

HARRIS INSTITUTE, PRESTON.

HARRIS INSTITUTE,

PRESTON.

PROSPECTUS

SESSION 1915-1916.

PRESTON:
MATHER BROS., PRINTERS, 31, LUNE STREET.
1915.

CONTENTS.

MEMBERS OF COUNCIL 5

DAY CLASSES.

AGRICULTURE 29

COMMERCIAL SCHOOL 21

COTTON SPINNING AND WEAVING 51

JUNIOR TECHNICAL SCHOOL, FOR BOYS 43

MATRICULATION AND SCIENCE 10

DAY AND EVENING CLASSES.

ART 73

DOMESTIC SCIENCE 55

EVENING CLASSES.

ORGANISED COURSES :—

BUILDING TRADES 111

COMMERCIAL 213

MECHANICAL ENGINEERING 145

PHYSICS AND ELECTRICAL ENGINEERING. 167

TEXTILE 191

SCHOLARSHIPS AND PRIZES 229

SCIENCE AND MISCELLANEOUS 93

HARRIS COUNCIL.

1915-1916.

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Mr. A. Holt, D.Sc., M.A. (Camb.) (Liverpool).

Principal and Secretary:

T. R. JOLLY, F.C.I.S.

Day Classes.

Matriculation & Intermediate Science.

Matriculation and Intermediate Science Classes.

SESSION 1915-16.

The Session commences on Tuesday, 21st September, 1915, and consists of Three Terms:—

WINTER TERM—

21st September to 23rd December, 1915.

SPRING TERM—

11th January to 1st April, 1916.

SUMMER TERM—

5th April to 1st July, 1916.

All communications to be addressed to—

T. R. JOLLY,

Principal and Secretary.

UNIVERSITY CLASSES

These provide complete Courses of Instruction for the Joint Matriculation of the Northern Universities ; the Intermediate B.Sc. and Intermediate B.Sc. Tech. Manchester ; the Intermediate B.Sc. Liverpool ; the Intermediate Examination of the University of London ; and the various Preliminary Professional Exaimnations, including Medical, Dental, and Pharmaceutical.

The Institute is affiliated to

THE MANCHESTER UNIVERSITY.

and recognised as a privileged Institution under their Ordinances to the extent that the attendance in the courses in Physics, Mathematics, and Chemistry at the Institute is accepted as satisfying the attendance for the Intermediate B.Sc. or Intermediate B.Sc. Tech. Courses.

The following is an extract from the " Manchester University Calendar " as applied to Privileged Institutions :—

> A Student of an affiliated Institution shall be exempted from attendance on such portion or portions of the regular course of study in the University as the Senate may approve, provided that—
>
> (a) He has attended at the recognised Institution a course of study approved by the Senate and extending over at least two years, unless for special reasons and on the recommendations of the Council the Court of the University shall reduce this period to one year in any individual case.
>
> (b) Before the commencement of the course of study in the recognised Institution the student shall have attained the age of 17 years.
>
> (c) At least one year of study at the recognised Institution shall be taken subsequent to the passing of the Matriculation Examination by the student, or such other examination as may be approved by the Joint Matriculation Board as exempting from the Matriculation Examination..
>
> (d) In no case shall a degree be conferred upon any person who has not attended in the University during two years at least the courses of study recognised for such degree.

THE LIVERPOOL UNIVERSITY.

also recognises the Institute under the provisions of Ordinance 29, Clause 4, for the purpose of courses of study qualifying for a degree in Science. The terms of this Clause are as follows :—

In the case of any affiliated College or Institution or of any part of such College or Institution recognised for the purposes of this Clause, students who have attained the age of 17 years and have passed the Matriculation Examination of the University, or an examination or examinations exempting from the Matriculation Examination, shall be allowed to attend at any such College or Institution a part or whole of a course of study approved by the Senate of the University as qualifying in part or in whole for exemption from the first year of attendance upon courses of study in the University. Such students may be then admitted to any degree examination for which a year's study is prescribed, and may enter the University as students of the second year, and shall be allowed to present themselves for the Degree of Bachelor in their respective faculties in the same way and under the same conditions as though they had attended during the first year of study the prescribed courses within the University.

Entrance Examination.

Students desirous of joining the classes must pass an Entrance Examination in General Subjects, or produce satisfactory documemntary evidence that they are able to profit by the proposed course of instruction.

The Entrance Examination will be held at the Harris Institute, on Monday morning, September 20th, 1915, from 9-30 to 12-30.

All new students must report themselves at that time, and either sit for the examination or produce certificates, etc.

New Students desirous of joining after the beginning of the Session must pass an Entrance Examination.

Discipline.

All students are expected to attend punctually and regularly, and do the prescribed homework. Irregularity in any of these, without adequate cause, will be reported to the Principal.

Fees.

Students wishing to take a definite Course of Lectures, suitable for the Examination of the Manchester, Liverpool, and London Universities may do so on payment of a Composition Fee of £10 10s. for the Course.

All fees *must be paid in advance*, and Students must obtain the official receipt and show the same to the Lecturer before their names can be entered on the Register.

For each Course of Lectures in any One Subject:—

	£	s.	d.	
Two hours per week (per Subject)	2	2	0	per Session.
Three hours per week ,, ...	2	12	6	,,

Fees for Term by arrangement.

STAFF.

HEAD OF DEPARTMENT - - R. H. JONES, M.Sc., F.C.S.

SUBJECT.	LECTURER.
Mathematics	J. T. CORKILL, B.A.
Chief Lecturer in Physics and Mechanics	G. E. GITTINS, B.Sc., A.I.E.E.
Assistant Lecturers	T. D. FARRAR, M.Sc J. D. ATHERTON. A. WOODS.
Chemistry	R. H. JONES, M.Sc. H. CROFTS, M.Sc.
Botany	H. W. EDMUNDS, B.Sc.
Latin, French, English	F. W. JACKSON, B.A.

UNIVERSITY COURSES.

MATRICULATION COURSE.

Subject.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sa
ENGLISH & HISTORY		3-0 to 4-0		2-0 to 3-0	4-0 to 5-0	
FRENCH			12-0 to 1-0		3-0 to 4-0	
LATIN		2 to 3		3-0 to 4-0		
MATHEMATICS		4 to 5	9-15 to 11-15	4 to 5.		
MECHANICS			2-30 to 3-30			
PHYSICS	2-0 to 4-0 (Prac.)	9-30 to 10-30 Heat & Light		9-30 to 10-30 (Mag.& Elect)		
CHEMISTRY	10-30 to 11-30	11-30 to 12-30 (Tutorial)		11-0 to 12-30 (Pract.)	9-30 to 10-30	
BOTANY	9-30 to 10-30		2-0 to 4-0			

INTERMEDIATE COURSE.

(This Time Table is subject to revision).

Subject.	Mon.	Tues.	Wed.	Thurs.	Fri.
HEMATICS		4 to 5.	9-15 to 11-15	4 to 5.	9-30 to 10-30
SICS	2 to 4 (Pract.)	10-15 to 12-15 2-0 to 3-30		11-0 to 12-0 2-0 to 4-30	12-0 to 1-0
MISTRY	11-30 to 12-30 (Organic)	11-30 to 12-30 (Tut.) 2 to 4 (Pract.)		2 to 4 (Pract.)	10-30 to 11-30 (Inorganic)

DENTAL AND PHARMACY COURSE.

Subject.	Mon.	Tues.	Wed.	Thurs.	Fri.
SICS	2-0 to 4-0 (Prac.)	9-30 to 10-30 Light & Heat		9-30 to 10-30 Mag. & Elec.	
MISTRY	10-30 to 11-30	11-30 to 12-30 (Tutorial).		-0 to 12-30 (Prac.)	9-30 to 10-30
ANY.....	9-30 to 10-30		2-0 to 4-0		

SYLLABUS OF CLASSES.

MATHEMATICS.

Lecturer, J. T. CORKILL, B.A.

Mariculation Course—

(1) Arithmetic and Elementary Algebra to Quadratic Equations (inclusive), with Arithmetical and Geometrical Progressions, and an Elementary treatment of Irrational Quantities and Proportion.

(2) Geometry—the subjects covered by Euclid I. to VI.

Intermediate Course—

(1) Substance of Euclid VI.; Elementary Solid Geometry; Mensuration of Simpler Solids.

(2) Algebra—the simpler portions beginning with Progressions.

(3) Plane Trigonometry to Solution of Triangles (inclusive).

(4) Analytical Geometry of the Straight Line and Circle.

For more Advanced Students—Elementary Analytical Geometry of the Conic Sections; Differentiation and Integration of Simple Algebraical and Trigonometrical Functions.

PHYSICS AND MECHANICS.

Chief Lecturer: G. E. GITTINS, B.Sc.

Assistant Lecturers: T. D. FARRAR, M.Sc.

J. D. ATHERTON.

A. WOODS.

Matriculation Course—

(1) Mechanics.

The elementary portions of statics, kinetics, and of the properties of liquids and gases, including:—laws of motion; uniform acceleration; composition and resolution of forces in one plane; moments of forces; work and energy; centre of gravity; uniform circular motion; simple pendulum; direct impact; fluid pressure; specify gravity; Boyle's law.

(1) GENERAL PHYSICS—

Units of length, mass and time. Velocity, momentum, acceleration, force and work. Distinctions between solids, liquids, and gases. Density and specific gravity. Atmospheric pressure. Barometers. Siphon, Diffusion. Osmosis. Dialysis. Surface Tension and capillarity.

(2) PHYSICS.

(*a*) HEAT.—Temperature. Thermometers. Expansion of solids, liquids and gases. Laws of Boyle and Charles. Quantity of heat. Specific heat. Latent heat. Vapour pressure. Conduction radiation.

(*b*) LIGHT.—Laws of reflection and refraction. Photometry. Formation of images by mirrors and lenses. Chromatic dispersion. Combination of two lenses. The Spectrometer. Simple microscope and telescope.

(*c*) MAGNETISM.—Magnets. Magnetic properties and magnetic induction. Magnetic force. Magnetic field. Terrestrial Magnetism.

(*d*) ELECTRICITY.—Simple voltaic cell. Magnetic field of current. Measurements of current. Electro motive force and resistance. Measuring instruments such as the Galvanometer. Ammeter, Voltmeter. Ohm's law. Heating effects of the current. Electrolysis. Electro-magnetic induction.

Elementary Statical Electricity, including :—Condensers, Law of Electric Force, and Potential.

LABORATORY CLASS.

Each Student is required to provide a Standard Laboratory Note Book, in which to enter an account of every experiment completed. As this is a very important part of the Laboratory Course, the Teacher in charge has instructions to see that the rule is strictly carried out.

The work in the Laboratory is arranged to illustrate and amplify the lecture course.

INTERMEDIATE COURSE.

INTERMEDIATE SCIENCE. LONDON AND VICTORIA UNIVERSITIES.

(*a*) GENERAL PHYSICS.—Properties of solids, liquids and gases. Laws of Boyle and Charles. Viscosity. Diffusion. Surface tension. Osmosis. Pendulums, simple and compound. Torsion pendulum. Young's modulus.

