30–9.30	B 27	W. J. O'Doherty	3

ADVANCED STAGE

	FOURTH YEAR:					
13	Machine Construction and Design	Tuesday ...	7.30–9.30	B 10	J. C. Fitzpatrick	22
14	Heat Engines	Monday ...	7.30–9.30	A 11	S. Rossiter	16
15	Applied Mechanics	Friday ...	7.30–9.30	A 5	E. P. Dunne	10
16	Mathematics	Thursday	7.30–9.30	B 27		4

HIGHER TECHNOLOGICAL STAGE

	FIFTH YEAR:					
17	Machine Design	Monday ...	7.30–9.30	B 10	J. C. Fitzpatrick	23
18	Applied Thermodynamics ...	Thursday	7.30–9.30	A 11	G. Latchford	17
19	Strength of Materials	Wednesday	7.30–9.30	B 10	J. Boylan	11
20	Mathematics	Tuesday ...	7.30–9.30	B 27	G. Latchford	5
20B	Theory of Machines	Friday ...	7.30–9.30	C 1	——	
	SIXTH YEAR:					
21	Machine Design	Friday ...	7.30–9.30	B 10	J. C Fitzpatrick	24
22	Applied Thermodynamics ...	Wednesday	7.30–9.30	A 11	G. Latchford	18
23	Strength of Materials	Thursday	7.30–9.30	B 10	J. Boylan	12
20	Mathematics	Tuesday ..	7.30–9.30	B 27	G. Latchford	6
20C	Theory of Machines	Monday ...	7.30–9.30	B 29	——	

MARINE ENGINEERS' CERTIFICATE COURSE

(Part A)

Subject	Day	Hour	Room	Teacher	Syllabus No.
FIRST YEAR:					
Technological Course					
SECOND YEAR.					
Technological Course					
THIRD YEAR.					
Technological Course					
FOURTH YEAR.					
Technological Course					

Note: Students successful at the Department of Education Advanced Stage Examinations in Applied Mechanics and Heat Engines and the Inter. Stage Examination in Machine Drawing and Construction, Mechanical Engineering Course, are exempt from part A of the Certificate of Competency Examination (2nd Class) of the Board of Trade.

HEATING, VENTILATING and AIR CONDITIONING — COURSE B

FIRST YEAR

Class No.	Subject	Day	Hour	Room	Teacher	Syllabus No.
1	Machine Drawing	Wednesday	7.30–9.30	B.11	B. E. Fee	19
2	Heat	Tuesday ...	7.30–9.30	A.11	M. Niall	13
3	Mechanics	Monday ...	7.30–9.30	A.5	E. P. Dunne	7
4	Mathematics	Friday ...	7.30–9.30	B.26	W. J. O'Doherty	1

SECOND YEAR

5	Machine Drawing	Thursday	7.30–9.30	B.11	B. E. Fee	20
6	Heat	Friday ...	7.30–9.30	A.11	S. O'Tuama	14
7	Mechanics	Tuesday ...	7.30–9.30	A.5	E. P. Dunne	8
8	Mathematics	Wednesday	7.30–9.30	B.26	W. J. O'Doherty	2

THIRD YEAR

9	Machine Draw. and Construction	Tuesday ...	7.30–9.30	B.11	B. Fee	21
10	Heat and Heat Engines	Friday ...	7.30–9.30	A.8	S. Rossiter	15
11	Applied Mechanics	Thursday	7.30–9.30	A.5	E. P. Dunne	9
12	Mathematics	Monday ...	7.30–9.30	B.27	W. J. O'Doherty	3

Fourth Year

Class No.	Subject	Day	Hour	Room	Teacher	Syllabus No.
13	Machine Construction and Design	Tuesday ...	7.30–9.30	B.10	J. C. Fitzpatrick	22
14	Heat Engines	Monday ...	7.30–9.30	A.11	S. Rossiter	10
15	Applied Mechanics	Friday ...	7.30–9.30	A.5	E. P. Dunne	10
16	Mathematics	Thursday	7.30–9.30	B.27	——	4

FIFTH AND SIXTH YEARS

17.A	Heating and Hot Water Service ...	——	7.30–9.30	—	——	80
18.A	Ventilation and Air Conditioning	——	7.30–9.30	—	——	79
19.A	Mechanics of Fluids	——	7.30–9.30	—	——	81
20.A	Boiler House Practice	——	7.30–9.30	—	——	82

TRADE CERTIFICATE COURSES

(Trade Apprentices and Mechanics)

FITTERS' WORK AND TURNERS' WORK

JUNIOR STAGE

Class No.	Subject	Day	Hour	Room	Teacher	Syllabus No.
	FIRST YEAR:					
25	Fitting and Turning ... 1 A	Thursday	7.30–9.30	D 5	W. De Renzy	43
26	Workshop Theory and ... 1 A	Monday ...	8.35–9.35	C 21	J. Gribben	33
27	Workshop Calculations ... 1 A	Monday ...	7.30–8.30	C 22	J. J. Hughes	37
28	Mechanical Drawing ... 1 A	Wednesday	7.30–9.30	B 13	J. C. Slater, J. Roche	39
29	Fitting and Turning ... 1 B	Wednesday	7.30–9.30	D 5	W. De Renzy	43
30	Workshop Theory and ... 1 B	Monday ...	7.30–8.30	C 21	J. Gribben	33
31	Workshop Calculations ... 1 B	Monday ...	8.35–9.35	C 22	J. J. Hughes	37
32	Mechanical Drawing ... 1 B	Friday ...	7.30–9.30	B 13	J. C. Slater, J. Roche	39
33	Fitting and Turning ... 1 C	Tuesday ...	7.30–9.30	D 5	R. Tynan	43
34	Workshop Theory and ... 1 C	Thursday	8.35–9.35	C 21	J. Gribben	33
35	Workshop Calculations ... 1 C	Thursday	7.30–8.30	C 22	J. J. Hughes	37
32	Mechanical Drawing ... 1 C	Friday ...	7.30–9.30	B 13	J. C. Slater, J. Roche	39
36	Fitting and Turning ... 1 D	Monday ...	7.30–9.30	D 5	R. Tynan	43
37	Workshop Theory and ... 1 D	Thursday	7.30–8.30	C 21	J. Gribben	33
38	Workshop Calculations ... 1 D	Thursday	8.35–9.35	C 22	J. J. Hughes	37
28	Mechanical Drawing ... 1 D	Wednesday	7.30–9.30	B 13	J. C. Slater, J. Roche	39
	SECOND YEAR:					
39	Fitting and Turning ... 2 A	Tuesday ...	7.30–9.30	D 7	G. Aungier, W. De Renzy	44
40	Workshop Theory and ... 2 A	Wednesday	7.30–8.30	C 21	J. Gribben	34
41	Workshop Calculations ... 2 A	Wednesday	8.35–9.35	C 22	J. J. Hughes	37
42	Mechanical Drawing ... 2 A	Friday ...	7.30–9.30	B 11	B. E. Fee, J. Lawless	40
43	Fitting and Turning ... 2 B	Monday ...	7.30–9.30	D 7	G. Aungier, W. De Renzy	44
44	Workshop Theory and ... 2 B	Wednesday	8.35–9.35	C 21	J. Gribben	34
45	Workshop Calculations ... 2 B	Wednesday	7.30–8.30	C 22	J. J. Hughes	37
46	Mechanical Drawing ... 2 B	Thursday...	7.30–9.30	B 13	J. C. Slater	40
47	Fitting and Turning ... 2 C	Thursday...	7.30–9.30	D 7	G. Aungier, R. Tynan	44
44	Workshop Theory and ... 2 C	Wednesday	8.35–9.35	C 21	J. Gribben	34
45	Workshop Calculations ... 2 C	Wednesday	7.30–8.30	C 22	J. J. Hughes	37
42	Mechanical Drawing ... 2 C	Friday ...	7.30–9.30	B 11	B. E. Fee, J. Lawless	40

SENIOR STAGE

Class No.	Subject	Day	Hour	Room	Teacher	Syllabus No
	THIRD YEAR:					
48	Fitting and Turning	Wednesday	7.30–9.30	D 7	G. Aungier, R. Tynan	45
49	Workshop Theory ... ... and	Tuesday ...	7.30–8 30	C 21	S. Rossiter	35
50	Workshop Calculations	Tuesday ...	8.35–9.35	C 22	J. J. Hughes	38
51	Machine Drawing	Monday ...	7.30–9.30	B 11	J. C. Slater J. Roche	41
	FOURTH YEAR:					
52	Fitting and Turning	Friday ...	7.30–9.30	D 7	G. Aungier, R. Tynan	46
53	Workshop Theory ... ... and	Tuesday ...	8.35–9.35	C 21	S. Rossiter	36
54	Workshop Calculations	Tuesday ...	7.30–8.30	C 22	J. J. Hughes	38
51	Machine Drawing	Monday ...	7.30–9.30	B 11	J. C. Slater J Roche	42
	FIFTH YEAR				G. Aungier,	
52	Fitting and Turning	Friday ...	7.30–9.30	D.7.	R. Tynan	46
122	Mechanical Engineering: Theory and Drawing ...	Monday ...	7.30–9.30	C.2.	J. Boylan	78

PATTERNMAKING

	FIRST YEAR:					
55, 55a	Patternmaking	Tues., Fri.	7.30–9.30	B 22	E. J. Kennedy	47
56	Workshop Drawing	Wednesday	7.30–9.30	B 23	E. J Kennedy	39
	SECOND YEAR:					
55, 55a	Patternmaking	Tues., Fri.	7.30–9.30	B 22	E. J. Kennedy	48
56	Workshop Drawing	Wednesday	7.30–9.30	B 23	E. J. Kennedy	40
	THIRD YEAR:					
55, 55a	Patternmaking	Tues., Fri.	7.30–9.30	B 22	E. J. Kennedy	49
56	Workshop Drawing	Wednesday	7.30–9.30	B 23	E. J. Kennedy	41

FOUNDRY WORK

	IRONMOULDING					
57	Ironmoulding—Practical ...	Wednesday	7.30–9.30	D 4	T. C. Smith	50
58	Foundry Work—Theory ...	Thursday	7.30–9.30	D 4	T. C. Smith	50
32	Mechanical Drawing	Friday ...	7.30–9.30	B 13	J. C. Slater J. Roche	39
	BRASSMOULDING					
59	Brassmoulding—Practical ..	Monday ..	7.30–9.30	D 4	C. Maples	50
60	Brassmoulding—Theory	Tuesday ..	7.30–9.30	D 4	C. Maples	50
32	Mechanical Drawing	Friday ..	7.30 9 30	B 13	J. C. Slater J. Roche	39

BRASS FINISHING

Class No.	Subject	Day	Hour	Room	Teacher	Syllabus No.
	FIRST YEAR:					
61	Brassfinishing—Practical... ...	Monday ...	7.30–9.30	C 10	M. O'Carroll	51
34	Workshop Theory ... ... and	Thursday	8.35–9.35	C 21	J. Gribben	33
35	Workshop Calculations	Thursday	7.30–8.30	C 22	J. J. Hughes	37
28	Mechanical Drawing	Wednesday	7.30–9.30	B 13	J. C. Slater J. Roche	29
	SECOND YEAR:					
62	Brassfinishing—Practical ...	Friday	7.30–9.30	C 10	M. O'Carroll	51
44	Workshop Theory ... ... and	Wednesday	8.35–9.35	C 21	J. Gribben	34
45	Workshop Calculations	Wednesday	7.30–8.30	C 22	J. J. Hughes	37
46	Mechanical Drawing	Thursday	7.30–9.30	B 13	J. C. Slater J. Roche	40
	THIRD YEAR:					
62	Brassfinishing—Practical ...	Friday	7.30–9.30	C 10	M. O'Carroll	51
49	Workshop Theory ... ... and	Tuesday ..	7.30–8.30	C 21	S. Rossiter	35
50	Workshop Calculations	Tuesday ..	8.35–9.35	C 22	J. J. Hughes	38
51	Machine Drawing	Monday ..	7.30–9.30	B 11	J. C. Slater J. Roche	41

Students are recommended to add a class in Free Drawing and Design.

BOILERMAKING

	FIRST YEAR					
64	Boilermaking, Lectures and Drawing I.	Wednesday	7.30–9.30	C 20	E. Bennett	52
65	Boilermaking, Practical I. ...	Tuesday ...	7.30–9.30	D 10	E. Bennett	53
	SECOND YEAR					
66	Boilermaking, Lectures and Drawing II.	Thursday	7.30–9.30	C 20	E. Bennett	52
67	Boilermaking, Practical II ...	Monday ...	7.30–9.30	D 10	E. Bennett	53

Students are recommended to add a suitable class in Mathematics.

SMITHWORK AND ART IRONWORK

68	Smithwork, Practical	Wednesday				
68a		and/or Friday	7.30–9.30	D 10	A. J. Ward	54
69	Art Ironwork, Practical ...	Thursday	7.30–9.30	D 10	A. J. Ward	55
32/28	Machine Drawing	Friday or Wednesday	7.30–9.30	B 13	J. C. Slater J. Roche	39

Students are recommended to add a class in Design.