(*b*) HEAT.—The work of the Matriculation Course together with Hygrometry, Thermal conductivity, Radiation and the Theory of Exchanges. The Mechanical Equivalent of Heat and Modes of determination. The Conservation of Energy.

(*c*) LIGHT.—Reflection and Refraction. Photometry. Spherical surfaces and the formation of images. The Spectrum : visible, ultra-violet, infra-red. The diffraction grating. Lenses, elementary mathematical theory of.

(*d*) MAGNETISM AND ELECTRICITY.—Mathematical work dealing with magnets. Terrestrial magnetism. The magnetic properties of iron and the elementary laws of the magnetic circuit.

Primary and secondary cells. Field of current. Measurements of current, pressure and resistance. Measuring instruments. Calculations on the electric circuit. Electro-magnetic induction. Thermo electricity.

Statical electricity: electrification by friction and influence. Electric field. Potential, capacity. Energy of charge. Electrometers. Discharge through gases.

(*e*) SOUND.—Production and propagation of sound. Wave motion. Amplitude. Wave length. Frequency. Determination of the velocity of sound. Reflexion. Determination of frequency. Resonance.

PRACTICAL CLASS.

Suitably graded experiments will be arranged for the Laboratory, and Students are expected to keep a careful record of all work carried out.

CHEMISTRY.

Lecturers, R. H. JONES, M.Sc.; H. Crofts, M.Sc.

Matriculation Course—Elementary Inorganic Chemistry, as per University Syllabus.

Dental Course—(Manchester and Liverpool Universities),

Essentially the same Course as the Matriculation.

Dental Course—(Royal College of Surgeons, London).

Chemistry of the Non-metals and Metals and Elementary Organic Chemistry.

Pharmacentical Course—(Minor Examination).

Chemistry of the Non-metals and Metals and Elementary Organic Chemistry.

Intermediate Course—

Advanced Inorganic and Elementary Organic Chemistry.

Practical Class (Matriculation)—Each Student is required to provide a Standard Laboratory Note Book, in which to enter an account of every experiment completed.

An experiment started must be duly completed satisfactorily.

Practical Class (Dental, Pharmacy, Inter-Science)—The requirements of individual Students will be carefully considered and courses arranged accordingly. A faithful record of all practical work must be kept.

BOTANY.

Lecturer, H. W. EDMUNDS, B.Sc.

Matriculation, Dental and Pharmacy Courses—

Elementary Botany.

Intermediate Course—

Advanced Botany.

LATIN.

Lecturer, F. W. JACKSON, B.A.

Subjects—Accidence and Elementary Syntax, Translations from English into Latin, Special Author and Unseen Translations.

FRENCH.

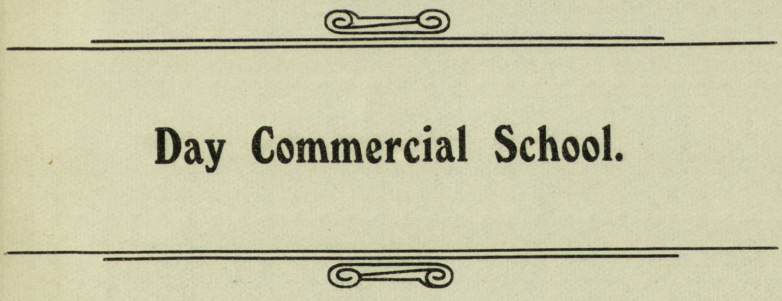
Lecturer, F. W. JACKSON, B.A.

Subjects—Accidence and Elementary Syntax, Etymology, Translation, and Composition.

ENGLISH AND HISTORY.

Lecturer, F. W. JACKSON, B.A.

Subjects—English Grammar—Parsing, Analysis, and Composition; Elementary Knowledge of the Language and Literature; History as per Syllabus.



Day Commercial School.

Day Commercial School.

Day Commercial School.

STAFF:

HEADMASTER:

VINCENT E. COLLINGE, A.C.I.S., F.Inc.S.T.

SUBJECTS AND LECTURERS:

Arithmetic and Mathematics.....J. T. Corkill, B.A.
Miss M. N. Roscamp.

Book-keeping .....V. E. Collinge, A.C.I.S.

Commerce.....V. E. Collinge, A.C.I.S.

Drawing.....Miss M. Duckett.

English.....Miss M. N. Roscamp.

French.....J. T. Corkill, B.A.

Geography .....Miss M. N. Roscamp.

History .....J. Hasenclever.

Physical Drill.....V. E. Collinge, A.C.I.S.
Miss M. N. Roscamp.

Shorthand.....V. E. Collinge, A.C.I.S.
Miss V. W. Spencer.

Typewriting .....Miss V. W. Spencer.

OBJECTS OF THE SCHOOL.

The primary object of the School is to prepare boys and girls for clerical posts in commercial and professional offices. The curriculum, however, is drawn up on broad lines, for the purpose of enabling Students to build a sound commercial education on the foundation of the chief primary subjects and the commercial

subjects provided. Specialised training will be given in the essential vocational subjects of a clerk's education; but little time will be spent with mere routine work which is quickly acquired by any office junior, though the reasons for the performance of such work, and the principles underlying it, will be clearly explained and thoroughly well grounded.

All the instruction will be given with the definite purpose of enlarging and improving the mental powers of the Students, so that any who aim at accountancy, secretarial, or other professional vocations, may have an initial training and equipment which will assure their subsequent progress.

The Syllabuses are so arranged as to admit of progression in the Advanced Evening School Courses, after the conclusion of the Day School Course.

ADMISSION TO THE SCHOOL.

Those seeking information respecting admission to the School should note the following regulations :—

(*a*) The AGE of the Student on the day of admission must be not less than 13. Students aged 16 and upwards should inform the Principal of their requirements, and special classes may be arranged.

(*b*) An ENTRANCE EXAMINATION must be passed in Arithmetic, English, and Geography (Standard VII work).

A number of ENTRANCE SCHOLARSHIPS, giving free admission to the School for two years, are offered by the Council of the Institute on the results of a special examination in the above subjects. Such scholarships are open to scholars of not less than two years' attendance at a Public Elementary Day School in the Borough of Preston.

(*c*) A scholar attending an Elementary School in the Borough, should first apply to the Director of Education, through the Head Teacher of the School attended. Other Candidates must apply to the Principal of the Harris Institute.

(*d*) Each Candidate for admission must produce a written statement of the intention of his or her parent or guardian to keep such candidate at the school for the full two-years' course.

[N.B.—Should a suitable position be offered, permission may be granted to leave the school prior to the completion of the two-years' course.]

(*e*) The Head Master may be consulted respecting admission to the School, on Monday, September 20th, from 9-30 to 12-30, and 2-0 to 4-0, also on Tuesdays and Fridays, from 9-0 to 10-0 or 2-0 to 3-0.

(*f*) The School is subject to the general rules governing the Institute.

(*g*) The School Session opens on Tuesday, September 21st, 1915, and closes on Friday, July 8th, 1916. It consists of three terms of 13 weeks each.

FEES.

(*h*) The Fee for admission is Fifteen Shillings per term, payable in advance, at the School. The receipts for admission fees must be presented to the Head Master for initialing.

TEXTBOOKS, ETC.

The textbooks and stationery prescribed, must be obtained by all students. The cost will be kept within reasonable limits.

ATTENDANCE.

Regular and punctual attendance is absolutely necessary. No student may be absent without permission from the Head Master. In cases of unavoidable absence explanations from the parent or guardian must be sent to the Head Master.

HOMEWORK.

In addition to Class Work, students will be required to do a certain amount of Homework. Marks awarded for Homework and General Conduct, will be taken into consideration when any recommendation or Certificate is given at the end of the Course.

REPORTS.

Reports as to the progress of the students will be sent to parents or guardians, at the end of each term. Scholarship students whose report at the end of the first year is unfavourable may have the Scholarship cancelled.

The Head Master may be interviewed on Tuesdays and Fridays, from 9-0 to 10-0 and 2-0 to 3-0.

TIME TABLE.—FIRST YEAR.

	Morning.			Afternoon.		
	9-15–10-15	10-15–11-15	11-15–12-15	2–3	3–4	4–4-30
Monday.....	Mathematics (Algebra)	French	English	Arithmetic & Accounts	Shorthand	Drill (boys)
Tuesday	Shorthand	Arithmetic & Accounts	Commerce	Geography	English	Drill (girls)
Wednesday...	English	Mathematics	French	Arithmetic & Accounts	Typewriting	Drill (boys)
Thursday	Shorthand	Drawing	English	Geography	Arithmetic & Accounts	Drill (girls)
Friday.....	French	Shorthand	Arithmetic & Accounts	Typewriting	History	.....



TECHNICAL SCHOOL,
PRESTON.

TIME TABLE.—SECOND YEAR.

	Morning.			Afternoon.		
	9-15–10-15	10-15–11-15	11-15–12-15	2–3	3–4	4–4-30
Monday.....	French	Shorthand	Commerce	Typewriting	History	Drill (boys)
Tuesday	English	Bookkeeping	Geography	Mathematics (Algebra)	French	Drill (girls)
Wednesday...	Shorthand	Bookkeeping	English	Typewriting	Arithmetic	Drill (boys)
Thursday	Drawing	Commerce	Shorthand	Mathematics (Algebra)	French	Drill (girls)
Friday.....	Geography	Arithmetic	Typewriting	English	Bookkeeping	.....

School of Agriculture.

School of Agriculture.

SCHOOL OF AGRICULTURE.

——:o:——

SESSION 1915-1916.

The Agricultural School is carried on by the Council of the Harris Institute, by arrangement with the Lancashire County Council, as part of the County Scheme of Instruction in Agriculture.

Systematic instruction in the principles and practice of Agriculture, in Chemistry, Botany, Zoology, Geology, Veterinary Science, Book-keeping, Engineering, and Land Surveying, &c., will be given at the County Council Agricultural School, Harris Institute, Preston, during the Session commencing on Tuesday, the 21st September, 1915, and ending on the 2nd April, 1916.

The object of this School is to prepare young men and women for the work of a farmer's life, by instructing them in the principles which underlie farming operations, and demonstrating—in the lecture room and on the farm—modern and scientific methods of Agriculture. The full course extends over three winter sessions, each comprising 26 weeks.

The Session will consist of Two Terms, viz. :—

First Term from Tuesday, 21st September, to Friday, 17th December, 1915, about 13 weeks.

Second Term from Tuesday, 11th January, to Friday, 7th April, 1916, about 13 weeks.

I.—DIPLOMA COURSE IN AGRICULTURE.

First Winter Session.

The first winter's work is of a preparatory character, leading up to the more specialised work of the following year. The work of the course covers those subjects included in the Examination for the Agricultural Exhibitions of the Lancashire Education Committee.

Second Winter Session.

During the second winter's study the Students are given thorough instruction in Agriculture, Botany, Bookkeeping,

Engineering, and Land Surveying. These subjects being given an agricultural bias, provide a training which will be of considerable value to those who will subsequently enter on farming careers. The Students are enabled to take these subjects in the National Diploma Examination and to compete for the Junior Agricultural Scholarships which may be awarded by the Lancashire Education Committee.

Third Winter Session.

This constitutes the last year of the Diploma Course. At this stage the subject of Agriculture receives special attention, particularly from the practical point of view; the stocking of farms, valuation, judging of stock, estimates, &c., being thoroughly dealt with; while Zoology, Veterinary Science and Agricultural Chemistry are also fully treated. These three are the remaining subjects for the National Diploma in Agriculture, the Lancashire Diploma in Agriculture, and are also the subjects of examination for the Senior Agricultural Scholarships which may be awarded by the Lancashire Education Committee.

II.—SHORT COURSE IN AGRICULTURE.

This Course, which comprises the first Winter Session of the Diploma Course, is suitable for those who are not in a position to devote three winters to the study of Agriculture and the Allied Sciences, but who wish to gain a working acquaintance with the general principles underlying agricultural operations.

Rules and Regulations.

1.—Students are required to attend punctually and regularly the classes for which their names are entered, and are expected to satisfy the Lecturers with their diligence and progress in the prescribed class work.

2.—The Principal of the Harris Institute is responsible for the attendance and discipline of the Students, and leave of absence from any class must be obtained from him. In the case of absence without leave, a written explanation must be sent to him.

3.—All Students are required to take the Terminal Examinations in the classes which they attend.

4.—The Course of study taken by Students holding Exhibitions or Scholarships must be approved by the Director of Education.

5.—Students are required to provide themselves with the Text Books used in the classes which they attend.

6.—Students who do not live with their parents or guardians are required to reside in approved apartments or lodgings, a list of which is kept at the Office of the Harris Institute. Students may, however, apply to the Principal for approval of any house at which they desire to stay. Removals cannot be made during a Session without reporting the matter to the Principal for his approval. At the end of each term, reports as to the conduct, regular hours, &c., of the Students will be obtained from the housekeeper where the Student resides, such reports being submitted to the Agricultural Committee for their consideration.

7.—Students may be requested to withdraw from the School before the completion of the Session, if the reports of their attendance, progress, or conduct are unsatisfactory.

Definition of County Students and further particulars of Syllabuses and Dairy Diploma Course, may be obtained from " The Scheme of Agricultural Education," issued by the Lancashire Education Committee.

Students residing in the administrative County of Lancaster, who seek admission, should, in the first instance apply for particuars to the Director of Education, County Offices, Preston.

Non-County Students should apply to T. R. Jolly, Principal of the Institute.

The Fees for Students not resident within the administrative County of Lancaster, are :—

For Full Course—

£10 10s. 0d. per Session.

£5 5s. 0d. per Term.

Payable in advance

STAFF.

Agriculture	THOMAS MILBURN, Ph.D., N.D.A., N.D.D. C. P. MAY, B.A., Univ. Dip. Agr. R. BOUTFLOUR, B.Sc.
Chemistry	R. H. JONES, M.Sc., F.C.S.
Agricultural Chemistry	H. CROFTS, M.Sc.
Zoology and Dairy Farming	C. P. MAY, B.A., Univ. Dip. Agr.
Botany, Geology, and Bacteriology	H. EDMUNDS, B.Sc.
Building Construction	W. RAWCLIFFE.
Veterinary Science	C. BLACKHURST, M.R.C.V.S.
Land Surveying	W. RAWCLIFFE.
Engineering	G. E. GITTINS, B.Sc., A.I.E.E. E. C. MOYLE, A.R.C.Sc. F. W. WALKER, 1st. Dip. M.E.
Physics and Mechanics	G. E. GITTINS, B.Sc., A.I.E.E.
Mathematics and Mensuration	J. T. CORKILL, B.A.
English	J. HASENCLEVER.
Book-keeping	V. E. COLLINGE, A.C.I.S., F.Inc.S.T.
Drawing	W. RATHBONE.

Principal and Secretary of the Harris Institute : T. R. JOLLY, F.C.I.S.

TIME TABLES OF AGRICULTURAL CLASSES.

FIRST WINTER SESSION.

Hours.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday
n. a.m. 30 to 10-30	BOTANY.	AGRICULTURE	AGRICULTURE	BOTANY	MENSURATION
n. a.m. 30 to 11-30	GEOLOGY.	PRACTICAL BOTANY	ENGLISH.	GEOLOGY	MATHEMATICS
n. p.m. 30 to 12-30	MATHEMATICS		DRAWING	AGRICULTURE	MECHANICS & PHYSICS
m. p.m. -0 to 3-0	BOOK-KEEPING	MECHANICS AND PHYSICS	MATHEMATICS	First Term. VETERINARY SCIENCE Second Term FARM CLASS.	PRACTICAL CHEMISTRY
m. p.m. -0 to 4-0					
.m. p.m. -0 to 5-0	GENERAL CHEMISTRY	...	...	...	...

SECOND WINTER SESSION.

Hours.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.
m. a.m. 30 to 10-30	AGRICULTURE	ENGINEERING	AGRICULTURE	ENGINEERING (9-30 to 11-15)	AGRICULTURE
m. a.m. 30 to 11-30	...	CHEMISTRY (10-45 to 11-45)	PRACTICAL BOTANY		BOOK-KEEPING (10-45 to 12-15)
m. p.m. 30 to 12-30	BOTANY	TRIGONOMETRY (11-45 to 12-45)		BOTANY	
.m. p.m. -0 to 4-0	BUILDING CONSTRUCTION	MENSURATION AND LAND SURVEYING	BOOK-KEEPING	MENSURATION AND LAND SURVEYING	1st Term ELECTRICAL ENGINEERING. 2nd Term *FIELD WORK

*Occasional Demonstrations in Agriculture and Botany will be arranged.

THIRD WINTER SESSION.

Hour.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.
a.m. a.m. 9-30 to 10-30	VETERINARY SCIENCE	AGRICULTURE	**1st Term.** FARM CLASS	AGRICULTURE	VETERINA SCIENCE
a.m. a.m. 10-30 to 11-30	AGRICULTURE	AGRICULTURAL CHEMISTRY	**2nd Term.** VETERINARY SCIENCE† (9-30 to 10-30)	PRACTICAL ZOOLOGY	ZOOLOGY
a.m. p.m. 11-30 to 12-30	ZOOLOGY	ZOOLOGY	ORGANIC CHEMISTRY (10-30 to 11-30		**1st Term** BACTERIOLO **2nd Term** DAIRY FARMING
p.m. p.m. 2-0 to 3-0	AGRICULTURAL CHEMISTRY*	AGRICULTURAL CHEMISTRY (3-0 to 5-0)	**1st Term.** VETERINARY SCIENCE† (2 to 3)	AGRICULTURAL CHEMISTRY	AGRICULTU CHEMISTR
p.m. p.m. 3-0 to 4-0	*		**2nd Term.** FARM CLASS (2 to 4)		

* Occasional Excursions to Farms will be arranged.

† Occasional Veterinary Demonstrations will be arranged.

SHORT COURSE.

Students taking this Course will attend the Lectures shown in the time tables for the First Winter Session of the Diploma Course.

TIME TABLE OF DAIRY DIPLOMA COURSE.

FIRST TERM—SEPTEMBER TO CHRISTMAS (13 WEEKS),

	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.
ORNINGS	———PRACTICAL BUTTER AND CHEESE MAKING———				
m. p.m. 0 to 3-0	BOOK-KEEPING (P)	DAIRYING (H)	DAIRYING (H)	VETERINARY SCIENCE (P)	ELEMENTS OF THEO. CHEM. (P)
m. p.m. 0 to 4-0		DAIRY MACHINERY (H)	AGRICULTURE (H)		PRACTICAL CHEMISTRY (P)
m. p.m. 0 to 5-0	...	...	...	...	

SECOND TERM—JANUARY TO APRIL, (13 WEEKS).

	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.
ORNINGS	———PRACTICAL BUTTER AND CHEESE MAKING———				
m. p.m. 0 to 3-0	BOOK-KEEPING (P)	DAIRY CHEMISTRY (P)	DAIRYING (H)	DAIRY BACTERIOLOGY (P)	DAIRYING (H)
m. p.m. 0 to 4-0		PRACTICAL DAIRY CHEMISTRY (P)	DAIRY FARMING (H)	PRACTICAL DAIRY BACTERIOLOGY (P)	AGRICULTURAL CHEMISTRY (H)
m. p.m. 0 to 5-0	...		...		...

THIRD TERM—APRIL TO JULY (14 WEEKS).

	Monday.	Tuesday	Wednesday.	Thursday.	Friday.
ORNINGS	———PRACTICAL BUTTER AND CHEESE MAKING———				
m. p.m. 0 to 3-0	DAIRYING (H)	DAIRY CHEMISTRY (P)	DAIRY FARMING (H)	DAIRY BACTERIOLOGY (P)	DAIRY FARMING (H)
m. p.m. 0 to 4-0	AGRICULTURAL CHEMISTRY (H)	PRACTICAL DAIRY CHEMISTRY (P)	...	PRACTICAL DAIRY BACTERIOLOGY (P)	BOTANY (H)
m. p.m. 0 to 5-0	...				...

Analytical Department.

Analyst, HAROLD CROFTS, M.Sc.

The Chemical Department of the School is prepared to analyse and report on samples of Manures, Feeding Stuffs, Soils, Waters and Dairy Produce, at especially low fees, for farmers, residing in the administrative County of Lancaster.

Care is taken to ensure the accuracy of any analysis, but no responsibility with regard to it is assumed.

On forwarding samples, *separate* letters should be sent specifying the nature of the information required, and, where possible, the object in view.

All samples for analysis, and all communications referring to analysis, must be addressed to T. R. Jolly, Principal and Secretary, Harris Institute, Preston, and endorsed "Analytical Department."

The Laboratory of the Institute will usually be closed during the month of August.

FEES.

SPECIAL FEES FOR ANALYSIS PAYABLE BY FARMERS.

The following Fees for Analysis will be payable by Farmers residing in the County of Lancaster, provided that such Analyses and reports be required for *bona-fide* agricultural purposes, and for the private information only of the Farmer applying for them ; and they are not conducted for the use of manufacturers or traders.

In the event of any Analysis or report showing a manure or feeding stuff to be either impure or below the guarantee given by the purchaser, the latter is at liberty to show such report and Analysis to the vendor ; but if the material proves to be up to the guarantee given, the Analysis and report must *not* be communicated to either vendor or manufacturer.

No money value of a manure or feeding stuff will be assessed, but if the Farmer names the price charged, the cost of carriage, and any other items which influence the cost, the Analyst will say whether the material is, in his opinion, worth the sum charged.

In the event of any report being misused, the farmer shall be called upon to pay to the Principal of the Harris Institute the ordinary Analyst's fee of one or two guineas.

LIST OF FEES.