METAL PLATE WORK

Class No.	Subject	Day	Hour	Room	Teacher	Syllabus No.
	FIRST YEAR:					
71	Metal Plate Work. Lectures and Drawing ... ... 1 A	Monday	7.30–9.30	C 5	J. Bryan	56
72	Metal Plate Work. Practical 1 A	Tuesday	7.30–9.30	D 2	A. O'Toole J. Bryan	57
73	Metal Plate Work. Lectures and Drawing ... ... 1 B	Tuesday	7.30–9.30	C 5	C. Devine	56
74	Metal Plate Work. Practical 1 B	Wednesday	7.30–9.30	D 2	A. O'Toole M. Kane	57
	SECOND YEAR:					
75	Metal Plate Work. Lectures and Drawing ... ... 2 A	Wednesday	7.30–9.30	C 5	J. Bryan	58
76	Metal Plate Work. Practical 2 A	Thursday	7.30–9.30	D 2	M .Kane C. Devine	59
77	Metal Plate Work. Lectures and Drawing ... ... 2 B	Thursday	7.30–9.30	C 5	A. O'Toole	58
78	Metal Plate Work. Practical 2 B	Friday	7.30–9.30	D 2	M. Kane C. Devine	59
	THIRD AND FOURTH YEARS:					
79	Metal Plate Work. Lectures and Drawing	Friday	7.30–9.30	C 5	A. O'Toole	58
80	Metal Plate Work. Practical	Monday	7.30–9.30	D 2	A. O'Toole M. Kane	59

OXY-ACETYLENE AND ELECTRIC WELDING

	FIRST YEAR:					
81	Oxy-Acetylene and Electric Welding ... ... 1 A	Friday	7.30–9.30	D 1	J. O'Toole P. Cowley	60 61
82	Oxy-Acetylene and Electric Welding ... ... 1 B	Thursday	7.30–9.30	D 1	J. O'Toole P. Cowley	60 61
	SECOND YEAR:					
83	Oxy-Acetylene and Electric Welding ... ... 2 A	Wednesday	7.30–9.30	D 1	J. O'Toole P. Cowley	60 61
84	Oxy-Acetylene and Electric Welding ... ... 2 B	Tuesday	7.30–9.30	D 1	J. O'Toole P. Cowley	60 61
	THIRD AND FOURTH YEARS:					
85	Oxy-Acetylene and Electric Welding	Monday	7.30–9.30	D 1	J. O'Toole P. Cowley	60 61

WATCH AND CLOCK MAKING

Class No.	Subject	Day	Hour	Room	Teacher	Syllabus No.
86	Watch and Clock Making—Theory and Practical	Thursday	7.30–9.30	C 6	F. O'Kelly	75

PHYSICAL TRAINING (Men)

87	Physical Training Div. I ...	Monday ...	7.30–9.30	C 9	M. C. Doogan
88	Physical Training Div. II ...	Tuesday ...	7.30–9.30	C 9	M. C. Doogan
89	Physical Training Div. III ...	Wednesday	7.30–9.30	C 9	M. C. Doogan

APPRENTICE MOTOR MECHANICS EVENING COURSES

Class No.	Subject	Day	Hour	Room	Teacher	Syllabus No.
	FIRST YEAR:					
90	Garage Practice ... ... 1 A	Monday ...	7.30–9.30	C 15	J. Fox	62
91	Workshop Practice ... 1 A	Tuesday ...	7.30–9.30	C 10	——	66
92	Motor Engineering (Lecture) 1 A	Friday ...	7.30–8.30	B 15	N. Brocks	70
93	Electricity ... ... 1 A	Friday ...	8.30–9.30	A 6	——	29
94	Garage Practice ... ... 1 B	Tuesday ...	7.30–9.30	C 15	M. Cully	62
95	Workshop Practice ... 1 B	Wednesday	7.30–9.30	C 10	——	—
92	Motor Engineering (Lecture) 1 A	Friday ...	7.30–8.30	B 15	N. Brooks	70
93	Electricity ... ... 1 A	Friday ...	8.30–9.30	A 6	——	29
96	Garage Practice ... ... 1 C	Wednesday	7.30–9.30	C 15	J. Fox	62
97	Workshop Practice ... 1 C	Thursday	7.30–9.30	C 10	——	66
98	Motor Engineering (Lecture) 1 B	Friday ...	8.30–9.30	B 15	N. Brooks	70
99	Electricity ... ... 1 B	Friday ...	7.30–8.30	A 6	——	29
	SECOND YEAR:					
100	Garage Practice ... ... 2 A	Thursday	7.30–9.30	C 15	P. Keogh	63
101	Workshop Practice ... 2 A	Friday ...	7.30–9.30	D 8	——	67
102	Motor Engineering (Lecture) 2 A	Monday ...	7.30–8.30	B 15	N. Brooks	71
103	Electricity ... ... 2 A	Monday ...	8.30–9.30	A 6	S. H. Knight	30
104	Garage Practice ... ... 2 B	Friday ...	7.30–9.30	C 15	M. Cully	63
105	Workshop Practice ... 2 B	Thursday	7.30–9.30	D 8	G. Aungier,	67
106	Motor Engineering (Lecture) 2 B	Monday ...	8.30–9.30	B 15	N. Brooks	71
107	Electricity ... ... 2 B	Monday ...	7.30–8.30	A 6	S. H. Knight	30
	THIRD YEAR:					
108	Garage Practice 3	Wednesday	7.30–9.30	D 8	R. J. Dowling	64
109	Workshop Practice ... 3	Friday ...	7.30–9.30	D 5	W. De Renzy	68
110	Motor Engineering (Lecture) 3	Tuesday ...	7.30–9.30	B 15	S. Guirke	72
111	Automobile Electricity 3	Thursday	7.30–9.30	A 6	S. H. Knight	30a
	FOURTH YEAR:					
112	Garage Practice 4	Monday ...	7.30–9.30	D 8	R. J. Dowling	65
52	Workshop Practice ... 4	Friday ...	7.30–9.30	D 7	G. Aungier,	69
114	Motor Engineering (Lecture) 4	Wednesday	7.30–9.30	B 15	S. Guirke	73
111A	Automobile Electricity ... 4	Tuesday ...	7.30–9.30	A 6	S. H. Knight	30b
	FIFTH YEAR.					
115	Garage Practice 5	Tueaday ...	7.30–9.30	D 8	R. J. Dowling	65
52	Workshop Practice ... 5	Friday ...	7.30–9.30	D 7	G. Aungier	69
116	Motor Engineering (Lecture) 5	Thursday	7.20–9.30	B15	S. Guirke	74

PART-TIME DAY AND EVENING COURSES

C.I.E. APPRENTICE MOTOR MECHANICS

Class No.	Subject	Day	Hour	Room	Teacher	Syllabus No.
	FIRST YEAR:					
	Garage Practice	Monday	2.00–3.30	C 15	S. Guirke	62
	Workshop Practice	Monday	3.30–5.00	D 8	— —	66
	Motor Engineering. Lecture	Monday	9.30–11.00	B 15	W. D. Pile	70
	Mechanics	Monday	11.00–12.30	B 15	W. D. Pile	7
117	Mathematics and Heat ...	Wednesday	7.30–9.30	A 6	S. O'Tuama	1 & 13
32	Mechanical Drawing	Friday	7.30–9.30	B 13	J. C. Slater J. Roche	39
	SECOND YEAR:					
	Garage Practice	Thursday	2.00–3.30	C 15	R. J. Dowling	63
	Workshop Practice	Thursday	3.30–5.00	D 8	——	66
	Motor Engineering. Lecture	Thursday	9.30–11.00	B 15	W. D. Pile	70
	Mechanics	Thursday	11.00–12.30	B 15	W. D. Pile	8
118	Mathematics and Heat ...	Tuesday	7.30–9.30	A 8	M. Niall	2 & 14
46	Mechanical Drawing	Thursday	7.30–9.30	B 13	J. C. Slater J. Roche	40
	THIRD YEAR:					
	Garage Practice	Friday	3.30–5.00	C 15	R. J. Dowling	64
	Workshop Practice ...	Friday	2.00–3.30	D 8	——	67
	Motor Engineering. Lecture	Friday	11.00–12.30	B 15	W. D. Pile	71
	Technical Drawing ...	Friday	9.30–11.00	B 15	W. D. Pile	77
119	Engineering Science ...	Wednesday	7.30–9.30	A 8	M. Niall	31
121	Machine Drawing ...	Tuesday	7.30–9.30	B 13	J. C. Slater J. Roche	40
	FOURTH YEAR:					
	Garage Practice	Thursday	9.30–11.00	C 15	R. J. Dowling	65
	Workshop Practice	Thursday	11.00–12.30	D 8	S. Guirke	67
	Motor Engineering. Lecture	Thursday	3.30–5.00	B 15	W. D. Pile	72
	Technical Drawing	Thursday	2.00–3.30	B 15	W. D. Pile	77
119	Engineering Science	Wednesday	7.30–9.30	A 8	M. Niall	32
121	Machine Drawing	Tuesday	7.30–9.30	B 13	J. C. Slater J. Roche	42
	FIFTH YEAR					
	Garage Practice	Tuesday	11.00–12.30	C 15	R. J. Dowling	65
	Workshop Practice	Tuesday	9.30–11.00	D 8	S. Guirke	67
	Motor Engineering. Lecture	Tuesday	3.30–5.00	B 15	W. D. Pile	73
	Technical Drawing	Tuesday	2.00–3.30	B 15	W. D. Pile	77
120	Engineering Science	Monday	7.30–9.30	A 8	M. Niall	32
121	Machine Drawing	Tuesday	7.30–9.30	B 13	J. C. Slater J. Roche	42
	Garage Practice	Wednesday	11.00–12.30	C 15	R. J. Dowling	65
	Workshop Practice	Wednesday	9.30–11.00	D 8	S Guirke	67
	Motor Engineering. Lecture	Wednesday	3.30–5.00	B 15	W. D. Pile	73
	Technical Drawing	Wednesday	2.00–3.30	B 15	W. D. Pile	77
120	Engineering Science	Monday	7.30–9.30	A 8	M. Niall	32
121	Machine Drawing	Tuesday	7.30–9.30	B 13	J. C. Slater J. Roche	42

PART-TIME DAY AND EVENING CLASSES

S.I.M.T. APPRENTICE MOTOR MECHANICS

Class No.	Subject	Day	Hour	Room	Teacher	Syllabus No.
	FIRST YEAR:					
	Garage Practice	Monday	3.30–5.00	C 15	S. Guirke	62
	Workshop Practice	Monday	2.00–3.30	D 8	——	66
	Motor Engineering. Lecture ...	Friday	8.30–9.30	B 15	N. Brooks	70
98	Electricity ... 1 B	Friday	7.30–8.30	A 6	——	29
99	Garage Practice	Friday	2.00–3.30	C 15	S Guirke	62
	Workshop Practice	Friday	3.30–5.00	D 8	——	66
	Motor Engineering. Lecture ...	Friday	8.30–9.30	B 15	N. Brooks	70
98	Electricity	Friday	7.30–8.30	A 6	——	29
	SECOND YEAR:					
	Garage Practice	Monday	11.00–12.30	C 15	S. Guirke	63
	Workshop Practice	Monday	9.30–11.00	D 8	——	66
102	Motor Engineering. Lecture ...	Monday	7.30–8.30	B 15	N. Brooks	71
103	Electricity	Monday	8.30–9.30	A 6	S. H. Knight	30
	Garage Practice	Friday	11.00–12.30	C 15	S. Guirke	63
	Workshop Practice	Friday	9.30–11.00	D 8	——	66
106	Motor Engineering. Lecture ...	Monday	8.30–9.30	B 15	N. Brooks	71
107	Electricity	Monday	7.30–8.30	A 6	S. H. Knight	30
	THIRD YEAR:					
	Garage Practice	Monday	9.30–11.00	C 15	R. J. Dowling	64
	Workshop Practice	Monday	11.00–12.30	D 8	——	67
110	Motor Engineering. Lecture ...	Tuesday	7.30–9.30	B 15	S. Guirke	72
111	Automobile Electricity ...	Thursday	7.30–9.30	A 6	S. H. Knight	30A
	Garage Practice	Friday	9.30–11.00	C 15	R. J. Dowling	64
	Workshop Practice	Friday	11.00–12.30	D 8	——	67
110	Motor Engineering. Lecture ...	Tuesday	7.30–9.30	B 15	S. Guirke	72
111	Automobile Electricity ...	Thursday	7.30–9.30	A 6	S. H. Knight	30A
	FOURTH YEAR:					
	Garage Practice	Wednesday	3.30–5.00	C 15	R. J. Dowling	65
	Workshop Practice	Wednesday	2.00–3.30	D 8	S. Guirke	67
114	Motor Engineering. Lecture ...	Wednesday	7.30–9.30	B 15	S. Guirke	72
111A	Automobile Electricity ...	Tuesday	7.30–9.30	A 6	S. H. Knight	30B
	Garage Practice	Thursday	3.30–5.00	C 15	R. J. Dowling	65
	Workshop Practice	Thursday	2.00–3.30	D 8	S. Guirke	67
114	Motor Engineering. Lecture ...	Wednesday	7.30–9.30	B 15	S. Guirke	72
111A	Automobile Electricity ...	Tuesday	7.30–9.30	A 6	S. H Knight	30B
	Garage Practice	Thursday	11.00–12.30	C 15	R. J. Dowling	65
	Workshop Practice	Thursday	9.30–11.00	D 8	——	67
114	Motor Engineering. Lecture ...	Wednesday	7.30 9.30	B 15	S. Guirke	72
111A	Automobile Electricity ...	Tuesday	7.30 9.30	A 6	S. H. Knight	30B
	FIFTH YEAR:					
	Garage Practice	Tuesday	9.30–11.00	C 15	R. J. Dowling	65
	Workshop Practice	Tuesday	11.00–12.30	D 8	S. Guirke	67
116	Motor Engineering. Lecture ...	Thursday	7.30–9.30	B 15	S. Guirke	74
	Garage Practice	Tuesday	3.30–5.00	C 15	R. J. Dowling	65
	Workshop Practice	Tuesday	2.00–3.30	D 8	S. Guirke	67
116	Motor Engineering Lecture ...	Thursday	7.30 9.30	B 15	S. Guirke	74
	Garage Practice	Wednesday	9.30–11.00	C 15	R. J. Dowling	65
	Workshop Practice	Wednesday	11.00–12.30	D 8	S. Guirke	67
116	Motor Engineering Lecture ...	Thursday	7.30–9.30	B 15	S. Guirke	74

Clárach Adhbar

Syllabuses of Subjects

1—MATHEMATICS I

Prime nos., prime factors. L.C.M. Vulgar fractions: add and sub., mult. and div. Decimals: add, sub., mult., and div.; approximations and limits of errors. Algebra: add and sub. evaluation. Mult. and div. Factors. Indices; logs.; characteristics. Mult. and div. by logs. Area: rect. and sq. problems. Vol. and surface area; prism and cube. Area: circle and ring. Vol. and surface area: cylinder. Log. calculations on above. Algebra: Simple equations. Formulæ and substitution in Ratio and Proportion. Unitary method and compound pro. Algebra: fractions. Area: figures from plotted points. Building up progressions. Simultaneous Equations. Mid-ordinate rule. Percentages and averages. Session Examination.