	£	s.	d.
1.—Determination of the percentage of Nitrogen in a Sample of Sulphate of Ammonia, Shoddy, Horn Dust, Dried Blood, or other Nitrogenous Manure...	0	2	6
2.—An Analysis of a Sample of Nitrate of Soda.....	0	2	6
3.—Determination of the percentage of Soluble Phosphates in a Sample of Mineral Superphosphate or in any other manure.....	0	2	6
4.—Determination of the percentage of Insoluble Phosphates in a Sample of Basic Slag (Thomas' Phosphate Powder), or in any other Manure.....	0	2	6
5.—Determination of the percentage of Soluble and Insoluble Phosphates in any Manure.....	0	3	6
6.—Determination of the percentage of Nitrogen, together with the Soluble *or* Insoluble Phosphate in any Manure (such as Bone Meal, &c.).....	0	3	6
7.—Determination of the percentage of Nitrogen, together with the Soluble *and* Insoluble Phosphates in any Manures (such as Dissolved Bones, Compound Manures, &c.).....	0	5	0
8.—Determination of the percentage of Potash in Sulphate of Muriate of Potash, &c.....	0	2	6
9.—Determination of the percentage of Lime in Limestone or Marl.....	0	1	6
10.—Determination of the percentage of Lime, Magnesia, and Phosphoric Acid in Limestone or Marl.....	0	5	0
11.—Determination of the percentage of the essential constituent in a Feeding Stuff (Oilcakes, Meals, &c.)...	0	5	0
12.—A *Complete* Analysis of any Manure or Feeding Stuff.....10s to	1	0	0

13.—A *Partial* Analysis of a Sample of Soil.....	0	10	0
14.—A *Complete* Analysis of a Sample of Soil.....	1	10	0
15.—Determination of the Hardness of a Sample of Water	0	3	6
16.—An Analysis of a Sample of Water to determine its suitability for domestic purposes.....	0	10	6
17.—Analysis of a Sample of Milk, Butter, or Cheese.....	0	5	0

Note.—(1) Fees for other determinations will be given on application.

(2) All Fees must be paid at the time of sending the samples to the Principal, Harris Institute, Preston.

Instructions for Selecting and Sending Samples for Analysis.

Take a large handful from several of the bags, break down any lumps with the hand, and mix the whole well together on a large sheet of paper. From the heap select six small portions of about 4 oz. each, and, after mixing these thoroughly together, put the mixture into a clean, dry, wide-necked bottle, with a well-fitting cork or stopper, or into a well-fitting clean tin box. Samples for analysis should upon no account be merely put up in paper.

Soils.

Dig a little trench about two feet deep, exposing the soil and subsoil. Cut from the side of this trench vertical scrapings of the soil down to the top of the subsoil. Catch these on a clean board, and collect in this manner about one pound weight of soil taken from the whole surface of the section. Similar scrapings of subsoil immediately below should be taken and preserved separately. Five or six similarly drawn samples should be taken from different parts of the field, and kept separately while being sent to the analyst, that he may examine them individually before mixing in the laboratory.

Waters.

The water should be sent in a perfectly clean Winchester quart bottle, made of clear glass, and with a well-fitting glass stopper, which is readily obtained at any chemist's shop, or the same will be supplied, ready for use, on application to the Principal of the Harris Institute—the carriage to be paid by the sender of the water. The

sample bottle should be rinsed out twice with the water to be analysed before being filled. Well water should be allowed to run for some time before the sample is drawn. Standing water from cisterns, ponds, &c., should be sampled by immersing the bottle entirely under water, and holding it, neck upwards, about four inches below the surface. Spring or stream water should be sampled in dry weather, by immersion, if possible; but, if not deep enough for that, a perfectly clean cup or glass should be used for transferring the water to the bottle. When the bottle has been filled, the stopper should be rinsed in the water before being replaced, after which it is to be securely tied down and sealed. For determination of the degree of hardness only one quart wine bottle of the water is required; this bottle must also of course, be perfectly clean.

N.B.—Samples should be dated and despatched to the laboratory immediately after being taken.

It ought to be unnecessary to add that the water supply of very farm should be above suspicion.

Limestone, Marls, Ironstones, and other Minerals.

Whole pieces, weighing from 4 to 8 oz., should be sent. These may be enclosed in small linen bags or wrapped in paper if there is no tin at hand.

Oil Cakes.

Take three slips (of the entire breadth of the cake) from the middle of three whole cakes, breaking the latter into two halves for the purpose. The three strips should then be packed in a tin, and the latter dated, labelled, and sealed down.

Feeding Meals.

Samples of these should be taken in the same manner as samples of manure, and put into tins. About 4 to 6 oz. are sufficient for an analysis.



Junior Technical School,

FOR BOYS.

Junior Technical School.

———:o:———

STAFF.

HEAD MASTER.

E. C. MOYLE, A.R.C.Sc. (Lond.), A.M.I.Mech.E., Wh.Ex.

LECTURERS AND INSTRUCTORS.

English and Penmanship	F. W. JACKSON, B.A. J. HASENCLEVER.
Freehand Drawing	W. E. BURTON.
Mathematics	E. C. MOYLE, A.R.C.Sc.
Metal Work	F. W. WALKER, Dip. M.E.
Practical Drawing	J. H. BINFIELD, Wh. Ex.
Science	D. FARRAR, M.Sc.
Woodwork	S. RUTTER (Silver Medallist)
Physical Drill	V. E. COLLINGE, A.C.I.S.

OBJECT OF THE SCHOOL.

The aim of the School is to provide a suitable education for boys, who, having completed the ordinary course of work in the Elementary Day School, desire to enter

ENGINEERING, BUILDING and other TRADES.

The complete course of instruction extends over a period of two years, and the curriculum is planned on a broad basis, the object being to give a good general training in all the subjects necessary to workmen wishing to carry on their trades under the best possible conditions.

With the modern tendency towards specialization of work, and the introduction of labour-saving appliances, the training of an apprentice must necessarily be to some extent limited. No attempt is made in this School to teach a trade, but a sound scientific and technical training is given with the object of enabling a boy better to adapt himself to new circumstances which may arise during his trade career.

The training given is a continuation of the most essential portions of the work of the Day Elementary School combined with training of a more practical and technical nature. In connection with the latter, reference to the Syllabus will show that special attention is paid to Practical Sketching and Drawing, Calculations, Workshop Practice and Science.

On completion of his training in the School and upon entrance to his apprenticeship the pupil will be strongly advised to join the Evening Classes. This he will be able to do without the necessity of having to pass through the elementary courses. His subsequent study will therefore be much easier, and by being able to start his apprenticeship with a sound knowledge of elementary principles, there will necessarily be advantage to both himself and his employer. It is hoped that employers of labour, especially those connnected with the Engineering, Building, and Textile Trades will so far support the work of the School as to encourage the employment of boys who have attended these Courses.

TIME TABLE (See pages 6 and 7).

Practical Mathematics includes Arithmetic, Algebra, Use of Logarithms, Geometry and Trigonometry, with special application to Workshop Calculations.

Practical Drawing includes the Sketching and Drawing to Scale of details relating to Engineering and other trades.

English includes Geography, History, Composition, &c.

Science includes Physics and Mechanics.

In addition to Class Work, Pupils will be required to do a certain amount of Homework.

Marks awarded for Homework and General Conduct will be taken into consideration when any recommendation or Certificate is given at the end of the Course, and reports as to the progress of each Student will be sent to the parents at the end of each term.

ADMISSION TO THE SCHOOL.

(*a*) Each boy admitted must not be less than 13 years old at the date of admission, and must pass the School Entrance Examination in Arithmetic, Drawing, and English, equivalent to the work done in Standard 7.

(*b*) Boys leaving the Elementary Schools in the Borough of Preston should, in the first instance, apply to the Director of Education through the Head Masters of the Schools at which the boys attend. Other Candidates must apply to the Principal of the Institute.

(*c*) Each boy must produce a written statement from his parents that it is their intention to keep him at the School for the full Course, and then for him to proceed to some trade or industrial occupation.

(*d*) The School is subject to the general conditions governing the Institute.

N.B.—In special cases, where a suitable position for the boy is offered for entry into a trade, permission may be given to him to leave the School prior to completing his two years' course.

ATTENDANCE.

Regular and punctual attendance is absolutely necessary. No boy may be absent without permission from the Head Master. In cases of unavoidable absence explanation from the parents must be sent to the Head Master.

FEES.

The Fee for admission is fifteen shillings per term, payable in advance at the School. The School year consists of three terms of 13 weeks' each.

SCHOLARSHIPS.

Entrance Scholarships giving free admission to the School for two years are offered by the Council of the Institute on the result of an Entrance Examination. The Scholarships are open to boys who have been Scholars in Public Elementary Day Schools in the Borough for not less than two years.

The Head Master may be consulted by the parents of intending pupils at the School on Tuesday afternoons between 2 and 4 p.m.

The School opens on Tuesday September, 21st. 1915.

The Head Master will be at the Technical School on Monday, September 20th, 1915, from 9-30 to 12-30 and 2-0 to 4-0 to interview parents.

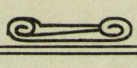
FIRST YEAR.

	MORNING.		AFTERNOON.	
MONDAY	9-30—11-30. Drawing.	11-30—12-30 English	2-0—4-0 Metal Work	4-0—5 0 Mathematics
TUESDAY	9-30—11-30 Drawing	11-30—12-30 Science	2-0—4-0 Mathematics	4-0—5-0 English
WEDNESDAY	9-30—10-30 English	10-30—12-30 Mathematics	2-0—4-0 Science	4-0—5-0 Mathematics
THURSDAY	9-30—10-30 Drill	10-30—12-30 Science	2-0—4-0 Woodwork	4-0—5-0 English
FRIDAY	9-30—11-0 Freehand	11-0—12-30 Mathematics	2-0—4-0 Metal Work	4-0—5-0 English

SECOND YEAR.

	MORNING.		AFTERNOON.		
MONDAY	9-30—11-30 Science	11-30—12-30 Mathematics	2-0—3-0 Science	3-0—4-0 Mathematics	4-0—5-0 English
TUESDAY	9-30—10-15 Drill	10-15—12-30 Mechanics	2-0—4-0 Metal Work		4-0—5-0 English
WEDNESDAY	9-30—11-0 Freehand	11-0—12-30 Woodwork	2-0—4-0 Drawing		4-0—5-0 English
THURSDAY	9-30—10-30 Mathematics	10-30—12-30 Metal Work	2-0—4-0 Mathematics		4-0—5-0 English
FRIDAY	9-30—10-30 Mathematics	10-30—12-30 Drawing	2-0—4-0 Science		4-0—5-0 English

SECOND YEAR.



Cotton Spinning, Weaving & Designing Day Classes.



Cotton Spinning, Weaving & Designing

Day Classes.

DAY TEXTILE CLASSES.

Lecturer: T. E. MITCHELL, A.M.S.T., Medallist in Cotton Weaving (Manufacturing).

Assistant: ED. BLINKHORN.

The Council of the Institute realize that a well adapted scheme of instuction, in connection with the Textile Trades, will be of great value to many Students engaged in the textile industry; thus enabling them to carryon practical work at the mill concurrently with their studies at the Technical School.

The course of instuction is arranged to give a sound training in the theory and practice of Cotton Spinning, Weaving, and Designing, to those who are, or intend to be, engaged in the buying and selling of textile materials, the spinning of yarns, the design and manufacture of woven fabrics, or the manufacture and export of textile machinery.