Bisections—lines and angles. Constructing angles equal to given angles. Isosceles and equilateral triangles. Study of circle. Plotting points; graphs. Simple graphs contd. Sum of angles of a triangle. Identical equality; triangles. Parallels and parallelogram. Area: triangles and parallelograms. Ratio as applied to lines. Ratio as applied to sides of right-angled triangle. Tan., sin. of an acute angle. Tan. and sin. as multipliers. Angles in a semicircle. Application; tan. and sin. Cos of an acute angle. Sq. on hypotenuse and applications. Solution of right-angled triangles from above. Two sides of triangles compared with third External angle=sum of interior, etc. $(a+b)^2$ by diagram. $(a—b)^2$ by diagram. Height problems. Ratios and their reciprocals. Graph of sin $\theta°$ to 90°. Graph 2 cos. $\theta°$ to 90°.

2—MATHEMATICS II

Vulgar fractions; calculations; problems. Decimals; approximations; limits of error. Substitution in formulæ. Calculations based on "difference of two squares." Square root and application to diagonals. Mens. of solids based on rect. sq., trapezium. Problems on foregoing, using logs. Mens. of circle, hexagon, octagon. Vol.: cylinder and pipes. Graph of straight line. Graphical sol. of simultaneous equal. Quadratic equations: factors and completing square. Quadratic equations: formulæ and problems. Graph of quadratic, maximum, minimum. Volume: pyramid and cone problems. Logs.; powers and roots. Frustrums: cylinder and cone. Mens. of sphere.

Proportion; percentages; averages. Scaling and arrangement of axes for statistical graphs. Statistical graphs. Sums of arith. and geom. progressions. Inserting means. Problems on above. General revision.

Parallels and parallelograms. Angles of closed rect. figures Revision of trigonometrical ratios. Sq. on hypotenuse and ratios, 45°, 30°, 60°. Heights and distance problems based on 4 and 5. Isosceles triangle and application, *e.g.*, angles in circle and semi-circle. Identical equality; triangles. Revision of above. Solution of right-angled triangle. Angles of elevation and depression and problems on. Cyclic quadrilateral. Angles formed by tangent and chord. Radian measure. Equality in area: triangles and parallelograms. Graphs: sin. and cos. $\theta°$ to 360°. Sin. rule. Cos. rule. Solution of triangles by sin. and cos. rules. Problems involving above. Graph: tan. 0° to 360°. Products of segments of chords. Height and distance problems. Euclid, Book II, 5 and 6.

3—MATHEMATICS III

Mensuration; Cylinders; Pipes; Frustums, etc. Substitution in formulæ. Log. Solutions, *e.g.* $[1—0.2^5]$. Naperian Logarithms. Revision of Trigonometry. Sin. and Cosine Rules. Heights of towers; widths of rivers, etc. More difficult problems. Area of oblique sections. Graph of straight line revised. Graphical and algebraic solutions of simultaneous equations. Equation of straight line from experimental results. Quadratic equations. Theory and problems. Graphs of quadratic; Discriminant. Forms of graphs. Area under irregular Curves. Simpson's Rule, etc. Maximum and minimum. Algebraic and graphical treatment. Graphs of trigonometrical functions. Circular measure. Co-ordinate geometry of straight line. Forms of equation. Equation of tangent to circle. Geometry of the circle. Secants. Chord and tangent. Indices; Factors. Binomial Theorem. Approximations. Application. Trigonometry. Difficult problems. Arithmetical and Geometrical Series to n. terms. Compound Interest. Problems. Exponential functions. Introduction to Differential Calculus. Differentiation of simple algebraic functions. Rate of Increase: Problems. Differentiation. Gradient of tangent. Tracing of curves.

4—MATHEMATICS IV

Trigonometry. Graphs of sin. 2θ, etc. Projection: vector quantities, components of. Sin., cos. and tan. of $(A \pm B)$, 2A, etc. Simple identities of compound angles. Trig. equations. Functions: elements of limits. Revision of elementary differentiation. Differentiation of products and quotients. Differentiation of function of a function. Rates of increase. Velocity and acceleration problems. Successive differentiation. Maxima and minima. Tracing of curves: points of inflection. Differentiation of trigonometry and logarithmic functions. Indefinite integration: Standard forms. Definite integration; limits; areas. Areas and volumes of integration. Centroids and moments of inertia. Centres of pressure. Partial fractions. Revision of differentiation. Inverse functions. Curvature. Revision of series. Binomial theorem. Approximations. Graphical solution of equations, cubic, etc. Remainder theorem. Complex numbers. Argand diagram. Work leading to Demoivrés theorem.

4A—MATHEMATICS

Algebra—Indices, the exponential theorem, logarithms, arithmetical and geometrical series; the binomial theorem and its application to approximations; graphical representation of functions; graphical solution of equations; determination of law connecting variables.

Trigonometry—The solution of plane triangles; the representation of directed quantities by vectors; the summation of vector quantities; the functions of the sum and difference of two angles with derived formulae; simple trigonometrical equations.

Differentiation and Intergration—Differentiation of simple functions; differentiation of products and quotients of two functions and of a function of a function; applications to maxima and minima; expansion in a series, and curvature; intergrations of simple functions; graphical methods of integration; applications of the integral calculus to the evolution of plane areas, surfaces, volumes; moments of inertia; mean values, and root mean squares.

5, 6—MATHEMATICS V, VI

Differentiation: products and quotients. Differentiation: Function of a function. Differentiation: Logarithmic and exponential functions. General problems in differentiation; trig. functions. Rate of increase. Problems. Successive differentiation; Velocity; Acceleration, etc. Maximum and minimum; Problems. Tracing of curves: points of inflection. General revision; Application of previous work. Inverse functions. Indefinite integration; problems. Definite integration; limits. Areas and Volumes by integration. Volumes by integration continued. Centroids by integration. Revision: Moments of inertia by integration. Centres of pressure. Complex quantities. Differentiation of exponential and hyperbolic functions. Integration. Partial fractions. Integration by parts. Reduction formulæ. Introduction to differential equations. Separation of variables. Exact and homogeneous equations. Integrating factors. Problems. Particular and General solutions; Operator D. Problems. Use of D Operator. Vibration problems, etc. Maclaurins theorem.

6A—MATHEMATICS

Further partial differentiation; maxima and minima of functions of several independent variables, including method of least squares: change of independent variables. Elementary vectors, including scalar and vector products. Fourier series and numerical harmonic analysis. Line, surface, and volume integrals. Differential equations, including first and second order equations, integrable by quadratures; linear differential equations with constant co-efficients, equations reducible to these, and simultaneous linear equations with constant co-efficients; easy examples of solution by separation of variables. Functions of a complex variable, elementary ideas and simple examples of conformal transformation. Three-dimensional co-ordinate geometry of the straight line, plane, and the simpler curved surfaces; tangent planes and normals. Spherical trigonometry. Plane motion of a rigid body; work, energy, momentum and moment of momentum. Virtual work; stationary energy; stability of equilibrium. Mathematical problems associated with engineering subjects.

7—MECHANICS I

Measuring instruments, Force, Work, Horsepower, Brake Horsepower, Simple Moments, The Lever, Centre of Gravity, Introduction to Simple Machines, Dry friction, Engineering Materials; The ferrous group; The non-ferrous group. Elementary notions of Energy, The Parallelogram and Triangle of Forces, Introduction to testing of materials.

8—MECHANICS II

Mass, Force, Weight, Force and its effects, Work done by a variable force; Diagram of Work, The Indicator diagram, Indicated and Brake Horsepower, Mechanical Efficiency of an Engine. Energy, Joules' Equivalent, Principle of Moments, Conditions of Equilibrium, Bell crank levers, Centre of parallel forces, Centre of Gravity, Laws of Friction, Lubrication, Velocity Ratio, Mechanical Advantage and Efficiency of simple machines, Properties of Engineering materials, Elementary study of heat treatment, Stress, Strain, Young's Modulus. Force diagrams, Bows notation.

9—APPLIED MECHANICS III.

Fundamental units, Laws of gravitation, work done by inclined forces, Rolling Friction, Heat generated by Friction, Friction horsepower. Transmission of power by belts and gearing. Displacement, Velocity and acceleration. Laws of motion; Momentum and Impulse. Centrifugal force; simple balancing. Torque; Work done by torque. Conservation of Energy, mechanical, heat and electrical units of energy; Potential and Kinetic energy. Complete tests of Simple machines. Function of a flywheel. Simple Hydrostatics. Commercial testing of Engineering materials.

10—APPLIED MECHANICS IV

Relative Velocity, Velocity and acceleration diagrams. Instantaneous centre of rotation; Piston Velocity and crank effort diagrams, Rotational Inertia. The Flywheel. Governors. Balancing of rotating masses in more than one plane. Simple Harmonic Motion. Motion of loaded springs. Inertia of reciprocating parts. Tension; Compression; Shear. Steady, impulsive and alternating loads. Temperature

stresses. Resilience. Compound bars. Stresses in thin shells. Rivetted joints. Bending moment and shear force diagrams for concentrated and distributed loads. Theory of Bending. Theory of torsion; application to shafts and close coiled springs. Forces in framed structures. Streamline flow in pipes, Impact and reaction of jets.

10A—APPLIED MECHANICS

Statics—Forces acting on a rigid body; moments of forces; composition and resolution of forces; friction; achines; efficiency couples; conditions of equilibrium, with application to simple framed structures and beams; bending-moment and sheer-force diagrams.

Hydrostatics—Pressure at a point in a liquid; centre of pressure on an immersed plane area; equilibrium of floating bodies.

Kinematics (of Motion in a Plane)—Velocity and acceleration of a point; relative motion; acceleration of a point moving in a circular path with uniform speed; simple harmonic motion; velocity-ratio diagrams of simple mechanism; instantaneous centre.

Kinetics—Force, mass, impulse, momentum, work, energy, power; moment of momentum; moment of inertia; their relations and measurements; conservation of energy; conservation of linear momentum; rectilinear motion of a body under a force (constant or variable); equation of motion of a particle; motion of a body in a circular path with uniform speed; balancing of rotating masses; rotation and oscillation of a body about a fixed axis.

Hydraulics—Pressure and velocity charge along a streamline. Bernoulli's theorem; flow through an orifice.

Strength of Materials (Elementary)—Hook's law; Young's modulus; modulus of rigidity; analysis of stress; theory of simple bending; theory of torsion of round and hollow shafts.

11—STRENGTH OF MATERIALS V

Revision of Compound bars. Live loads. B.M. and S.F. diagrams. Beams and structures. Structures; Stress diagrams; Method of sections. Theory of bending; Application; Built-up joists, etc. Short

struts; Eccentric loading in one and two directions. Maximum and Minimum Stresses. Carriage springs, etc. Work done in bending. Revision of torsion. Solid and hollow shaft. Strength and stiffness. Work done in torsion. Close-coiled springs: axial loading. Close-coiled springs: axial couples. Flat springs. Oblique stresses; principal stresses in two dimensions. Maximum principle stresses; Maximum principle shear stresses. Combined bending and twisting. Thin cylinders and spheres. Thick cylinders α and $\chi\beta$ formulæ. Lamé formula. Problems on thick cylinders. Compound cylinders. Deflection of beams. Constant bending moment across beam. Deflection of beams. Simply-supported beam. Central load. Uniformly distributed load. Deflection of beams. Macaulay's method. Deflection of beams. Cantilever; end load and uniformly distributed load. Deflections (continued). Other simple cases. Load in props. Structures. More difficult problems. Stresses. Deflection of structures. Single load. Hydraulics. Revision of centre of pressure with applications. Problems. Bernoullis Theorem. Application. Venturi Meter. Problems. Pelton-wheel. Theory and problems. Reaction turbine. Pumps. Pipe lines.

12—STRENGTH OF MATERIALS VI

More difficult cases of principal stresses. Combined bending and twisting with end loads. Deflection of beams. Revision and further application. Several loads. General cases. Props. Encastré beams. Reactions and fixing moments. Deflections with symmetrical loading. Deflections. General cases. Props. Maximum bending; moment. Built-in beams. Theorem of three moments. Clapeyron's Theorem. Application of Clapeyron's Theorem. Distribution of Shear Stress. Formula. Rectangular and Circular sections. Beam sections. Open-coiled springs. Deflection and stresses due to axial loading. Struts; Euler and Rankine formulæ for central loads. Long Columns; Eccentric loading; Rankine formula, etc. Influence diagrams; rolling loads. Deflection of Structures (continued). General case. General work in Hydraulics. Specific speed, etc. Pumps. Reciprocating and Centrifugal. Revision of turbines. Friction in pipe lines. Cavitation. Turbines. Theory and practice.

12A—PROPERTIES AND STRENGTH OF MATERIALS

Stress and Strain—Stress and strain in tension, compression, and shear; Hooke's law; relations between elastic constants.

Combined stress in two dimensions. Circle diagram.

Compound bars in tension and compression; elementary consideration of stress due to temperature changes.

Riveted and welded joints.

Cylinders—(1) Thin cylindrical and spherical shells under internal pressure. (2) Stress in thick-walled cylinders under internal and external pressure. Force and shrink fits.

Beams—Direct and shear stresses in beams.

Slope and deflexion of cantilevers and freely supported and built-in beams for simple cases of loading.

Torsion.—Torsion of round bars. Transmission of power by shafts.

Combined Stresses.—Combined bending and direct stress, and combined bending and torsion.

Strain Energy—(1) Work done in elastic deformation. (2) Stresses due to suddenly applied loads.

Springs—Laminated springs and close-coiled helical springs.

Struts—Elementary theory of struts with use of empirical formulæ.

Properties of Materials—The mechanical properties of materials; composition and properties of the important metals used by engineers; effects of heat treatment, annealing and normalising; the effect of cold work on the properties of metals; elasticity, plasticity, ductility, tenacity, hardness, resistance to shock; resistance to repeated and alternating stress; effect of form and surface conditions; failure under combined stress; creep at high temperatures; considerations affecting the choice of the safe working stress in design.

Testing of Materials—Common types of machine and instruments for the investigation of mechanical properties. Forms of specimen; procedure in carrying out tests, and methods of expressing results.

12B—STRENGTH AND ELASTICITY OF MATERIALS

(*a*) Standard mechanical tests for strength, ductility, hardness, creep and resistance to impact and fatigue. Systems of complex stress. Principal stresses and principal planes. Principal strains. Relation between the elastic constants. Resilience in tension, bending and torsion. Theories of elastic failure. Effect of impact loads on ties and beams. Encastre beams. Distribution of shearing stresses in beams. The general theory of struts subjected to axial and parallel eccentric loads. Stresses and strains in thick cylinders subjected to fluid pressure. Compound cylinders. Flat spiral springs and leaf springs. Free longitudinal, transverse and torsional vibrations.

(*b*) More difficult questions on the work of (*a*) together with :— Deflections of beams due to shear. Theory of bending of curved bars with simple applications. Laterally loaded struts and ties. Wire wound cylinders. Open coiled helical springs. Stress analysis of rotating rings and discs. Stresses in the simple cases of thin plates subjected to normal loading.

(*c*) Elements of crystallography as applied to metallurgy. More detailed discussion of thermal equilibrium diagrams. Typical constitutional diagrams of the common non-ferrous engineering alloys. The iron-carbon diagram. Metallography (microstructure and macrostructure), heat treatment and uses of plain carbon and alloy steels. Cast irons including high-duty, special and malleable cast irons. Classification of heat-treatment and melting furnaces. Types of industrial pyrometers. Melting and casting of ferrous and non-ferrous metals and alloys. Production of steel ingots; ingot defects. Effects of elevated temperatures on metals and alloys. Corrosion of metals and methods of protection. Typical examples of deformation processes. Typical welding processes; examination of welds. Non-destructive testing of metals and alloys; radiological, magnetic and other methods.

12C—THEORY OF MACHINES

Kinematics—Location of rigid bodies. Pairings, kinematic, chains, mechanisms, inversion.

Methods of determining the relative velocities of parts in machines by calculation and by graphic methods. Simple cases of acceleration diagrams.

Cams : harmonic, constant-velocity, and constant-acceleration types.; displacement, velocity, and acceleration of follower.

Gears : theory of shape and action of teeth; simple, compound, and epicyclic trains. Worm gears.

Kinetics—Inertia forces; on elements of mechanisms, cam followers, etc.

Gearing : strength and durability of teeth. Use of British Standard Specification No. 435, 1940.

Engine turning moment diagrams; flywheels; governors.

Balancing; rotating parts; primary balancing of reciprocating parts, including locomotive balancing and secondary balancing of "in line" engines.

Vibrations : body with single degree of freedom; torsional oscillations of shafts with attached masses; transverse vibrations of beams; whirling of shafts; forces vibrations with viscous damping; use of vector diagram for determination of amplitude.

Gyroscope : theory and action.

Tractive effort and performance curves for vehicles.

Friction and Lubrication—"Dry" friction; friction circle, plate and cone clutches, screws and pivots.

Belt and rope drives.

Elementary qualitative treatment of boundary and film lubrication applied to journal and thrust bearings.

General characteristics of ball and roller bearings.

12D—THEORY OF MACHINES

Acceleration diagrams for mechanism. Acceleration of geared systems. Performance of vehicles. Steam engine valve gears. Inertia forces and balancing of reciprocating engines. Elementary kinematics of a body moving in three dimensions. Couplings between non-axial shafts. Helical, bevel, worm and screw gearing. Elements of gyroscopic theory. Applications of the elementary principles of rigid dynamics. The vibrations of mechanical systems including forced vibrations and the effects of viscous friction. The transverse vibrations of wires and beams. Whirling of shafts. Torsional vibrations. Approximate methods.

13—HEAT I

Sources of Heat: Sun, fuel, mechanical, chemical, electrical. *Heat Transmission*: Elementary, notions of conduction, convection and radiation. *Expansion*: Solids, liquids, and gases. Practical application of same. *Pressure in liquids*: Laws of. *Atmospheric Pressure*: Starting from weight of air to simple, Fortin and Aneroid barometers. *Applications of Atmospheric Pressure*: Weather forecasting, common pump. *Thermometry*: Air thermometer. Mercury thermometer. Effect of pressure on boiling point. Upper and lower fixed points. Scales. Fahrenheit v. Centigrade graph. Using the graph for conversion. Mathematical conversion. Special types of thermometer, such as the clinical, maximum and minimum. *Vaporisation*: Laws of. Cooling effect of evaporation. *Boiler temperature*: Temperature v. Pressure graph. *Effect of solution on b.p.t. Distillation* and its uses. *Freezing of water*: Maximum density. Effect of pressure on f. pt. *Further concept of heat*: Sensible heat. Introduction to latent heat. Heat of condensation. *Revision of Elementary ideas of heat transmission*: *Conductors and Insulators.* Applications, including lagging of steam pipes, Davy safety lamp. *Convection*: Ventilation. Heating Systems—hot air, hot water radiators, house warming system. Land and sea breezes. Constant winds, weather maps. Isobars and Isotherms. *Radiation*: Absorption, reflection and radiation. Radiators. Thermos flask. *Co-efficient of linear expansion*: Comparison of expansion of metals. Co-efficient of linear expansion. Mathematical work on same.

14—HEAT II

Revision of first year Course—more detailed treatment. *Co-efficient of expansion*: Comparison of linear expansion of metals. Co-efficient of linear expansion. Superficial and cubical expansion. *Temperature and Amount of Heat*: Difference between temperature and amount of heat, heat capacity. Units. *Water equivalent of Calorimeter. Specific heat* of metals. Water equivalent of tanks, boilers, pipes, etc. *Sensible and Latent Heat*: Latent heat of steam. *Melting and Freezing Points*: Cooling curve for paraffin wax. Latent heat for melting solids. Latent heat of fusion of ice. *Radiation*: Comparisons with light: absorption and radiation. Reflection. *Boyle's Law*: Using J-Tube and Boyle's Law Apparatus. *Charles' Law*: Co-efficient of expansion for air. Other gases. *Absolute temperature*: Volumes at S.T.P., using the gas laws. *Calorific value of Fuels, Joule's equivalent*: Heat energy and mechanical energy interchangeable. Work done by expanding gas.

15—HEAT ENGINES III

Boyle's and Charles's Laws. Combination of. Expansions and Compressions, PV=RT. Latent heat. Specific heat. Laws of expansions: Isothermal; Adiabatic; Polytropic. Joule's Law—specific heats of gases. Characteristic gas constant. Steam; sensible. Latent, and total heat, etc. Relation between saturation pressure, temperature and specific volume of a vapour. Dryness fraction. Steam tables. Descriptive treatment of steam engine. Valve diagrams —simple cases. H.P. and Mechanical Efficiency. Dalton's Law. Problems. Humidity. Wet and Dry bulb thermometers. Laws of thermodynamics. Steam boilers; vertical, etc. Fire-tube and water-tube boilers. Fittings; construction, etc. Internal combustion engines; four-stroke cycle. Petrol and gas engines details. Valves and valve timing. Elements of carburation. Two-stroke cycle of operations. Problems on H.P. Mechanical Efficiency. Thermal Efficiency. Oil and Diesel engines. Elementary treatment. Calorific value of fuels—Calorimeters. Elements of combustion. Hydrocarbons. Flue gas analysis. Orsat apparatus. Descriptive treatment of refrigeration plant. Air compressors, turbines, etc.

16—HEAT ENGINES IV

Steam Engine — Indicator Cards. Steam Engine Valve diagrams. Zeuner; Reuleaux; Bilgram Valve diagrams. Isothermal, adiabatic and polytropic operations. Work done during polytropic operations. Carnot cycle. Standard cycles. Air standard efficiency. Calculation of M.E.P. and cylinder dimensions for single cylinder steam engine. Cushioning of steam. Missing quantity, etc. Throttling process. Wire-drawing. Constant Volume cycle. Calculation of work done, etc. Cylinder dimensions of petrol engine, etc. Petrol engine details. Indicator Cards. Indicator Cards for Diesel engine. Fuel injection systems. Diesel engine details. Mechanical, thermal and relative efficiencies of I.C.E.s. Heat balance sheet for I.C.E. Combustion of liquid and solid fuels. Combustion of gaseous fuels. Calorimetry. Fuels. Flue gas analysis. Recorders. Simple heat balance sheet for steam plant. Boilers; condensers; etc. Descriptive treatment of Refrigerating Plant. Refrigerating Machines. Steam Turbine; Descriptive Treatment. Impulse and Reaction types.

16A—APPLIED HEAT

Thermometry—Measurement of temperature; pyrometry; platinum-resistance and gas thermometers; thermocouples, radiation pyrometers.

Transfer of Heat—Conduction, convection, radiation.

Calorimetry.—The first and second laws of thermodynamics; the gas laws of Charles, Boyle, Avogadro, Dalton, and Joule (internal energy); absolute temperature; the two specific heats; use of the gas constant R; internal and external energy; distinction between gases and vapours; phenomena of the critical state, total heat of wet, dry and superheated steam; dryness fraction of steam; use of steam tables, isothermal and adiabatic expansion and compression; heat added = increase of internal energy plus work done; application to constant volume, constant pressure, isothermal and adiabatic change; the P/V Diagrams for constant volume (Otto), constant-temperature (Carnot) and constant-pressure cycles; calculations of pressure, volume, and temperature throughout the cycles.

Heat Engines—The indicator card for the reciprocating engine; mean effective pressure; horsepower.

Combustion—Calorific value of fuels; higher and lower values; quantity of air required for combustion of carbon and hydrogen.

Properties of Matter—Viscosity of gases and liquids and its dependence on temperature, surface tension and its variation with temperature.

17—APPLIED THERMODYNAMICS V

Revision of work done during polytropic operations. Heat passing through cylinder walls. Heat balance sheet for internal combustion engines. Petrols. Thermal efficiency. Relative efficiency. Revision of constant Volume Cycle. Constant pressure and composite cycles. Thermal efficiencies. Various cycles. Stirling, etc. Diesel engine cycle. Ideal efficiency. Cylinder dimension for Diesel engine. Heat balance sheets. Air compressors. Isothermal efficiency. Introduction to entropy. Carnot cycle on $T-\Phi$ diagram, etc. Entropy chart for water and steam. Plotting points. Carnot and Rankine cycles using steam. Rankine cycle continued. Thermal efficiency for wet steam, dry saturated steam and superheated steam. Throttling process. Calorimeter. General work on steam. Complete engine test in laboratory. Analysis of engine test. Flue analysis. Combustion. Calorific values. Solid, liquid, and gaseous fuels. I.C.E. general theory. Timing diagrams. Combustion chamber. Tests, etc. Nozzles. Velocity of steam. Discharge. Simple turbine, vector, velocity diagrams. Total heat—entropy charts. Construction and uses.

18—APPLIED THERMODYNAMICS VI

Compound steam engine. Indicator cord, etc. Cylinder dimensions for compound steam engine. Problems. Equal work, etc. Valve gears continued. Steam Nozzles. Design. Problems. Maximum discharge. Steam turbine. Vector velocity diagrams. Velocity compounding; Pressure compounding, etc. Air compressors. Multi-stage. Intercooling. Completion of work on air compressors. Use of compressed air. Air motors, etc. Complete engine test in laboratory. Analysis of engine test. Further work on combustion. Combustion continued. Actual. Air-fuel ratios, etc. General work

on boilers. Heat balance sheet for boilers. General work on steam plant. Heat balance sheet for plant. General revision of work on steam plant. Condensers. Refrigeration. Types of refrigerators. Co-efficient of performance. Further work on refrigeration. General work on I.C.E. combustion process. Turbulence. Detonation, etc. Gas turbine.

18A—APPLIED THERMODYNAMICS

Thermodynamics—General therodynamics of gases and vapours. Internal and external energy, total heat and entropy. Energy charts for gases and vapours, including pressure-volume, pressure-total heat, temperature-entropy and total heat-entropy charts. Reversible and irreversible processes; throttling, isothermal, adiabatic and polytropic operations, and their representation on the energy diagrams. The Carnot cycle and the absolute scale of temperature.

Ideal Cycles for Vapour Engines—The Rankine cycle, including incomplete expansion and use of the steam jacket. The reheat cycle; the regenerative cycle by extraction of vapour during expansion; the binary vapour cycle. Representation of the cycles on energy diagrams and the calculation of their thermal efficiency.

Ideal Cycles for Internal Combustion Engines—The Ericsson, Stirling, constant volume and constant pressure cycles, including their modified forms; Diesel, Atkinson and dual combustion cycles. Representation of these cycles on energy diagrams and calculation of their thermal efficiency.

Elements of Heat Transfer, including: conduction through simple and composite walls; radiation to surfaces of simple geometrical shapes and between parallel planes; natural and forced convection.

Combustion—Properties of solid, liquid, and gaseous fuels; calorific value and its determination. The process of combustion. Calculation of air supply. Analysis of the gaseous products of combustion.

Air Compressors and Motors. Simple treatment of air compressors and motors; multistage compressor and inter-cooling; volumetric efficiency; rotary compression; isothermal and adiabatic efficiencies.

Refrigeration and Heat Pump Cycles—The Carnot and the Joule cycles reversed; the vapour compression and the vapour absorption cycles; representation on energy diagrams and calculation of co-efficients of performance.

Steam Plant—Description of and simple calculations on boilers (standard forms), economizers, superheaters, and air preheaters; condensers (simple form of jet and surface types) and extraction of air and condensate. The steam reciprocating engine; the action of steam in the cylinder. Compounding. Diagram factor and efficiency ratio. Simple principles of the flow of steam through nozzles and of the impulse and reaction turbines, including velocity diagrams.

Internal Combustion Engines—Internal combustion engines and turbines and their cycles of operation as modified by the properties of the working fluid.

18B—APPLIED THERMODYNAMICS

(*a*) Applied Thermodynamics

The properties of gases including variable specific heats, volumetric heats. The properties of vapours. Mixtures of gases and vapours. Entropy chart for steam and other vapours. Flow of gases and vapours through nozzles. Combustion. Effect of air-fuel ratio. Gas producers. Humidity of the atmosphere. Evaporative coolers. Air conditioning. Air compressors and motors. Volumetric efficiency. Multi-stage compression. Centrifugal and other rotary compressors. Air and vapour-compression refrigerators. Absorption machines. Choice of refrigerant. Heat transfer. Elementary knowledge of radiation, conduction and convection. Applications to tubes, plates and lagging.

(*b*) Steam Engines

Steam engine cycles. The Rankine cycle with incomplete expansion. Compounding. Regenerative, resuperheating and binary-vapour cycles. The operating conditions of steam power plant and their effect upon efficiency. Boiler plant, modern developments. Boiler testing and efficiency. Air supply and regulation. Superheaters, feed heaters, air preheaters. Condensers, extraction systems, de-aeration, Evaporators, accumulators. Further work on refrigeration, including multiple-effect cycle. The heat pump.