The scheme of theoretical, practical, and experimental study includes the technology of fibres; the principles and processes of Spinning and Weaving, as applied to cotton and mixed fabrics; together with the various calculations involved in the processes and machinery.

Whilst the instruction is specially intended for those over 16 years of age, who can take the complete course, in special cases the Council may arrange for a Student to take a portion of a Course subject to the approval of the Principal of the Institute.

Fee for all or part of the Course, £3 3s. 0d. per Session, or £1 11s. 6d. per Term of 13 weeks. The Classes will commence on Tuesday, September 21st, 1914.

TIME TABLE

(Subject to Alterations).

	2-15 to 3-30 p.m.	3-30 p.m. to 4-30 p.m.
Monday	Fabric Structure.	Weaving Mechanism.
	9-30 a.m. to 10-30 a.m.	10-30 a.m. to 12-15 p.m.
Tuesday	Cotton Spinning Theoretical.	Practical Spinning and Handsketching.
	9-30 a.m. to 10-30 a.m.	10-30 a.m. to 12-15 p.m.
Wednesday	Weaving Calculations.	Cloth Dissection and Analysis.
	9-30 a.m. to 10-30 a.m.	10-30 a.m. to 12-15 p.m.
Thursday	Spinning Calculations.	Textile Mechanics.
	2-15 p.m. to 4-30 p.m.	
Friday	Practical Weaving and Handsketching.	

Note.—A Full Time Day Course, including other suitable subjects will be arranged for special Students.

TRAINING SCHOOL

OF

Domestic Science.

Training School of Domestic Science.

HOSTEL FOR STUDENTS.

"FERNLEIGH," NEWTON ROAD, ASHTON-ON-RIBBLE.

The above Hostel has been provided for the accommodation of Students who have previously been compelled to live in rooms.

It has been frequently noticed that daily travelling of any distance is detrimental to both health and work. The Authorities of the Training School, therefore, strongly advise that parents and guardians should make use of the Hostel for Students during their time of training.

The house is healthily situated in a suburban part of the town, and has a good garden and tennis court. It is lighted throughout by electricity and the drainage is thoroughly satisfactory. It has every modern convenience, and the health and comfort of the Students has been carefully considered by the Governing body in appointing and furnishing it.

FEES.

	£	s.	d.	
For Full Board and Residence	13	0	0	per Term.
For Students who do not remain at the Hostel at weekends, but only from Monday to Friday inclusive.....each week	11	15	0	,,
Occasional Week-ends for such Students	0	4	0	,,
Extra Days for such Students	0	2	0	per day.
Bed and Breakfast at the Hostel for the convenience of Students attending Evening Classes	0	1	6	

Each Student must bring bath towels, table napkins and toilet soap.

The Fees should be paid at the School of Domestic Science, and may be paid in two instalments if desired ; half at the beginning of the Term, and the remainder at the half-term.

Students are required to give half a term's notice before leaving, such notice to expire at the end of the Term. In default of this they will be charged for the ensuing Term. Fees when once paid will not be returned.

Training School of Domestic Science.

COMMITTEE :

Dr. R. C. Brown, Chairman : Mr. W. Breakell, Vice-Chairman.

Dr. T. H. C. Derham.
Mr. Councillor J. Dewhurst
Mr. E. Dickson.
Mr. H. Wilding.
Miss Ascroft.
Miss Crane.
Miss Hollins.

STAFF.

Superintendent :

MISS PEPPER, B.Sc.

Training School Staff :

MISS HUNTLY.
MISS O'NEILL.
MISS MARSHALL.
MISS SEED.
MISS BOLTON.
MISS NORWOOD.
MISS DUNNETT.
MISS HASSALL.

Additional Staff for Evening Classes, etc. :

MRS. LAMB.
MISS HALLIWELL.
MISS LOMAX.
MISS FOWLER.
MRS. SPEAKMAN BROWN.
MISS E. E. SMITH.
MISS A. CROSS.

Chemistry Lecturer :

Mr. R. H. JONES, M.Sc., F.C.S.

Lecturer in Method and Education :

Mr. F. W. JACKSON, B.A.

Sick Nursing and Ambulance :

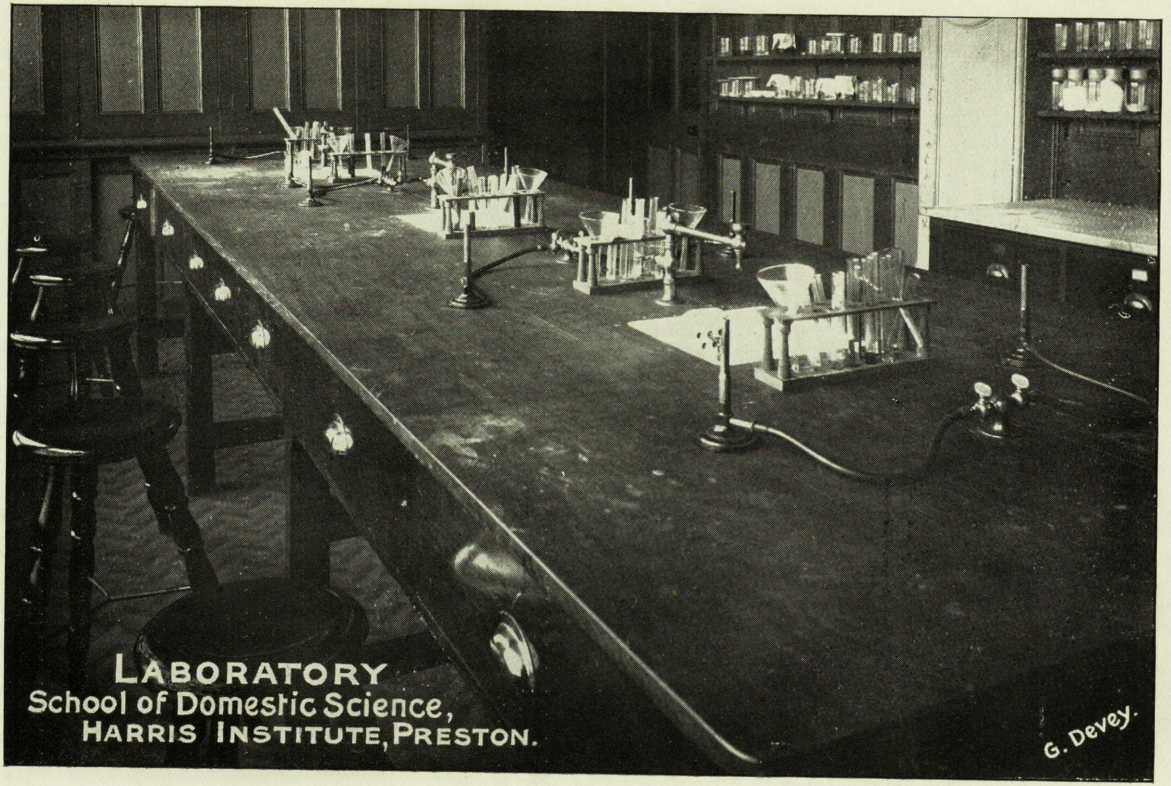
Dr. R. WILKINS.

Correspondent for National Union :

MISS ASCROFT.

Principal and Secretary of Harris Institute :

T. R. JOLLY.


LABORATORY
School of Domestic Science,
HARRIS INSTITUTE, PRESTON.
G. Devey.

Work Undertaken by the Training School.

I. Full Day Courses.

(*a*). The Training of Teachers of all branches of Domestic Science, including Cookery, Laundrywork, Housewifery, Needlework, Dressmaking, and Millinery.

(*b*). Home Life Courses for the training of Housewives.

II. Day Technical Classes in Cookery, Laundry-work, Housewifery, Needlework, Dressmaking, Millinery, Ambulance, and Sick Nursing.

III. Evening Classes in Cookery, Laundry-work Housewifery, Needlework, Dressmaking, Millinery, Ambulance, and Sick Nursing.

Applications for admission and letters of inquiry should be addressed to :—

Miss M. C. Pepper,

Training School of Domestic Science,

Glovers Court,

Preston.

Personal interviews by arrangement.

DAY TRAINING SCHOOL FOR TEACHERS OF DOMESTIC SUBJECTS.

The Day Training School was established in 1894 for the Training of Teachers in all branches of Domestic Subjects.

The School and the Diplomas which it issues are recognised by the Board of Education.

The Day Training School provides instruction in all subjects required by teachers of Cookery, Laundrywork, Housewifery, Needlework, Dressmaking, and Millinery, and organised Courses of instruction in these subjects have been arranged.

Under the Regulations of the Board of Education for the Training of Teachers of Domestic Subjects, it is stated that no Student who does not already hold a Diploma will be admitted to a Training School from 1st August, 1915, onwards, unless she is prepared to take the full Two Years' Course. The authorities of the Training School have, therefore, organised a Two Years' (six terms) Course of Instruction covering the three subjects—Cookery, Laundry-work and Housewifery, in place of the former seven term's course covering these subjects. The work in this Course will be taken in the following order :—

(*a*) An introductory section dealing with simple cleaning processes.

(*b*) Laundry work.

(*c*) Cookery.

(*d*) General home management, including Cookery and and Laundry-work as part of the routine work of the house.

Instruction in Elementary Science in relation to Domestic Subjects and the Principles and Practice of Teaching in relation to Domestic Subjects will be included as essential parts of the Two Years' Course.

The Courses have been devised with a view to giving teachers the necessary skill in Housecraft, together with a knowledge of the scientific principles underlying Household work. Lectures and Laboratory work in Heat, Chemistry, Physiology, Hygiene, are an essential part of the training, as are also Lectures on the Theory and Practice of Education, including Psychology, Methods of Class Teaching, and Organisation, and School Hygiene. For practice in teaching students attend children's and adult classes in the Training School and surrounding districts.

1.—General Conditions of Admission for Diploma Courses.

(i.) AGE.

Candidates for training must be over 18 years of age.

(ii.) PHYSICAL CAPACITY.

They must produce a satisfactory Medical Certificate in a prescribed form.

(iii.) QUALIFICATIONS.

The candidates must hold a certificate giving proof of a good general education (e.g., Oxford and Cambridge Senior Local Certificates, Matriculation. or equivalent) or pass the Entrance Examination of the Training School in the following subjects :—

(*a*) English Literature and Composition.
(*b*) History.
(*c*) Arithmetic.
(*d*) Science or Language.

Fee for Entrance Examination, 2/6.

It is desirable that Candidates should have done preparatory work in Physics and Chemistry, Physiology, and Hygiene, before entering on their course of training.

It is probable that after 1918 no Entrance Examination will be held for Candidates coming directly from a secondary school, but all will be expected to have passed a recognised examination, or to hold a leaving certificate from a recognised school or college, where practical Science has been included in the curriculum.

(iv.) DECLARATION.

Candidates must sign a declaration that they enter the School with the intention of becoming Teachers of Domestic Subjects, either in a Public Elementary School or in some other school approved by the Board of Education for the purpose.

(v.) TIME OF ADMISSION.

Students can be admitted to the organised Courses at the beginning of the session in September. For the separate subjects, Needlework, Dressmaking and Millinery, Students can be admitted at the beginning of any term if there are vacancies.