(*c*) INTERNAL-COMBUSTION ENGINES

The cycles of operation of internal-combustion engines, with their representation on pressure-volume and temperature-entropy diagrams. The actual cycle as modified by air-fuel ratio, dissociation and variable specific heats. Volumetric efficiency, supercharging, methods of cooling. The constructional details of the various types of internal-combustion engines. Combustion, detonation, properties of fuels. Shape of combustion head, turbulence. Indicators. Ignition systems, carburettors, feed pumps, fuel injection systems. Elementary treatment of gas turbines. The regenerative cycle. Centrifugal and turbo-blowers and compressors. Condition curve and efficiencies. The testing and performance of internal-combustion engines.

19—MACHINE DRAWING I

Use of instruments. Set square exercises. Internal and external angles. Applied geometry. Division of a line — geometrical and scale method. To draw a line parallel to another. The theory of projection drawing. Orthographic projection. Simple problems. To draw a circle through three points. Tangents to circle. Arc tangent to two lines. Three views of an irregular object. Tangent views of an irregular object. Tangent to two circles. Problems giving practice in accurate joining of tangent lines. Open and crossed belts. Problem in orthographic projection. Conic sections. Properties and construction of the ellipse. Various methods of drawing ellipse. The elliptic cam. Three views of a forked lever. Three views of a bearing brass. Three views of a forging tool. Development of surfaces Development of prisms and cones. Frustrum of square pyramid. Three views of a tool holder for a shaping machine. Three views of a slide valve. Whitworth standards. Three views of a standard nut. Screw threads. The helix and its development. Conventional representation of threads. Three views of a hinge bolt and nut. Taper of rods and draw of cotter. Two views of a coned, cottered connection. Two views of a coned crosshead pin and nut. True length exercises. True length of hole drilled in rectangular block. Three views of a hinge bracket. Making a detail sketch. Measuring and dimensioning. Working drawing from sketch. Order of dimensioning. Size and location

dimensioning. Sections and conventions. Flange in half-section and plan. Part sectional views of a shaft bearing. Projected curves. Two views of a connecting rod end.

20—MACHINE DRAWING II

Drawings and the shop: Pattern shop and foundry. Three views of a C.I. bearing bracket from two views on print. Three views of a sector bracket from two views on board. Intersection of a surface of revolution and a plane. Three views of a turned lathe carrier, two being given without curve of intersection. Rigid shaft couplings. Keys and Keyways. Two views, part sectional, of a flange coupling. Sections and conventions. Three views of a foot-step bearing for a vertical shaft. Assembly of a crosshead with piston rod and cotter in position. Cone of rods and taper of cotters. Developments. Development of lower portion of hexagonal prism cut by oblique plane, and a frustrum of right core. Development of pipe elbow, etc. Auxiliary projection. Working drawing with auxiliary view. Hydraulic leathers. Assembly drawing of hydraulic piston from details. True length lines. Triangulation. Development of a transition piece. Square to round. Two views of a locomotive piston head with rod end and castle nut, part sectional. Three views of a marine type big end. Two views, part sectional, of a compression coupling. Three views, part sectional, of a pailley bracket for a hydraulic lift. Use of jib and cotter. Three views, part sectional, of a strap type big end. Arrangement of a Hooke's coupling from details. Developed surfaces and intersections. Three views, part sectional, of a headstock for testing machine. Two views, part sectional, of gas engine piston with gudgeon pin and connection-rod end. The helix and its application to screw threads and springs. Technical sketching. Measuring and dimensioning. Two views, part sectional, of a cylinder cover and stuffing box. Printing, dimensions and notes. Two views of a crosshead pin with tapered ends, key and nut. Dimension and notes to be given. Assembly of marine engine bearing from details. Three views of each detail of solid type little end with wedge adjustment from arrangement. Geometrical problems and developments.

21—MACHINE DRAWING AND CONSTRUCTION III

Screw thread conventions. Standard Whitworth nut and bolt, B.S.F., etc. Studs, lock nuts, etc. Proportion of key, keyways, splined shafts. Simple dog clutch. Boiler tubes and stays. Pipe joints—hydraulics, etc. Propellor shafts. Muff coupling. Simple C.I. brackets. Ribs in castings—Lecture. Minimum thickness in castings. Bearings. Metals used. Representative modern types. Marine coupling—simple proportions. Flange coupling—simple proportions. Rivets. Single and double rivetted lap joints. Single and double rivetted butt joints. Lozenge joint. Knuckle joint. Proportions. Cottered joints. Valves (ball; gate; poppet; slide; piston and spring). Tooth profiles of gear wheels. General machine construction to illustrate above. Loco and marine type crossheads. Loco and marine type big and small ends. Couplings; compression, etc. Steam stop valve. Safety valves. Regulator valves. Steam and I.C. engine pistons. Toothed gearing and cams. Cylinder covers. Pedestal bearings. Boiler details. Casting in general. Workshop details.

21A—ENGINEERING DRAWING

Orthographic, oblique and isometric projection. Intersection of planes and solids. Development of surfaces. Construction of loci, conic sections, cycloid, epicycloid, hypocycloid, and involutes. Locus of a point in a simple mechanism.

Construction of working drawings and sketches, including assemblies of the following:—

Machine Constructional Details:—

Fastenings. Nuts, bolts, studs; keys, cotters, pins, locking devices.

Fixed and Flexible Joints. Riveted joints, forms and proportions of rivets; knuckle and cottered joints.

Transmission of Motion and Power:—

Bearings. Types; details of construction; adjustment for wear and alignment. Lubrication. Supports and housing.

Shafts and Shafting. Couplings and simple clutches.

Tooth Gearing. Ordinary proportions of wheels and wheel teeth; tooth profiles.

Cams. Simple forms; determination of profiles.

Belt and Rope Drives. Pulleys.

Pressure Transmission:—

Pipes and joints for steam, gas and water; valves; expansion joints; pressure packing.

22—MACHINE CONSTRUCTION AND DESIGN IV

General: Completion of Third Year Course with more detailed treatment of design problems. Treble rivetted butt joint—design. Gusset stays. Intersection of rivetted joints. Built-up girder and column details. Example of drawing of reinforced concrete beam; column.

Steam Engine Cylinder Details, Including Design: Piston and piston rod. Stuffing box. Crosshead. Eccentric sheaves. Valve chest details, etc.

Boiler Mountings: Steam valves; pump details; steam trap, etc.

Internal Combustion Engine Details: Piston assembly. Cylinder head. Crankshafts. Connecting rod, etc. Valves and camshafts. Universal joints. Gear wheels. Simple single reduction gear box. Friction clutch, etc.

Workshop Details and Machine Tools: Headstock and tailstock. Drives, pulleys, built-up pulley. Jigs and fixture. Tool posts. Carriage and mechanism. Brackets and bearings. Castings, etc. Allowances and tolerances. Sketching, proportioning and calculating dimensions of component members of above. Representative machine construction drawings; detailed and assembled.

23—MACHINE DESIGN AND THEORY OF MACHINES V

General revision; Linear and Circular motion. Crank effort and Turning Moment Diagrams for reciprocating engines. Fluctuation of energy. Flywheels. Friction; Theory of Screw and Nut, etc. Frictional torque. Bearings; Collar; Thrust, etc. Banking of roads,

etc. Vector diagrams; Four-bar chain; Instantaneous centre. Displacement: Velocity and acceleration diagrams, for reciprocating engines. Graphical and Analytical solutions. Balancing of Rotating and Reciprocating parts. Primary and secondary balance. Multi-cylinder engines. Simple and loaded governors. Various types of governors.

MACHINE DESIGN:

Short Lectures on: Stress concentration; overstrain; loads repeatedly applied and removed; temperature stresses; fatigue of metals; creep of metals; choice of working stresses; fits and tolerances shrinking and forcing fits; methods of manufacture.

Revision of stresses in bolts; axial and eccentric loading. Revision of rivetted joints; design of boiler shell. Design of boiler shell continued. Corrected pitches. Welded joints. Typical design. Design of beams and girders. Use of steel section hard work. Belt, rope and chain drives. Gears. Design of teeth and simple trains. Bearings; lubrication; design of bearings and journal. Design of con. rods; piston rods and other strut members. Crosshead and slide bars. Gudgeon pins, etc.

A few representative designs such as:—

A double purchase crab winch; a bushed-pin type of flexible shaft coupling; a short centre belt drive and pulleys; a dry single plate clutch; bracket and bolts for a tilting gear, wall crane; hydraulic cylinder and pipe joint; a differential hydraulic accumulator; an exhaust-valve gear for a gas engine; centrifugal clutch; welded steel crane gantry girder.

24—MACHINE DESIGN AND THEORY OF MACHINES VI

Simple harmonic motion; cams; motion of follower. Simple and compound pendulums. Oscillations; torsional oscillations; various cases. Torsional oscillations continued. Whirling speeds. Vibrations of springs, etc. Vibrations. One degree and two degrees of freedom. Damped vibrations. Forced vibrations. Vibration absorbers. Critical speeds for reciprocating engines. Gyroscopic torque; precession; nutation; gyroscope; applications.

MACHINE DESIGN

Representative designs of modern Mechanical Engineering Practice. The design for a number of the following items will be worked out and sketched in class and the students will make drawings of the design at home.

Diesel: oil and petrol engine cylinders and details. Gear boxes and other torque magnification units. Hydraulic units; pumps, etc. Steam condensers. Boilers, and other steam plant details. Steam engines; steam and gas turbines. Plate girders. Travelling cranes; jib cranes. Workshop machine units. General factory construction layouts. Steel and reinforced concrete structures.

27—ELECTRICITY I

MAGNETISM:

Magnets; natural and artificial. Magnetic substances; properties of magnets. Magnetic poles and their interactions. Identification of magnets and magnetic poles. Magnetisation and demagnetisation; care and storage of magnets. Inseparability of poles. Magnetic fields and lines of force. Magnetic properties of iron and steel. Temporary and permanent magnets. Magnetic induction. Effect of iron on a magnetic field.

ELECTRICITY. Sources of: Natural; Frictional; Chemical; Mechanical. What Electricity can do: heating, lighting. The magnetic and chemical effects. Detection of current. The cell: primary and secondary. Battery: battery terminals. Circuit: necessity for completed circuit, switch, conductors and non-conductors; insulators. Idea of Resistance: factor affecting the resistance of conductors. Unit of Resistance. Variable Resistance: control of current, weak and strong currents, unit of current, strength; use of ammeter, current flow in simple circuit. Idea of potential difference, unit of P.D. Ohms Law. Measurement of Resistance by ammeter and voltmeter. Resistance in series and parallel. Diagrams and wiring of simple circuit. Heating effect of current. Effect of heat on resistance. Fuse. Magnetic effect of current. Solenoid electromagnet. Relation of polarity to direction of current. Simple applications of electromagnet; make and break; electric bell, electric horn. Traffic Indicators. Simple electric motors, etc.

28—ELECTRICITY II

MAGNETISM :

Qualitative treatment of the following :—Magnets : natural and artificial. Magnetic substances. Magnetic poles. Methods of magnetisation. Destruction of magnetisation—care and storage of magnets. Lines of magnetic force—magnetic fields. Magnetic properties of iron and steel, permanent and temporary magnets, special magnet steels. Magnetic induction—effect of iron on a magnetic field. Magnetic screens. Inseparability of magnetic poles. The molecular theory of magnetism : its explanation of the methods of magnetisation, of the destruction of magnetisation, of magnetic saturation, and of residual magnetism.

ELECTRICITY :

The battery as a source of electricity. Primary and secondary cells and their care. Necessity for a complete circuit. Detection of the current—the heating, magnetic, and chemical effects. Application of these effects. Simple electric detectors—hot wire and magnetic. Use of ammeter as a current indicator. Effect of gap in circuit—the switch. Classification of substances as conductors and non-conductors. Use of insulators. Idea of resistance—factors influencing the resistance of a conductor. The unit of resistance. Variable resistance. Control of the electric current. Unit of current strength. The ammeter. The water analogy. Idea of potential difference—Ohm's Law. The voltmeter. Measurement of resistance by ammeter and voltmeter methods. Effect of temperature on resistance. Resistances in series and in parallel. Lamp-wiring diagrams. Switching devices.

The heating effect of the current—its dependence on the current, voltage and time. Electrical energy—the watt, the joule, the Board of Trade unit. The relationship of electrical to mechanical power. Wattage of lamps.

The magnetic effect of the current. The electro-magnet—its polarity in relation to direction of current flow. Winding of electro-magnets. The field of force of an electro-magnet. The strength of the electro-magnet dependent on the ampere turns. Effect of the core—magnetic saturation and residual magnetism. Pull of electro-

magnet—effect of an air gap. Simple application of the electro-magnet. The electric bell, the electric horn, etc. Inductive and non-inductive windings. The moving coil galvanometer. Magnetic types of ammeters and voltmeters. Essential differences between the ammeter and voltmeter.

Electro-magnetic induction—the induction of E.M.F.s by relative movement of magnets and conductors and by the stopping and starting of a current. Lenz's Law. The induction coil. Alternating current. Simple treatment of the dynamo. The D.C. dynamo—the commutator. General description of the essential parts of the dynamo. Simple treatment of the machine when used as an electric motor.

29—ELECTRICITY I

MAGNETISM :

Magnets; natural and artificial; magnetic substances; magnetic poles, reactions between poles, identification of poles. Magnetisation and destruction of magnetisation; care of magnets; inseparability of poles. Lines of magnetic force, magnetic fields. Iron and steel; temporary and permanent magnets. Effect of iron on magnetic field.

ELECTRICITY :

Sources : natural, frictional, chemical, mechanical. Effects of electric current : heating, lighting, chemical, magnetic. Cell, battery, terminals, circuit, switch. Conductors and insulators. Resistance, factors affecting resistance of conductor. Heating effect of current. Lamps, fuse, series and parallel circuits. Magnetic effect of current; straight wire, loop; coil; solenoid with iron core; electro-magnet. Devices based on electro-magnet effect—Bell, horn, trafficators, etc.

30—ELECTRICITY II

MAGNETISM :

Revision of first year material, dealing in more detail with; iron and steel, magnetic induction, saturation.

ELECTRICITY :

Electro-magnetic effects. Force on conductor in magnetic field. " Left-hand rule." Coil in magnetic field. Electro-magnetic induction. Conductor moving in magnetic field, " right-hand rule " coil moving in magnetic field. Applications; instruments; galvanometer, ammeter, voltmeter; D.C. motor, function of commutator; D.C. generator; Eddy current effects. Primary and secondary cells and batteries. Charge and discharge of secondary battery, care and maintenance.