(vi.) SCHOLARSHIPS.

Two Scholarships for Domestic Economy of the annual value of £60, and tenable for a period not exceeding three years, are given by the Lancashire County Council and can be held at the Preston School.

Particulars can be obtained from Dr. Lloyd Snape, Education Department, County Offices, Preston.

(vii.) EMPLOYMENT AFTER TRAINING.

Every assistance is given to Students in obtaining appointments on the completion of their training. Commencing salaries vary from £80 to about £120 per annum, and so far there has been no difficulty in finding posts for successful Students who have taken the Full Course of Training. There is a growing demand for Domestic Science Teachers in Secondary Schools, and a good demand for Teachers in Technical, Public Elementary, and Evening Schools.

2.—School Terms and Holidays.

The educational year is from the middle of September to the middle of July, and is divided into three Terms of about 13 weeks each.

The holidays are three weeks at Christmas, ten days at Easter, two days at Whitsuntide, and eight weeks at Midsummer.

The hours of attendance are daily (Saturdays excepted) from 9 or 10 a.m. to 4-30 or 5 p.m. In some instances Students are allowed to attend Evening Classes at the Training School in order to become familiar with evening work.

For Session 1915-1916 the terms will be as follows :—

AUTUMN TERM .....Sept. 14th, 1915 to Dec. 22nd, 1915.

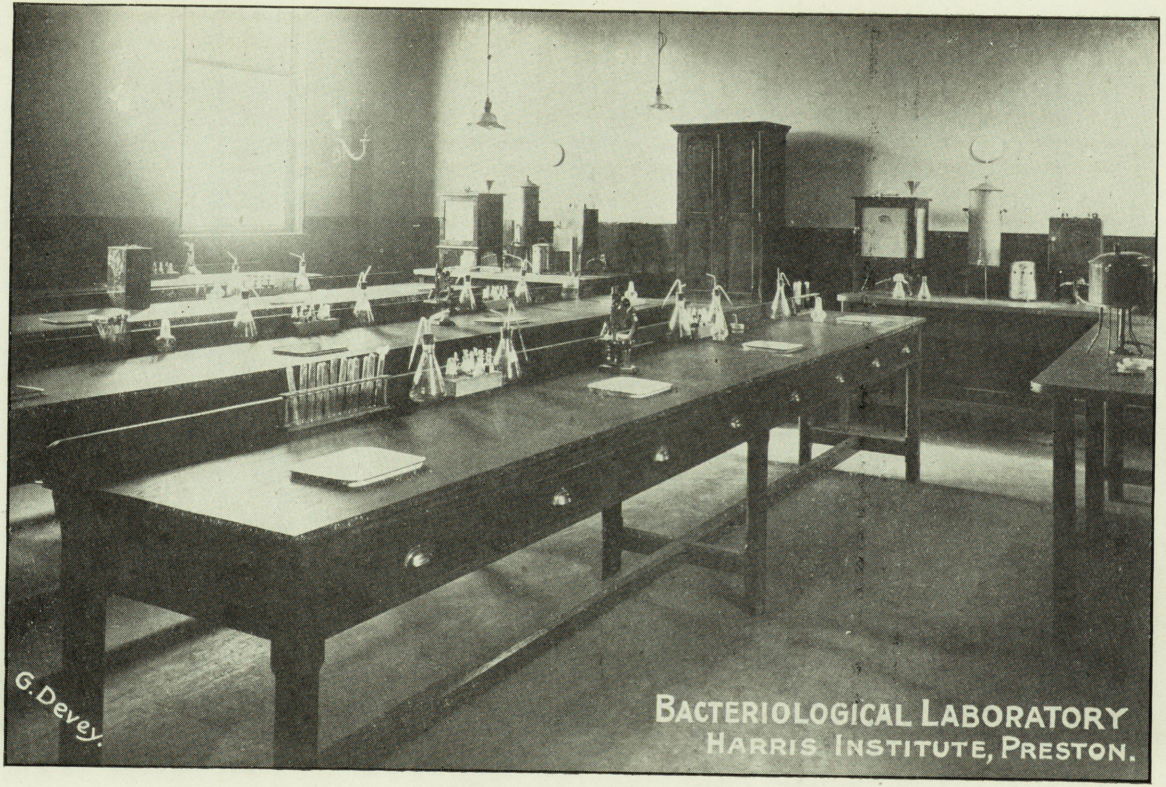
SPRING TERM .....Jan. 18th 1916 to April 19th, 1916.

SUMMER TERM .....May 1st, 1916 to July 14th, 1916.

3.—Rules for Students in Training.

(i.) ATTENDANCE.

Students are expected to attend the classes punctually and regularly. Except in case of illness no Student may absent herself from any class without the permission


G. Devey.
BACTERIOLOGICAL LABORATORY
HARRIS INSTITUTE, PRESTON.

of the Principal. **In case of illness notice should be sent to the Principal at once, followed by a Medical Certificate if asked for.** Immediate notice must be given whenever an infectious disease exists in the house where a Student lives, and no Student is allowed to attend the school from such a house without the permission of the Principal.

(ii.) DRESS.

Students will be expected to wear the uniform of the School, with blue and white striped cotton or flannel blouse (pattern of which may be obtained), navy blue skirt not touching the ground, white linen apron and sleeves, collar and navy blue tie, and white mob cap. No jewellery is allowed. Students should provide themselves with six aprons, tea-towels, pairs of sleeves, two dish-cloths, and two oven cloths, with owners name marked plainly on each article. Students are expected to wear shoes with low heels in the school.

(iii.) DINNER.

Students are expected to have dinner at the school, which is provided at a charge of 6d. per day.

The fee for each week's dinners should be paid at the office on the Monday morning of each week.

IV.—RESIDENCE.

Students unable to live at home will be expected to reside at the Hostel, particulars of which are given on Page 55. Accommodation can be provided at the Hostel for Students who wish to stay the night in Preston after evening school work.

Part of the Hostel is used as a Housewifery School, in which Students will reside for a specified period during the Housewifery section of their training. A boarding fee will be charged for these weeks of residence.

(v.) PRACTICE IN TEACHING.

Students are not allowed to undertake any teaching other than that included in the Training Course, without special permission.

4.—Regulations of the Board of Education for the Award of Diplomas in Domestic Science.

(i.) A Diploma issued by the Board of Education, is regarded as a *prima facie* qualification for teaching (*a*) either scholars in Public Elementary, Higher Elementary, or Secondary Schools, or (*b*) persons under instruction in Technical or other Schools or Classes, whether Day or Evening.

(ii.) In the award of any Diploma the Board of Education will take into account (*a*) the records of the work done and the progress shown by the Student during the course of training; (*b*) the results of the examinations conducted by the Board or by expert examiners approved by the Board.

(iii.) A Diploma will only be provisionally recognised by the Board until the teacher has been employed for two years in a School or Class under inspection. It may then be endorsed by the Board for full recognition if a favourable report from an Inspector of the Board has been received.

(iv.) The Diploma issued by the Board will show the name of the Training School in which the Student was trained, and any passes with distinction obtained by the Student.

(v.) A Two Year Student who is not considered by the Board to be qualified for the award of a Diploma must, in order to qualify for the award of a Diploma, satisfy such further tests as the Board may require in her case, at such times as the Board may appoint.

(vi.) Students must not enter for any Examination other than the Examinations under these Regulations, during the course of Training.

V. Particulars of Training Courses and Fees.

Course I.

All Students wishing to obtain a Diploma in Combined Domestic Subjects must enter for the Two Years' Course. The fee for this course is £50, and it should be paid in instalments of £8 per term until the sixth term, when the balance of the fee should be paid.

The subjects taken in this Course are Cookery, Laundrywork, Housewifery (including Needlework), Hygiene, Physiology, Heat, Chemistry, Theory and Practice of Education, Voice production and Blackboard Drawing. This Course will begin in the September of each year.

Course II.

Students may enter for the course of training for the Diplomas in Needlework Subjects (Needlework, Dressmaking and Millinery). These Diplomas are issued by the National Union for the Technical Education of Women in Domestic Subjects, and are recognised as a qualificat on to teach in Day, Evening and Technical Schools. The fee for the full Course, including Needlework, Dressmaking and Millinery (5 terms), is £25, and it should be paid in instalments of £5 per term.

SINGLE SUBJECTS.

	£	s.	d.
Full Cookery Diploma, open only to holders of Laundry-work Diplomas (3 terms)	28	0	0
High-class Cookery Diploma for qualified Cookery Teachers (1 term)	10	10	0
Laundrywork Diploma, open only to holders of Cookery Diplomas (2 terms)	14	0	0
Housewifery Diploma, open to holders of Cookery and Laundrywork Diplomas (one term)	10	10	0
Plain Needlework Diploma (two terms)	11	11	6
Plain Dressmaking Diploma (two terms)	11	11	6
Full Dressmaking Diploma (three terms)	18	0	0
Millinery Certificate (1 term)	5	0	0
Plain Needlework Diploma (two terms)	11	11	6
Plain Dressmaking Diploma (two terms)	11	11	6
Full Dressmaking Diploma (three terms)	18	0	0
Millinery Certificate (one term)	5	0	0

The above fees include the cost of materials for Cookery and Laundry work, all fees for first examinations, and for the diplomas. Books and materials for other subjects are provided by the Students.

All fees must be paid in advance.

Cheques must be made payable to Miss M. C. Pepper.

If re-examination or further training is necessary, the extra fees must be paid.

The Committee reserve to themselves the right to require the withdrawal, at any period of her training, of a Student whose conduct or progress is unsatisfactory, or who is unsuited to the work. In cases of withdrawal, whether voluntary or otherwise, fees cannot be returned.

For the First Term Students are considered to be on probation.

BOOKS.

Students must provide themselves with the text books recommended by the teachers in the different departments, among which are the following :—

	s.	d.
"Food and the Principles of Dietetics."—R. Hutchison ...	16	0
"The Chemistry of Cookery,"—Mattieu Williams	6	0
"Economics of Modern Cookery,"—Mallock	3	6
"Manual of Household Work and Management,"—A. Butterworth	3	6
"Laundry Chemistry,"—R. H. Jones...	3	0
"Teachers' Handbook of Psychology."—Sully	6	0
"Elementary Physiology."—Foster and Shore	2	6

COURSES FOR THOSE WHO DO NOT INTEND TO BECOME TEACHERS.

In addition to the Courses for Teaching Diplomas, Courses varying in length are arranged in all subjects for ladies, cooks, housekeepers, matrons, practical dressmakers, and milliners, or for girls just leaving school. All applications for such courses should be made to the Principal of the Training School.

1.—Full Day Courses.

(i.) A six months' course (two terms) including Cookery, Laundrywork, Housewifery, Needlework, simple Blouse and Skirt making, preparing Students for the Housewifery or Housekeeper's Certificate, has been arranged. Fee £5 5s. per term exclusive of examination fee.

(ii.) A Three Months' Course is also given, but does not prepare for any examination. Fee, £5 5s.

(iii.) A Three Months' Course for girls who have just left school can be arranged at intervals as required. The instruction will be given on five half days per week, and will include Cookery, Laundrywork, Housewifery, and some Needlework. Fee £3 3s.