30A—AUTOMOBILE ELECTRICITY

THIRD YEAR

Electrical equipment of the automobile. Ignition systems, magneto and coil; contact beaker, distributor, plugs, high tension wiring. Dynamo, cut-out and voltage regulators, battery, ammeter and fuses. Lighting and auxiliary circuits. Starter motor. Wiring of the various circuits and tracing of faults, etc.

30B—AUTOMOBILE ELECTRICITY

FOURTH YEAR

Third year Course in more detail, with particular application to tests and fault-finding on individual automobile circuits.

31—ENGINEERING SCIENCE I

Areas and volumes. Vernier callipers and micrometer gauges. Weight of unit volume of solids; density. Effect of weighing bodies in liquids. Principle of Archimedes. Pressure in liquids. Floating bodies. Specific gravity. Hydrometers. Weight of air. Atmospheric pressure. Barometer. Normal pressure. Pumps. Syphon. Force. Work. Work in engine cylinders. Power. Horsepower developed in engine. Force. Turning effect. Moments. Principle of moments. Clockwise and anti-clockwise moments. Parallel forces; centre of gravity; states of equilibrium; stability. Introduction to simple machines. Classes of lever. Load. Effort. Principle of work. Mechanical advantage. Elementary notions of energy. Sources of heat. Expansion effects of heat on solids, liquids and gases. Thermometry. Scales. Fixed points. Co-efficient of expansion. Invar and its uses. Evaporation; cooling caused by evaporation; boiling point. Distillation. Expansion of water on freezing. Anti-freezing mixtures. Hardness. Brittleness. Malleability. Elasticity of metals. Engineering materials—ferrous and non-ferrous groups.

32—ENGINEERING SCIENCE II

Conduction. Convection. Radiation. Thermo-syphon systems. Units of heat. Specific heat. Motion. Velocity. Acceleration. Newton's Laws. Freely falling bodies. Inertia. Momentum. Centrifugal force—its uses. Laws of dry friction. Co-efficient of friction. Fluid friction. Lubrication. Work. Power. Energy. Kinetic and potential. Conservation of energy. Transformations of energy. Joule's mechanical equivalent of heat. Machines. V.R., M.A. and efficiency. Pulleys. Wheel and axle. Inclined plane. Screw jack. Train of gear wheels. Differential pulley. Latent heat of vapourisation. Boyle's and Charles' Laws. Absolute scales. N.T.P. Work done by expanding gases. Cooling effect of expansion. Preparation and properties of Oxygen, Hydrogen, Carbon Dioxide, Carbon Monoxide. Air a mixture of Oxygen and Nitrogen. Elements. Combustion. Calorific value of fuels. Energy losses in parts of automobile. Applications of the above to automobile problems.

33—ENGINEERING WORKSHOP THEORY I

Ferrous metal; reducing ores to metal. Cast-iron manufacture of properties; uses. Wrought-iron and low carbon steels—how made. Properties; uses. High carbon steels. Properties; uses. Non-ferrous metals; copper; reducing copper from ore. Copper; grades; properties; uses. Copper alloys; brasses; bronzes; properties; uses. Aluminium, tin, lead. Properties; uses. General revision of ferrous metals. General revision of non-ferrous metals. Measuring instruments : rule, straight edge, Callipers. Jennies; dividers. Hammers; chisels; use; sizes; forms for different purposes. Marking-out tools : scriber, centre punch, square level. Marking-out tools; V. blocks; surface plate; angle plate; level scribing block. Bolts, nuts, studs, set screws; different types of joints. Washers; locking devices. Screw threads; forms; lead; pitch whit. B.S.F., B.A. Hand cutting of

threads; dies; different types. Stocks. Hand cutting threads; taps. Drills; types, sizes, shanks. Straight flute drills; countersinks, rose heads, spot facers. Hacksaws; blades; frames; pitch of teeth cutting; various metals. Files; use, sizes, shapes. Files; character of cut, grades of cut. Pipes and pipe fittings; various joints; brass and gas threads. Soldered joints; solders; fluxes. Problems in marking out; holes in flanges; key seats or shafts. Problems in marking out; centring shafts, simple brackets; bearings.

34—ENGINEERING WORKSHOP THEORY II

General revision of ferrous metals; various forms in use in workshop. Sheets, plates, bars, sections. Heat treatment of W.I. and low carbon steels. Heat treatment of high carbon steels. General revision of non-ferrous metals used in workshop. Revision of measuring instruments. Marking out tools and instruments. Precision measuring instruments: micrometer, vernier. Revision of cutting tools: chisels, hacksaws, files. Revision of drills; taps; dies. Scrapers; use; types for different jobs and metals. Hand reamers; use; various kinds; parallel; taper; adjustable. Drilling machine; kinds; breast drill; electric hand. Drilling machine; chucks, sockets, sleeves; shanks. Drilling machine; marking off, holding and locating for drilling; different metals; speeds; lubrication drilling. Examples in marking out and holding (continued). Lathe; general use of; names of different parts and functions of these. Lathe; drives; motor; countershaft; sizes; bed shears. Lathe—head stock. Lathe—tail stock. Lathe: saddle; slide rest, tool post. Lathe: face plate, self-centre chuck, 4-jaw chuck. Lathe: centres, slocomb drill. Lathe: carriers, dogs, steadiers. Lathe: preparation of lathe and work for parallel turning between centres. Lathe: examples of work (continued). Lathe: tools, round nose, side tools, parting tools, knife tools. Shafting couplings, bearings, pulleys, collars. Belts—joints, care and treatment. Gears, drives—different kinds and their use.

35—ENGINEERING WORKSHOP THEORY III

Revision of precision measuring instruments and their application to workshop measuring tools. Revision of drilling machine; drilling and reaming; examples of marking out; holding various types of

work. Use of jigs and templates for marking out and drilling. General revision of engines; lathe examples of work between centres. Cast-iron—composition and uses of various types. High carbon steel; alloys; composition and uses. Nickel, tungsten, chrome, manganese. Copper alloys—composition and use of. White metals—composition and uses. Aluminium and alloys. Duraluminium, monel. Chuck work in lathe, 3-jaw and 4-jaw compared. Face plate work in lathe. Setting up and balancing special work. Use of angle plate. Revision of head stock. Use of tumblers and swing plate. Revision of tail stock. Use when drilling and taper turning. Slide rest and tool post. Taper turning and boring chuck work Examples—parallel and taper boring, chuck work (continued). Screw cutting—formation of threads. Screw cutting (continued). Change wheels, single train calculating. Screw cutting (continued). Change wheels, compound train. Lathe tools: forging, grinding, hardening and tempering. Lathe tool holders—high speed cutters. Twist drills: body, land, lip clearance, grinding. Rake and clearance, for lathe tools for cutting different metals. Speeds and feeds for cutting different metals in lathe; heights of tools in lathe. Cutting and cooling lubricants and their application. Revision of soldering, brazing, spelters, fluxes. Rivets and forms of rivets—comparison with bolted joint. Rivetted joints—caulking.

36—ENGINEERING WORKSHOP THEORY IV

General revision of the composition, properties and uses of cast-iron tool and alloy steels. Alloys of copper and aluminium. Hardening, tempering and grinding of tools for hand and machine work. Rake and clearance of different tools for cutting different metals. Revision of taper turning and boring (chuck work), taper turning attachment. Revision of screw cutting. Screw cutting right- and left-hand threads. Cutting a worm. Grinding and setting tool. Lead and pitch of thread. Cutting and double start thread. Change wheels for fractional pitches and metric pitches. Using lathe for special jobs—horizontal boring, use of boring head. Shaping machine, drive, stroke, holding work. Tools and tool holders. Planing machine, drives, bolting down work. Tools. Grinding and lapping. Precision grinding. Using lathe with grinding head attachment.

Milling machine — different types, horizontal arbors and mills. Examples of work. Universal milling machine. End and vertical mills. Simple gear cutting on milling machine. Machining and marking out blanks. Indexing—use of index head. Examples of simple and compound indexing. Gauges—use and care of different types. Manufacturing tolerances, allowances, fits, limits. Storage and care of workshop tools and materials. General layout of workshop, benches and machines. Erecting brackets, bearings and shafting. Erecting and alignment of machines. Guarding of machines and drives. White-metalling, scraping and bedding of bearings. Cutting keyseats in pulleys and shafting. Fitting keys.

36A—WORKSHOP TECHNOLOGY

MATERIALS. The composition, physical properties and engineering uses of the more common metals and their alloys, such as cast iron, wrought iron, malleable iron, mild steel, medium-carbon steel, copper, gunmetal, brass, phosphor bronze, bearing metals, and light alloys.

Tool steels, carbon and high-speed steels, and special tool alloys; their suitability for different kinds of tools.

Market form of supply and relative costs, *e.g.*, castings, forging, drop forging, bars, sheets, plates, rod and wire.

HEAT TREATMENT. The relation between heat treatment and the physical properties of plain carbon steels.

The effect of carbon. Critical temperatures. Hardening, tempering, annealing, normalising, and case hardening. Types of furnaces. Temperature measurement and control. Quenching media.

MANUFACTURING PROCESSES. An outline of the preparatory processes for forming, materials, *e.g.*, moulding and casting, forging, drop stamping and die casting, rolling and drawing metal bars, dishing, drawing, and embossing sheet metal, pressing, spinning, and extruding, brazing and soldering, welding and cutting by arc and oxy-acetylene blowpipe flame.

MEASURING, GAUGING AND INSPECTION. General principles of interchangeable production and limit gauging.

B.S.I. Standards. Systems of limits and fits for plain and screwed work. Tolerances, limits, clearance, interference and transition fits. Tolerances associated with different machining operations.

Types of limit gauges. Advantages of adjustable gauges. Measuring equipment. Construction, care and use of surface plates, straightedges, squares, micrometers (external and internal), vernier callipers and height gauges, dial gauges, rules and protractors. Basic standards of lengths. Imperial standard yard. International standard metre. Conversion factor. Standard and workshop end gauges; their accuracies and uses.

CUTTING TOOLS. Cutting action of tools such as hand tools, lathe tools, drills, reamers, milling cutters, dies, taps, etc. Tool angles for different materials and purposes; measurements of tool angles. Cutting speeds and feeds. Estimation of machining times.

MACHINE TOOLS. Fundamental principles in the production of machine surfaces. Copying or forming and generating. Principal features of construction and functions of the more important general purpose machines, such as lathes, sensitive, vertical and radial drilling machines; shaping, slotting, planing and boring machines; plain milling machines and accessories; capstan and turret lathes; grinding and lapping machines. Chatter and the use of steadies. Lubrication. Types of lubricants. Types and use of cutting oils and solutions. Selection and methods of application.

SAFETY MEASURES. Sources of danger and methods of protection. Types of guards and safety devices. Home Office Regulations.

OPERATION PLANNING. Planning the operation layout, and estimation of floor-to-floor times for simple machined parts.

37—WORKSHOP CALCULATIONS I, II

Foot rule and its sub-divisions as a basis of manipulation of fractions up to 1/64 in., including function of brackets. Decimals in relation to British and metric units. Decimalisation of fractions and *vice versa*, especially in relation to use of drill tablets. Powers and square root. Practice in evaluation and transformation of workshop formulæ. Percentages, ratio, and proportion. Area, volume and weight (with density and specific gravity) in relation to cubes,

rectangular solids, cylinders, etc. Solution of simple equations with practical applications (extension of No. 4 above). Use of logarithms. Graphs. Angular measurement. Exercises on simple geometrical principles (*e.g.*, theorem of Pythagoras).

38—WORKSHOP CALCULATIONS III, IV

Surface, area, volume, weight of regular solids, and of right composite solids built up from them. Surface area, volume, and weight of prisms, pyramids, and cones. Mid-ordinate and Simpson rules applied to areas and volumes. Simultaneous and quadratic equations with practical applications. Harder graphs. Degrees and circular measure. Properties of the right-angled triangle trigonometrical ratios. Simple trigonometry related to marking out, tapering, levelling, chordal distances, tangential lines. Mathematical treatment of harder aspects of (*a*) pitch and lead of a screw; (*b*) gear ratios, simple and compound trains; (*c*) torque, axial pressure, and transmission of power.

39—MECHANICAL DRAWING I

Lettering and dimensioning. Use of T. square and Set square, etc. Centre lines, triangles, circles, pentagons, construction lines. Hexagons, octagons, etc. Exercises in marking out. Triangles and ellipse by two methods. Ellipse and heart-shaped cam. Heart-shaped cam and further edge cam. Isometric and oblique projection. Methods. Isometric and oblique projection of simple solids. Development of surfaces, square, square pyramid. Development of surfaces of hexagonal pyramid and cone, etc. Orthographic projection: 3 views of brick, cube, etc.; 3 views of simple solids; 3 views of square, triangular and hexagonal pyramids; 3 views of hexagonal prism, and frustrum of hexagonal; 3 views of Vee block and C.I. bracket. Other simple exercises. Measuring up and rough sketch of casting supplied, and 3 views. Two geometrical patterns of C.I. grating. Orthographic projections—sections of simple solids. Sections of half-brass and 2 other views. Three views and section of strap fork guide block. Diagonal scales and scales: 1½ in.=1 ft., 3 in.=1 ft. and

6 in.=1ft. Screw threads; drawing of threads. Drawing 3 views of hexagonal nut and bolt, and nut. Three views of C.I. handwheel—1 view in section. Two views of palm end rod, showing method of intersection.

40—MECHANICAL DRAWING II

Standard Whitworth nut. Cast-iron bracket with adjusting screw. Three views of a footstep bearing, two views—half-section. Three views of a coned cottered connection. Draw one view of a 1¼" spanner. Flange coupling—half-section. Front elevation, sectional end elevation, and inverted plan of a hanger bracket for a swivel bearing. Hydraulic packing for pump plunger. Cast-iron overhanging bearing. Lever toggle. Three views of stay for a 6" lathe; one view being a sectional elevation. Sectional elevation, plan and two end elevations of a piston rod end and guide block. Loose headstock for testing machine—front sectional elevation, end elevation developing curve of intersection and plan. Freehand sketching—rudiments of small C.I. bracket, sketch and dimension. Freehand sketching; dimensioned sketches in orthographic projection from small cast-iron models.