Students taking the above Courses will be expected to obey the rules of the School for Students in Training, given on page 7.

2.—Technical Classes.

Classes are usually held once a week, but if school arrangements allow, lessons may be given more frequently. Each lesson lasts two hours. Arrangements as to day and hours are made at the office beforehand.

The morning lessons are held from 10 to 12, the afternoon from 2-30 to 4-30. Students are particularly requested to be at the School five minutes beforehand, in order that they may begin the lesson punctually.

All fees are payable in advance, and lessons which the pupil has missed cannot be made up to her.

Courses in Cookery.

Pupils are not required to provide their own materials, but it is hoped that they will purchase at least one of the dishes made by them at the practice classes.

Pupils are expected to provide themselves with apron, sleeves, tea-towel, and oven cloth, plainly marked with owner's name.

Any crockery taken from the school must be returned without delay, and any that is broken must be replaced.

Public demonstrations in Cookery will be given on Tuesday afternoons, from 2-30 to 4-30.

FEES.

Demonstrations.	£	s.	d.
Single Admission	0	0	6
Ticket for 6 Demonstrations	0	2	6
Practical Lessons.			
12 Lessons per Term (to be taken in one term).	1	5	0
6 Lessons per Term	0	15	0
Single Lesson	0	3	0
Single Lesson—Ices and Icing	0	5	0
6 Lessons in Icing	1	1	0
6 Lessons in Sweetmaking	1	10	0
Single Lesson in Sweetmaking	0	5	0

Courses in Laundrywork.

FEES.

Demonstrations.	£	s.	d.
Ticket for 6 Demonstrations	0	2	6
Single Admission	0	0	6
Practical Lessons.			
Course of 12 Lessons per Term	0	15	0
Single Lesson	0	2	0

Courses in Dressmaking, Needlework, and Millinery.

FEES.	£	s.	d.
12 Lessons in Cutting and Making-up a Blouse and Skirt	0	15	0
12 Lessons in Needlework and Cutting Out Underclothing	0	15	0
12 Lessons in Millinery....	0	15	0
6 Lessons in Upholstery	0	12	6

Day Classes are also held in Dressmaking, Needlework and Millinery for Training for the City and Guilds Evening Teachers Certificates (1st and 2nd year).

	£	s.	d.
First Year Course (1 half-day per week).....	1	1	0
Second Year Course (2 days per week).....	5	0	0
Examination Fee for 2nd Year's Course.....	1	0	0

The Second Year Course includes Blackboard Drawing (Exam. Fee 2/6), and Theory and Practice of Education.



EVENING CLASSES.

COMMENCING MONDAY SEPTEMBER 20th, 1915.

These Classes are open to Pupils over 15 years of age.

DRESSMAKING: Mrs. Lamb, Miss Halliwell, Miss Cross, Miss E. E. Smith.

NEEDLEWORK: Miss Lomax, Miss Fowler, Miss Corkill.

MILLINERY: Miss Norwood, Miss Lomax.

COOKERY: Miss Marshall, Miss Brocklehurst, Miss Rennard, Miss Wright.

HOUSEWIFERY: Miss Marshall, Miss Woods.

AMBULANCE AND SICK NURSING: Dr. Wilkins and Miss O'Neill.

Evening Classes are held on Monday, Tuesday, Wednesday, Thursday and Friday evenings during the Autumn and Spring Terms. They are arranged to meet the needs of those Students who are unable to attend Day Classes. Their aim is to impart a thoroughly useful knowledge of Domestic Subjects, and to prepare Students for the Lancashire and Cheshire, and City and Guilds Examinations.

GENERAL TIME TABLE.

MONDAY:	7-30—9-30...Elementary Dressmaking.
	7-30—9-30...Advanced Dressmaking (City & Guilds).
	7—9 .....Elementary Cookery.
	7-30—9 .....Housewifery.
TUESDAY:	7-30—9-30...Dressmaking (Elementary).
	7-30—9-30...Dressmaking (Advanced).
	7-30—9-30...Dressmaking (Costume Class).
	7—9 .....Cookery (Advanced).
	7-15—9-15...Needlework (Advanced).
	7-15—9-15...Millinery (Elementary).
WEDNESDAY:	7-30—9-30...Dressmaking (Elementary).
	7-30—9-30...Dressmaking (Advanced)
	7-30—9-30...Drsssmaking (Costume Class).
	7—9 .....Cookery (City and Guilds).
	7-15—9-15...Ambulance, First Aid and Sick Nursing.
	7-15—9-15...Millinery (Advanced).
THURSDAY:	7-30—9-30...Dressmaking (Elementary).
	7-30—9-30...Dressmaking (Advanced).
	7-30—9-30...Cookery (Advanced).
	7-15—9-15...Needlework (Elementary).

GENERAL TIME TABLE.—*Continued.*

FRIDAY : 7-30—9-30...Dressmaking (Advanced).
7-15—9-15...Dressmaking (Elementary).
7—9 .....Cookery (Elementary).
7—9 .....Millinery (Elementary).

In the Domestic Economy Classes the number of students entered in each class is limited. Should the entries in any class be considerably below the limit, it may be necessary to transfer students to another class.

Additional Classes to those arranged will be started if necessary ; for example : if sufficient applications are received, classes in Hygiene and Physiology will be formed.

FEES.

	£	s.	d.
Elementary Courses in Cookery, Laundrywork, Housewifery, Needlework, Dressmaking, First Aid, and Sick Nursing—			
For any Two Subjects, per Session	0	4	6
For one of the above with Millinery ...	0	7	6
For Cookery, in preparation for the City and Guilds Examination, and one Elementary Subject	0	7	6
For Dressmaking in preparation for the City & Guilds Examination, and one Elementary Subject	0	7	6
For special Cookery Class	0	15	0
For special Blouse and Skirt Making Class and one Elementary Subject	0	7	6
For special Dressmaking Class and one Elementary Subject	0	7	6

Students in the Evening Classes are expected to attend regularly and punctually throughout the Session.

School of Art.



ART ROOM,
HARRIS INSTITUTE PRESTON.

SCHOOL OF ART.

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SESSION 1915-1916.

The Session commences on Monday, September 20th, 1915 It consists of three terms—

Winter Term—September 20th to December 23rd, 1915.

Spring Term—January 10th to March 31st, 1916

Summer Term—April 3rd to July 7th, 1916.

The vacations during the Session will be—

Christmas Vacation—December 24th, 1915, to January 9th, 1916.

Easter Vacation—Good Friday and Easter Monday.

Whitsuntide Vacation—Whit-week.

The Classes are held at the Institute, Avenham, and Students may enter their names at the Institute, on Friday, September 17th, between 7 and 9 p.m., or at any time during the Session.

Students are expected to attend regularly and punctually and to conform to the general regulations of the school.

Lockers are provided for the use of Students, but the Council will not be responsible for the loss of any property left by Students in the School.

No work must be taken out of the School without the permission of the Head Master.

SCHOOL STAFF :

WILLIAM RATHBONE.

Assistant Teachers :

FRANCES M. BENTHAM. W. E. BURTON.

Pupil Teachers :

ELIZABETH MEAGHER. EDOUARDINE ADKINS.

Painters' and Decorators' Work :

FREDERICK W. SHARPLES.

Art Needlework :

MARY C. ARMITSTEAD.

MARGARET M. DUCKETT.

Lace Making :

M'LLES. WYDOOGHE.

FEES.

DAY CLASSES.

STUDENTS ATTENDING 2, 3, 4, OR 5 DAYS PER WEEK :—

	£	s.	d
For one Term (about 13 weeks).....	1	1	0
For the Session (three Terms).....	2	2	0

STUDENTS ATTENDING ONE DAY PER WEEK :—

	£	s.	d.
For one Term.....	0	10	6
For the Session.....	1	1	0

EVENING CLASSES.

	£	s.	d.
For one Term.....	0	5	0
For the Session.....	0	10	0

	£	s.	d.
Woodcarving (including Design and Modelling).....	1	5	0
Metal Work do. do.	1	5	0
Embroidery do. do. (and Plant Drawing).....	1	5	0
Painting and Decorating Class.....	0	7	6

All Fees payable in advance at the time of entry.

OBJECTS OF THE SCHOOL.

The objects of the school are :—

(1). To give instruction in Art to those engaged in trades and professions in which the power of drawing and a knowledge of design are essential or helpful.

(2). To train those wishing to qualify to become teachers of Art in Secondary Schools, or in Schools of Art.

(3). To provide facilities to those desiring to study Art as a branch of general education, or as a preparation for the training as painter or sculptor.

Time Table of Classes.*

	Morning. 10-0—12-30.	Afternoon. 2-30—4-30.	Evening. 7-15—9-15.
Monday.	Outline Drawing. Still Life. Figure Drawing. Anatomy	Still Life. Figure Drawing.	Anatomy (6-45). Outline Drawing. Design. Life Class Painters' and Decorators' Class.
Tuesday.	Light and Shade. Memory Drawing	Geometry. Perspective Light and Shade. Figure Composition.	Textile Drawing. Textile Design. Antique. Modelling. Painters' and Decorators' Class.
Wednesday.	Design. Still Life. Painting from Life	Embroidery. Still Life. Painting from Life. Lace Making.	Lace Making. Light and Shade. Embroidery. Historic Orna.
Thursday.	Metal Work and Practice.	Woodcarving and Practice.	Object & Memory Drawing. Antique. Wood Carving. Modelling.
Friday.	Figure Drawing. Object & Memory Drawing. Modelling.	Historic Orna. Light and Shade.	Decorative Painting. Life Class. Metal Work. Geometry & Perspective.
Saturday.	Class for Elem. School Teachers.		

* Day Students who have work in progress, may attend for practice at any time when the school is open.

DAY COURSES.

Students desiring to specialise in Painting, Modelling, Pictorial or Industrial Design, are advised to take the Courses outlined below; but those who are unable to devote the time may take single subjects on arrangement with the headmaster.

1st Year:—

Outline Drawing from Ornament, Plants, and other Natural Objects.

Drawing from Models and Common Objects.

Memory Drawing (Including training in Observation and Imagination.

Light and Shade.

Geometry.

Elementary Design.

Students in this year will be required to complete, to the satisfaction of the Headmaster, the following finished drawings:—

A drawing, in outline, of a piece of ornament from the cast.

A drawing, in outline or shaded, of a group of objects.

A shaded drawing of a piece of ornament from the cast.

A sheet of drawings in outline, of plants and birds from nature.

2nd Year:—

Perspective.

Advanced Design.

History and Principles of Ornament.

Drawing from the Antique.

Modelling.

Students, in this year, will be required to complete, to the satisfaction of the Headmaster, the following finished drawings:—

A shaded drawing of a head, or a set details of the human figure.

Two drawings, on half-imperial sheets, of full-length antique figures.

A sheet of drawings, in colour, of plants from nature.

A sheet of Lettering.

3rd Year :—

Drawing the Figure from Life.
Anatomy.
Painting or Modelling Course.
Drawing, or Industrial Design Course.