Components of different types of connecting rod ends. Three views of connecting rod end—part sectional (from freehand sketches). To complete plan and end elevations of a truncated hexagon prism, truncated hexagon pyramid and cylinder, and also to draw true shape of cut faces of truncated prism, pyramid and cylinder. To develop the sides, top and bottom of truncated hexagon prism, and pyramid. Development of truncated hexagonal pyramid and a truncated hexagonal pyramid and a truncated cone. Development of curves of intersection. Upright pedestal for 2½" shaft—three views elevation and plane part in section. Freehand sketches of workshop details. Working drawings.

41—MACHINE DRAWING III

Technical sketching. Kinds of technical sketches. Technique. Practice. Order working. Measuring and dimensioning. Completing working drawings from students own sketches. Sections and con-

ventions. Sections : full, half, broken, revolved, removed, phantom, auxiliary. Dimensions for workshop drawings : the pattern shop, the foundry, the forge shop.

Dimensions and notes. Decimal dimensioning. Allowances and tolerances—classification of fits. Metric system; Ford system.

Detail drawings made from actual machine parts : Lever safety valves; pump links for marine engineers; slide valves; stop cocks; angular and adjustable crachets. Piston heads, cross heads of various types. Automobile cylinder heads, gear and cams. Elements of structural, electrical and aircraft drawing.

In addition to the above, approximately 26 short lectures on special machine details are given.

42—MACHINE DRAWING IV

More advanced treatment of the third year subjects. Assembly drawings. Choice of views. Order of pencilling, tracing, inking, checking. Gears and cams, cam diagrams, timing diagrams. Jigs and fixtures.

Pictorial sketching. Axonometric sketching. Oblique sketching. Sketching from memory. Standard screw threads tables and their uses in drawing. Complete working drawings of : Eccentric and strap; pillow block and pedestal bearings; swivel bearings. Construction of pawls and ratchets, ball bearing carriers. Coiled springs in valves. Relief valves. Flexible couplings. Bell driver. Belt tighteners. Details of workshop machinery; milling machines; drilling machines; split nuts; face plates, and chucks.

Approximately 26 short lectures on standard drawing office practice will be given during the course.

43—FITTING AND TURNING I

Measuring appliances : Use of rule, callipers, micrometer and vernier. Marking out : Use of jennys, dividers, surface gauge, try-square and centre punch. Procedure at the machine drill. Fitting : Use of the hammer, chisel and file in preparation of flat surfaces. Making of templates and small tools. Rivetting operations. Use

of stocks and dies and taps. Turning and machine work : Simple exercises in turning of pins, bolts and spindles; use of chucks and face plates; boring and facing; tapered work. Smithwork : Simple exercises in preparing, dressing and tempering chisels and other small tools.

44—FITTING AND TURNING II

Fitting : Angle and bevel gauges, squares, callipers, clamps and other bench tools. Fitting and assembling of simple machine parts. Preparation of plane surfaces by means of scraper. Lathe and machine work. More advanced exercises in turning and boring; screwcutting, external and internal. Operations in milling, planing, shaping, drilling. Grinding of lathe tools, drills, etc.

44A—FITTING AND TURNING. 3rd YEAR

Tool Making : Exercises in making bevel gauges, surface gauge, trammel, "V" blocks, punches, clamp and bench tools, etc., requiring a high degree of accuracy and finish. Heat treatment of steels. Hardening and tempering.

Lathe Work : Advanced exercises in turning (parallel and taper) Screw-cutting (external and internal) involving Whitworth, Acmer, Buttress and square threads. Assembly of component and interchangeable parts.

Machine Work : Planing, shaping, milling; use of dividing head, angle plate, etc.

Grinding of lathe tools and drills.

45—FITTING AND TURNING III

Lathe work : Advanced exercises in turning, boring, multiple screwcutting, involving the assembly of component and interchangeable parts. Machine work : Planing, shaping, milling; use of the dividing bead, angle plate, etc.

45A—FITTING AND TURNING. 4th YEAR

The application and use of modern high-grade measuring instruments and gauges. Advanced turning exercises on syllabus of previous years. Machining, fitting and assembly of machine and engine parts, requiring a high degree of accuracy and finish.

Grinding external and internal engine parts. All precision work. Milling of spur and ratchet wheels, bevel wheels, etc. Complete making of crank, connecting rod, cross head, etc. Steam engine parts complete. Screw jacks and other workshop accessories.

Advanced work on screwing. Tapered work. Cottered connections and other workshop accessories.

46—FITTING AND TURNING IV

Advanced work on syllabus of previous years, involving the complete turning, machining, fitting and assembly of machine and engine details requiring a high degree of accuracy and finish. The application and use of modern high-grade measuring instruments and gauges. Production of spur and ratchet wheels, tapered work, cottered connections, screw jacks and other workshop accessories.

46A—FITTING AND TURNING. 5th YEAR

Complete overhauling, assembling and renewals of component parts of twin cylinder steam engine. Complete manufacture of simple jigs for drilling and milling. More advanced external grinding.

47—PATTERNMAKING I

Selection, qualities and application of timbers and other materials used. Use of patternmaking tools and appliances; the contraction rule. Operation of wood-turning lathe. Construction of simple patterns of flanges, brackets, bearings, brasses and cocks. Core box making; use of core prints.

48—PATTERNMAKING II

Patterns of more advanced type: built-up patterns, pedestals, wall brackets, hangers, toothed wheels, pulleys, clutches, pipe bends, valves, cocks, pistons. Use of strickles and loam board.

49—PATTERNMAKING III

Cylinders and connections for engines and pumps, hydraulic details. Patterns of complex nature, involving coring of passages, chambers and recesses. Patterns for ornamental castings in iron, brass and bronze.

50—FOUNDRY WORK

Materials used: sand, loam and graphite. Foundry appliances and tools. Characteristics and properties of cast-iron, brasses and bronzes. Castings in aluminium, brass and iron. Arrangements and management of furnaces for melting metals. Miscellaneous exercises in moulding and casting from patterns of a simple nature. Preparation and use of cores. Moulding by use of strickle.

51—BRASSFINISHING

Bench and lathe operations involved in finishing and assembly of cocks, valves, lubricators, injectors, gauges, steam whistles. Turning of screwed spindles and of balls. Preparation of small switches and other simple electrical fittings. Ecclesiastical and ornamental brasswork, requiring a high degree of finish. Chasing, knurling, spinning, brazing, polishing and lacquering operations.

52—BOILERMAKING: THEORY AND DRAWING I, II

Lectures: Elementary details of boiler construction; rivets and rivetted joints; methods of closing rivets; steam-tight steams; caulking and fullering. Boiler domes and manholes; furnace tubes; dished plates. Boilermaking materials. Drawing: Simple drawing and precision exercises. Developments of cylindrical and coned shells, rivetted seams and boiler shell connections. Spacing of holes for flue tubes, stays, manholes.

53—BOILERMAKING: PRACTICAL I, II

Marking out, cutting and bending to required shape and dimensions of cylindrical and coned rivetted bodies. Preparation of plates for boiler construction, levelling, squaring, cutting and drilling. Simple rivetted joints, caulking and fullering. Rivetted tank work, water-tight joints, corner connections, stiffening and staying. Boiler smithwork, heating of angle and channel bars in the fire, bending to required shape and size, welding and finishing. Flanging of boiler end plates. Oxy-acetylene processes applied to boilermaking.

54—SMITHWORK

Making up and care of fire, varieties and qualities of fuels; smith's tools and appliances. Forging in wrought iron, mild steel and tool steel. Welding. Forging of pins, bolts, keys, hooks, cotters, spanners, shackles, links, tongs, pincers, levers. Forging, dressing and tempering of chisels, centre punches and lathe tools. Thin flattened and pointed forgings. Use of oxy-acetylene plant.

55—ART IRONWORK

Iron, its nature and properties. Various kinds of iron used by art iron workers; tools used. Treatment and manipulation of wrought iron: forging, welding, jumping, bending and embossing. Methods of joining ironwork. Details used in art smithing, rivetting, intersecting, slitting, tenoning, shrinking on collars, twisting, scrolls and volates.

56—METAL PLATE WORK: DRAWING AND THEORY I

Lectures: Fuels used in actual plate work. Metals: Characteristics and applications of tinplate, zinc, copper and iron. Solders and brazing materials. Galvanising, tinning and re-tinning processes. Calculations of dimensions, capacities and weights of vessels of various designs.

Drawing: Geometrical problems involved in metal plate work; intersections and penetrations. Development of patterns for vessels and other objects of simple form, such as: Cylindrical pipes and

branches; coned articles in two or more pieces; equal tapering bodies; baking pans; objects with combined flat and coned surfaces, tee pipes, bends in two or more pieces, V and Y pipes. Patterns for finials, simple mouldings, gutters and other roof work details. Principal joints used in metal plate work practice.

57—METAL PLATE WORK: PRACTICAL I

Use of hand tools, cutting and bending appliances. Cutting, rolling, hammering, bending and flattering operations. Preparation of notches; allowances for lap, wiring and joining of seams and intersecting parts. Jointing, soldering, brazing, rivetting and grooving processes. Brazing in iron, copper and brass. Annealing, stretching, raising and planishing. Tinning and re-tinning methods. Preparation of flue and ventilation pipes and branches, hoods, ventilators. T and Y pipes, household utensils, toilet ware, baking pans and cake tins. Preparation of roof flashings, mouldings, chimney pipes and cowls.

58—METAL PLATE WORK: DRAWING AND THEORY II, III

Metals and alloys: their physical and chemical properties. Special uses of tinplate, galvanised and lead-coated iron. Fuels, solid and gaseous; their methods of application. Oxy-acetylene processes. Development of patterns of an advanced type, involving triangulation methods. Development of complex patterns and mouldings.

59—METAL PLATE WORK: PRACTICAL II, III

In addition to advanced work on the syllabus for the first year, special attention will be given to the following: Oxy-acetylene processes applied to the cutting and welding of sheet metal objects; the choice and use of blowpipes, welding rods and fluxes. Oxy-acetylene methods in the treatment of sheet copper, aluminium, brass, and stainless steel. Sifbronze welding. Preparation of lamps, vases, caskets and other ornamental work, involving a high degree of finish. Flashings for domes, spires and special roof forms.

60—OXY-ACETYLENE WELDING I-IV

Dissolved acetylene; care of high pressure acetylene and oxygen cylinders, valves, gauges and other fittings. Precautions to be observed in use of plant. Choice and use of blowpipes for various purposes. Cutting and welding processes. Practical exercises in cutting and welding plates, angle and bars of other sections. Welding of framed structures. Oxy-acetylene methods applied to cast-iron. Aluminium alloys, brasses, bronzes and copper. Use of welding rods and fluxes for different metals.

61—ELECTRIC WELDING I-IV

Details of equipment in care and maintenance of plant; precautions in use. Correct sizes of electrodes and current density for various purposes. Electric arc travel for various kinds of work. Types of joints and their preparation for arc welding. Perpendicular line of welding and overhead welding. Cutting with the arc. Jointing of plates, bars and tubes, etc.

62—GARAGE PRACTICE I

First Year

Demonstrations of structural arrangement of motor car chassis and units of various types; mechanics' hand tools and common garage appliances; retaining and securing devices, and methods of dismantling and re-erecting.

Practical exercises in identifying principal components of main units; ascertaining methods of working and of adjustment; inspection for wear; removing, dismantling, reassembling and replacing easily detachable components of simple construction; cleaning, replenishing and maintaining oil, fuel, water and air containers.

63—GARAGE PRACTICE II

Exercises in removing and replacing less detachable or accessible units and components; dismantling, effecting simple repairs, involving substitution for worn parts and reassembling; making adjustments of related operating and controlling mechanism; detecting and correcting simple causes of improper operation.

64—GARAGE PRACTICE III

Exercises in removing and replacing units and components complicated by variations in layout and design; effecting repairs involving workshop processes; making adjustments related to functional operation of components affecting the performances of units; detecting and correcting more abstract causes of improper performance.

65—GARAGE PRACTICE IV

Effecting major repairs to power and transmission units; alignment and adjustment operations to undercarriage and chassis as a whole; checking and testing repaired units and vehicles in the workshop.

66—WORKSHOP PRACTICE I

Demonstration of the forms; purposes and care of fitters' hand tools; forms and working properties of commonly used materials; forms and uses of fastenings and other finished stock. Exercises in the use of tools in measuring, marking off and marking out; cutting; filing and fitting; drilling by hand and machine; punching; hot and cold bending; hot and cold rivetting; soft and hard soldering; brazing; hand tapping and screwing; annealing, hardening, tempering and casehardening. Use of surface plate, surface gauge and vee blocks. Making useful household fittings, simple metal workers' tools, garage and workshop appliances. Simple pipe work.

67—WORKSHOP PRACTICE II

More advanced treatment of matter outlined in first year syllabus. Additional exercises in producing flat surfaces; chipping, scraping; also reaming; drifting; cutting keyways and oil grooves; scraping bearings.

68—WORKSHOP PRACTICE III

See Third Year Syllabus in Workshop Practice for Fitters and Turners.

69—WORKSHOP PRACTICE IV

See Fourth Year Syllabus in Workshop Practice for Fitters and Turners.

70—MOTOR ENGINEERING (LECT.) I

FIRST YEAR

General arrangement of conventional passenger chassis. Single, and multi-cylinder spark ignition engines; arrangement of power system; valves and valve operating mechanisms; fuel system; constant vacuum carburettor; coil ignition; pressure lubrication; water cooling. Common types of solid friction clutch, sliding engagement gearbox, bevel gear, final drive and differential, mechanical universal joints and propellor shaft. Independent frame construction, damped semi-elliptic springing, divided front axle with Ackermann linkage, common types of steering gear, mechanical internal expanding brakes, steel wheels and hubs, low pressure types.

71—MOTOR ENGINEERING (LECT.) II

The structural features of more advanced types of construction, including 6 and vee-8 cylinder designs, overhead valves, constant choke carburettors, controlled temperature cooling, fluid friction clutch, constant mesh gearbox, hypoid gear final drive, enclosed propellor shaft, transverse springing, triangular bracing, three-quarter and full-floating rear axle, improved steering gears, hydraulic brakes.

The functions and operating conditions of important components and the provision made to comply with these conditions. Maintenance of units in working order; setting adjustments; causes of wear; effects of incorrect adjustment and normal wear; detection and correction of simple faults.

72—MOTOR ENGINEERING (LECT.) III

Construction peculiar to heavy commercial and public service vehicles, including compression ignition engines, centrifugal clutches, heavy duty and multiple speed gearboxes, worn, final drive, spur gear differential, twin rear axle, construction, twin front axle construction, divided transmission shafts, power assisted steering gears, servo-assisted brake arrangements.

73—MOTOR ENGINEERING (LECT.) IV

Detection of defective engine performance; determination of causes and discrimination between results of mal-adjustment and wear; connection of mal-adjustment and rectification of wear. Failure to start, misfiring, lack of power, knocking, excessive oil and fuel consumption, vibration, overheating. Clutch defects, adjustment and repairs. Gearbox deterioration and repair. Rear axle final drive and differential installation, and adjustment. Spring and damper maintenance and adjustment. Front axle wear and damage rectification. Brake performance, wear, adjustment and repairs. Alignment of frame, axles and wheels.

74—MOTOR ENGINEERING (LECT.) V

Types of bearings, primary functions, application in individual units, particular duties, care installation, maintenance in service, causes of deterioration and effects thereof on the unit and on the vehicle, methods of repair or replacement, capacities and alternative sizes. Fluid tight joints: types, construction and application; jointing materials, causes and effects of deterioration, repair and replacement and adjustment. Restricted motion joints. Fixed joints: types, construction and application, methods of disconnection, effects of damage during manipulation, reconditioning and reconnecting, locking devices.

75—WATCHMAKING

THEORY:

Measurement of Time. Theory of Watch and Clock Trains, Wheel and pinion Depths. Jewelling. Main spring strengths and Balance Vibrations. Metals Balance Vibrations and Balance Springs. Counts of wheels and pinions and motion work, wheel and pinion Depths.

PRACTICAL:

Lathe work. Pinions and pivots, pinions winding and going. Fitting balance springs. Re-bushing. New pinions and pivoting. Winding Stems, Balance Staffs and general small Lathe work. Winding Stems, making and fitting.

76—TECHNICAL DRAWING

Guiding principles. Lettering, sketching practice, geometrical definitions and figures, principles of projection, exercises on bolts and nuts, oil seals, springs, threads, etc.

77—TECHNICAL DRAWING

Application of matter of earlier syllabus in illustration of details in construction and arrangement of motor vehicle units by way of illustration of notes on Motor Engineering lectures.

78—MECHANICAL ENGINEERING THEORY AND DRAWING

1. INTERNAL COMBUSTION ENGINES:

Petrol; Paraffin; Gas; Diesel and Semi-Diesel, etc.

Constructional details and fitting of: Cylinders, cylinder heads, pistons, rings, valves, bearings and fuel pumps. Setting of exhaust, fuel and air valves.

Cycle of operations; timing diagrams, for 4- and 2-stroke engines. Pressures and temperatures at the more important positions. Lubrication. Fuel valves; mechanical and blast air types. Air compressors and Bottles. Dynamometer tests and Indicator Cards. Maintenance and annual survey.

2. STEAM ENGINE PLANT:

Steam Engine: Constructional details and fitting of: Cylinders, pistons, shaft and bearings.

Assembly and setting of valve and valve gears. Valves: Slide valve; piston valve, inside and outside steam. Effect of the variation of cut-off. Indicator Cards. Condensers, air and circulating pumps, etc.

Boilers: Constructional details of: Water and gas tube; Lancashire; Cornish and Vertical Cross-tube types, etc. Mountings and fittings. Adjustment of safety valves. Gauge glasses. Feed Pumps; reciprocating and centrifugal. Preparation for annual survey.

Steam Turbines; Refrigerating Plant, and Hydraulic Machinery.

79—VENTILATION AND AIR CONDITIONING

PHYSIOLOGICAL CONSIDERATIONS. Atmospheric pollution. Requirements for comfort and industrial processes. Standards of ventilation.

TRANSMISSION OF HEAT. Heat gains (sensible and latent). Calculation of heat to be removed from buildings.

VENTILATION. Mechanical ventilation. Inlet and exhaust.

EQUIPMENT. Air filters. Pre, main and booster air heaters. Fans and fan drives. Selection of fans. Ductwork, dampers and regulators.

AIR DISTRIBUTING SYSTEMS. Design and sizing of ducts. Resistance of systems.

NOISE. Cause and prevention of noise and vibration.

PSYCHROMETRY. The use of psychrometric charts and hygrometric tables.

REFRIGERATION. Refrigeration cycles. Types of refrigerators. Absorption, compressor and steam jet systems.

ANCILLARY EQUIPMENT. Including condenser water coolers, atmospheric and spray type; direct and indirect humidifiers.

INSULATION. Humidifiers and pipework and air-conditioning ductwork.

AIR CONDITIONING EQUIPMENT. Air-conditioners and unit coolers. Direct humidifying systems. Air washers and de-humidifiers.

CONTROLS. Automatic temperature and humidity controls; pneumatic, electric and hydraulic systems.

CALCULATIONS AND DRAWINGS. Complete calculations and drawings for a simple air-conditioning system, including plant chamber details.

DRAWING AND DESIGN.

(a) Installation of automatic controls, traps and reducing valves.
(b) Fan inlet and outlet connections.
(c) Supports and platforms for fan sets.
(d) Operating gear for large louvred dampers.

80—HEATING AND HOT WATER SERVICES

TRANSMISSION OF HEAT. Calculation of heat losses and heat requirements of buildings.

HEAT EMISSION. Heat emission from pipes, radiators and convectors.

INSULATION. Economics of the thermal insulation of buildings as affected by the initial cost of building and installation and annual fuel consumption. Thermal insulation of plant.

HEATING SYSTEMS. Hot water heating systems; low pressure and high pressure. Steam heating systems; low pressure and vacuum. Unit heaters, radiators and convectors. Low temperature panel warming. General description of district heating systems.

HOT WATER SUPPLY. Hot water supply installations and estimations of storage and demand.

EQUIPMENT. Selection of boilers of all types; automatic stoking, gas and oil firing equipment. Selection of calorifiers, pumps and steam traps. Boiler and automatic controls. Electric water heaters. Thermal storage.

FUEL CONSUMPTION AND COST. Degree days. Thermal capacity of buildings. Running costs of heating buildings with comparison of system using gas, electricity, solid and liquid fuels.

DESIGN. Principles of design and calculations for gravity- and pump-circulated hot water heating systems, steam heating systems, and hot water supply installations.

CALCULATIONS. Complete calculations and set of drawings incorporating the layout and boiler-house details for (a) hot water and steam heating systems; (b) hot water supply installations.

(NOTE—Emphasis should be placed on the use and selection of appliances mentioned above rather than on constructional design.)

DRAWING AND DESIGN.

(a) Isometric and planometric projection.
(b) Expansion joints and anchors.
(c) Supports for overhead piping systems.
(d) Supports for heavy pieces of apparatus.

81—MECHANICS OF FLUIDS

HYDROSTATICS. Measurements of pressure. Pressure gauges and manometers.

LAW OF FLUID CONTROL. Benouilli's theorem. Flow of water, steam and air in conduits. Critical velocity. Loss of heat through pipes, fittings, valves and orifices. Effect of viscosity and temperature.

THEORY OF DIMENSIONS. Principles of dynamical similarity.

MEASURING INSTRUMENTS. Venturi-meter. Notches and orifices. Steam and water meters. Anemometer. Manometer. Pilot tube. Velometer.

PUMPS. Reciprocating and centrifugal. Characteristics. Cavitation. Slip. Air separation. Air vessels.

FANS. Laws. Types. Characteristics. Performance.

AIR COMPRESSORS. General principles. Unloading valves. Oil and water separation.

82—BOILER-HOUSE PRACTICE

FUELS. Types; sampling and testing; proximate and ultimate, analysis; estimation of calorific value; calorimeters; combustion.

STEAM. Saturated and superheated steam. Sensible, latent and total heat; superheat; use of steam tables; dryness fraction; steam calorimetry.

STEAM GENERATION. Types of boiler and mountings, settings, and economisers. Furnaces, grates, and fittings, Draught—natural, induced and forced systems; dampers and flues. Boiler feed pumps.

BOILER OPERATION AND MAINTENANCE. Stoking, blowing down, priming and foaming; boiler tests; preparation of boilers for inspection; smoke abatement.

WATER TREATMENT. Causes of corrosion and scale formation. Electrolytic action. Feed-water treatment and water hardness tests.

GENERAL CURRICULUM OF THE SCHOOLS
UNDER THE CONTROL OF
The City of Dublin Vocational Education Committee

TECHNICAL INSTITUTE, BOLTON STREET.

Mechanical Engineering.
Motor Car Engineering.
Marine Engineering.
Mechanical Engineering Trades.
Motor Car Engineering Trades.
Smithwork and Art Ironwork.
Brassfinishing.
Watchmaking.
Oxy-Acetylene and Electric Welding.
Architecture.
Civil Engineering.
Quantity and Building Surveying.
Building Technology
Surveying and Levelling.
Building Trades.
Furniture Trades.
Coachbuilding, Coachtrimming and Coach-painting.
Printing and Book Production.

Day Junior Technical Courses.
Day Apprentice Courses.

TECHNICAL INSTITUTE, CAPEL STREET

Continuation Courses.
Post Office Messengers.
Manual Instruction: Woodwork, Metalwork. Day Junior Technical Courses.
Trade Classes:—Tailoring. Bootmaking. Hairdressing.

CABRA TECHNICAL INSTITUTE.

Day Junior Technical School.
Pre-Learner Day Course
Day School of Commerce.
General Commercial Subjects.
Languages.
Metalwork. Domestic Science and Housecraft
Woodwork. Physical Training.
Science and Mathematics.

INSTITUTE OF SCIENCE AND TECHNOLOGY—KEVIN ST.

Pure and Applied Mathematics.
Pure and Applied Physics.
Pure and Applied Chemistry.
Physical Chemistry.
Bio-Chemistry: Botany.
Bacteriology: Biology.
Pharmacy.
Industrial Technology: Manufactures.
Illuminating Engineering.
Bootmaking
Ophthalmic Optics.
Electrical Engineering and Allied Trades
P.O. Engineering Technology.
Instrument Making.
Radio Engineering and Service Work.
Radio Telegraphy (Radio Officers).
Air Navigation.
Radar and Radar System.
Bakery Science and Practice.

PARNELL SQUARE TECHNICAL INSTITUTE.

Day School of Commerce (Girls) and Retail Distribution (Part-Time Classes)
Day Junior School of Domestic Economy.
General Commercial Subjects.
Domestic Science and Housecraft.
Languages.
Retail Distribution.
Lip-Reading Classes
Preliminary Examinations.
Physical Training (Girls).

HARCOURT STREET SCHOOL OF DOMESTIC SCIENCE.

Day Junior Domestic Economy.
Day and Evening Part-Time Classes in Cookery, Needlework, Dressmaking, etc

PEMBROKE TECHNICAL INSTITUTES.

BALLSBRIDGE.

General Commercial Subjects.
Languages.
Domestic Science and Housecraft.
Art and Art Crafts.
Day School of Commerce (Girls).
Day Junior Technical Course (Girls).

RINGSEND.

Mechanical Engineering.
Motor Car Engineering.
Oxy-Acetylene and Electric Welding.
Woodworking Trades and Handicraft.
Day Junior Technical School (Boys).
Special Teachers Training Course.
Ship Construction.

GENERAL CURRICULUM OF THE SCHOOLS
UNDER THE CONTROL OF
The City of Dublin Vocational Education Committee

THE HIGH SCHOOL OF COMMERCE.
Rathmines Road. Phone 92374.

JUNIOR DAY SCHOOL COURSES.
Preparatory (Boys). Commerce (Boys and Girls), 1st and 2nd Year.

SENIOR DAY SCHOOL COURSES.
Matriculation. Secretarial. Commercial Diploma.
Continuation Education for Youths in Employment.

EVENING COURSES

Accountants and Auditors.
Advertising and Publicity.
Art in Industry and Commerce.
Banking and Finance.
Bookshop Practice and Literature.
Company Secretaries.
Cost and Works Accountants.
Economics and Social Science.
Government Accountancy and Finance.
Income Tax Law and Practice.
Languages.
Leatherwork.
Office Practice (Book-keeping, Commerce, etc.).
Physical Training.
Preliminary Examinations.
Promotion Examinations.
Secretarial (Shorthand, Typewriting, etc.)
Transport.
Window and Shop Display.
Woodwork for Adults.
Insurance (Industrial).

RATHMINES SCHOOL OF DOMESTIC ECONOMY.
Rathmines Road. Phone 91780.

DAY COURSES.
Preparatory (Girls). Junior Day Technical School (Girls).

MORNING. AFTERNOON AND EVENING COURSES.

Cookery. Embroidery. Household Management. Laundry.
Dressmaking. Housecraft. Needlework. Knitting.

ST. MARY'S COLLEGE—CATHAL BRUGHA STREET.

Diploma Course (Training Teachers).
Household Management.
Institutional Management.
Dietetics Course.
Hotel and Institutional Cookery.
Apprentice Chefs Course.
Evening Classes—Cookery, etc.

MARINO TECHNICAL INSTITUTE.

General Commercial Subjects.
Languages.
Domestic Science and Housecraft.
Metalwork and Woodwork.
Physical Training.
Day Junior Technical School (Boys and Girls).
Day School of Commerce.

HOWTH TECHNICAL INSTITUTE.
Irish. Domestic Science. Art Leatherwork.

CHATHAM ROW SCHOOL OF MUSIC (Day and Evening Classes).

Pianoforte.
Violin.
Viola.
Violoncello.
Double Bass.
Drums.
Orchestral Playing.
Percussion Band.
Voice Production.
Singing.
Gaelic Singing.
Aural Training.
All Woodwind and Brass Instruments.
Chamber Music.
Theory.
Harmony.
Uileann and War Pipes.
Sight Reading (Vocal)
Elocution.

Offices—TOWN HALL, MERRION ROAD, BALLSBRIDGE.

MARTIN M. GLEESON, M.A., B.Comm.,
Chief Executive Officer.

WM. WARREN & SON, LTD., PRINTERS, 15 LOWER ORMOND QUAY, DUBLIN.

Coiste Fairm-oideachais Cathair Bhaile Átha Cliath

DEPARTMENT OF

ARCHITECTURE AND BUILDING

TECHNICAL INSTITUTE

BOLTON STREET, DUBLIN

1951-52

PROSPECTUS

FOR DAY AND EVENING

CLASSES