Students, in this year, will be required to complete, to the satisfaction of the headmaster, the following finished drawings :—

A shaded drawing, on an imperial sheet, of an antique figure.
A shaded drawing, on an imperial sheet, of a figure from life.
A shaded drawing of a head from life.

4th Year :—

Painting or Modelling Course. Industrial or Pictorial Design.
Drapery.
Figure Composition. Black and White and Colour.

EVENING COURSES.

These Courses are arranged to cover a period of Four Years, and include subjects useful to various artistic trades and crafts, such as Woodcarving, Modelling, Painting and Decorating, Lithography, &c.

Students are expected to take, together with the practice of their particular branch, at least two other subjects from the General Course outlined below.

GENERAL COURSE.

1st Year includes :—

Drawing from Ornament, Plants, and other Natural Objects.
Drawing in Light and Shade.
Object and Memory Drawing.

2nd Year includes :—

Elementary Design.
Perspective and Geometry
Antique Details.

3rd Year includes :—

Drawing the Figure, Antique and Life.
Historic Ornament
Design, in its application to some industry.
Modelling.
Decorative Painting.

4th Year includes :—

Drawing from Life

Anatomy. Drapery.

Painting or Modelling the Figure.

Figure Composition.

SPECIAL COURSES.

These Courses are to be supplemented by the Subjects in the General Course.

PAINTING COURSE.

1st Year :—

Painting from Groups of Objects or casts, in monochrome, in oil, water-colour, or Tempera.

Painting simple Groups of Still-life in colour.

2nd Year :—

Painting Still-life, Flowers, Fruit, &c., in colour.

Painting the Head from Life, and Costume Study.

3rd Year :—

Painting the Figure from Antique and Life.

Painting the draped Figure.

Painting Interiors and Landscapes.

4th Year :—

Figure Composition, Mural Decoration, &c.

MODELLING COURSE.

1st Year :—

Modelling in Relief, Ornament, Antique Details, Plants, Birds, &c.

2nd Year :—

Modelling Design, Anatomical Details.

Modelling Busts from Antique and Life.

3rd Year :—

Modelling Figure in Relief.

Modelling Figure with Architectual surroundings.

4th Year :—

Modelling Figure in the round.

Modelling Figure Compositions.

PAINTERS & DECORATORS' COURSE.

1st and 2nd Years :—

Practical and Theoretical Painters' Work, including Graining, Marbling, and Stencilling.

3rd and 4th Years :—

Advanced Practical and Theoretical Painters' Work including Writing, Lettering, Gilding, and Glass Embossing, Decorative Compositions in Monochrome and colour, Schemes for Decoration of Interiors.

Textile Drawing and Design.

Elementary (for 3rd Year Weaving Course Students—

Outline drawing from ornament, with pencil and brush.

Tracing, Enlarging, Reducing.

The geometric basis of flat patterns (the simplest forms of repeats) ; the materials used in designing, use of water colours, transparent and opaque pigments. Theory of colour, primary, secondary, and complementary colours ; colour harmony and contrast ; colour matching.

Copying examples of cloths.

Advanced (for 4th Year Weaving Course Students)—

Analysis of pattern. The more involved methods of repeat. The characteristic features of the historic styles of ornament.

Adapting colour schemes from natural objects, e.g., feathers, butterflies, etc.

Making simple patters for spots, stripes, sprigs, for blouses shirtings, ties, &c.

Making finished designs for woven fabrics.

CRAFTS.

Art Needlework.

The various materials for embroidery grounds, *e.g.*, linen, canvas, silk, etc. ; the threads, wools, and silks, used upon them.

The stitches used in embroidery, such as stem, chain, satin, long and short, herringbone, oriental, etc.

Applique. Cut-work, etc.

Lace Making.

Wood Carving.

The woods most suitable for carving, *e.g.*, pine, oak, walnut, mahogany, etc.

The different shapes of tools, and how to sharpen and keep them in order.

The use and handling of tools.

Carving Panels, &c., in Low or High Relief; Pierced Work, Carving in the Round.

Metalwork.

The properties of metals employed for repoussé, annealing, hard and soft soldering, brazing, rivetting, piercing, raising. Use of tools and appliances. Composition of cement beds.

Construction of Articles from Students' designs.

SUMMER TERM.

The Time Table is slightly changed after the Examination in April, when some of the Classes are discontinued, and in their place time is given to subjects which it is not possible to take during the Winter months. These include outdoor sketching, colour work in the Evening Classes, and a Class for the study of birds and animals at the Harris Museum.

SKETCH CLUB & STUDENTS' UNION.

The Sketch Club is organised by the Staff and Students for the purpose of encouraging individual effort. Monthly competitions are arranged during the Session, and a series of subjects are set for the long vacation.

The aim of the Students' Union is to stimulate sociability and to this end Social Evenings and Debates are occasionally held.

All Students are eligible. Further information and particulars may be obtained from members of the Staff.

SYLLABUSES OF SUBJECTS.

Outline Drawing.

Drawing with pencil, pen, or brush, from casts of ornament in low relief, flowers, plants, birds, shells, and other natural objects.

Object Drawing.

The representation of Objects in Perspective.
Sketch Plans and Elevations.
Memory and Observational Drawing.
Composition and Grouping.

Light and Shade.

Drawing in Light and Shade, with pencil, chalk, charcoal, or Sepia, from casts, and from objects and groups of objects.

The principles governing the representation of shade, half-tone, light and reflection, and cast shadows.

Geometry.

The use of the T square, set squares, and instruments; the division of lines, and the construction of rectilineal figures; the properties of straight lined figures and circles; ratio or proportion; plain and diagonal scales; enlarging and reducing plane figures; areas; sections of the cone.

Application of the foregoing to the construction of patterns and ornament.

Plans and elevations of simple solids from diagrams and specification; alteration of ground line; sections of solids

Perspective.

The principles governing the representations of solid objects, both by the Direct Method and by the Measuring Point Method.

Projection of shadows by natural and artificial light; reflections on plane horizontal and vertical mirrors.

Application of the rules of perspective to the representation of objects, views of buildings, landscapes, etc., by the aid of instruments, or by freehand sketches.

Still Life Painting.

Painting in Oil or Water Colour from Groups of objects, drapery, fruit flowers, &c.; materials, brushes, properties of pigments, mediums, vehicles, varnishes, &c.

Composition and Grouping, lighting and tone values.

Design—Elementary.

Simple designs embodying geometric and abstract forms, interlacing bands, etc., in black and white, and in colour ; Chequers ; spots, stripes ; the various forms of repeats.

Designs in colour to fill given shapes, and based on a plant or some other natural form.

Design—Advanced.

Adapting natural and ornamental forms to the preparation of designs for some specific method of execution, e.g., wood or stone carving, stencilling, wall-paper printing, cotton printing and weaving etc.

Heraldic and traditional forms employed in ornament.

Figure Drawing and Painting.

Drawing in pencil, charcoal, or chalk, from the Antique and Life.

The proporations of the human figure ; construction ; influence of the anatomical structures on the surface form.

Time sketches from the Life. Studies of drapery on the antique and on the living model.

Drawing the figure from memory.

Painting from the Antique and Life, in monochrome and colour.

Anatomy.

The study of the structures which determines the external forms of the human body. The influence of posture on the forms of man. The skeleton, the skull, vertical column, ribs, pelvis, upper and lower extremities ; the joints and their movements.

The muscles, their origin and attachments ; their influence on the surface forms in repose and in action.

The face, hands, and feet.

The varying proportions in the child and the adult ; the male and female.

Principles & History of Ornament.

The principles governing Architecture, Sculpture, Industrial and Pictorial Art, and Painting.

The styles of Ornament, including Egyptian, Classic, Gothic, Renaissance, &c.

The influence of materials, climate, etc., on the character of architecture and ornament.

Figure Composition.

Decorative Possibilities of the Figure.

The Figure with Ornamental and various surroundings; Grouping, &c.

The principles of composition. The sketch design in black and white; development of same in pen and ink, water colour, oil colour, or tempera.

Modelling.

Modelling in clay from casts or ornament, or from flowers, fruit, or other natural objects. Modelling busts, hands, feet, etc., in relief, and from the round, from the Antique, and from Life. The figure in relief and in the round from the Antique.

Original designs in relief and in the round.

Casting from waste moulds in plaster or wax.

Practical Painting and Decorating.

The Syllabus includes:—Uses and properties of oils, paints, and varnishes; colour mixing; stopping and filling; plain painting; varnishing; graining; marbling; decorative painting; lettering; stencilling; gilding, and glass embossing, calculations, &c.

EXAMINATIONS IN ART.

INTERNAL.

Grouped Examinations will be held annually for three years, comprising the subjects of the various Courses.

A Certificate endorsed by the Board of Education will be issued to each Student who completes the Three Year's Scheme, provided he or she has passed successfully in each of the Annual Tests.

CITY AND GUILDS OF LONDON.

Students are prepared for these Examinations in the following Subjects:— Painting and Decorating, Embroidery, Principles of Art as applied to Cotton Weaving.

The Board of Education will hold Examinations in the following subjects of Art:—

(*a*) Drawing.

(*b*) Painting.

(*c*) Modelling.

(*d*) Pictorial Design for Reproduction in black and white or colour.

(*e*) Industrial Design for (i) Handicrafts and (ii) Manufactures.

2. The Examination in Drawing will be of a standard suitable for candidates who, after a good general education, including some preliminary instruction in Drawing, up to the age of 16 or later, have devoted themselves to serious and continuous study of Drawing for, as a rule, not less than two years.

3. The Examinations in Painting, Modelling, and Pictorial Design will be of such a standard as could be attained, according to the capacity of the candidate, by two or more years of serious and continuous specialised study after passing the Examination in Drawing.

4. Examination in Industrial Design will be of such a standard as could be attained through regular attendance at evening or other part-time classes in the intervals of employment for a period of four years after the age of 16.

5. Candidates will not be admitted to the Examinations in Painting, Modelling, or Pictorial Design unless they have previously passed the Examination in Drawing; except that, for the present, the Board will accept First Class successes in Drawing from the Antique and Drawing from Life, obtained in the Art Examinations of 1912 or previous years, as an equivalent qualification for this purpose to a pass in Drawing under the present scheme. The Examination in Industrial Design will be arranged so as to afford a sufficient test of the attainments of industrial students in Drawing.

6. The subjects of each Examination will be subdivided for the purpose of setting tests; but candidates must in all cases take the Examination as a whole, and marked success in one test may be allowed to compensate for comparative want of success in another. Similarly, if a candidate has passed at the Art Examiantions of 1912 or any previous year, in any subject covered by the syllabus for an Examination under the present scheme, the marks obtained at the earlier Examination will, if it is to the advantage of the candidate, be taken into account by the Examiners before a decision is arrived at. The tests will mainly take the form of exercises to be worked by the candidates, but candidates will also be required to show evidence of reading in relation to their study, and of some power to express themselves in writing.

7. The Examination in Drawing will include tests in—

(*a*) Drawing from the antique and from life.

(*b*) Drawing from memory of the antique, of natural objects, and of the human figure in action.

(*c*) Artistic anatomy and perspective.

(*d*) Elementary architecture, including drawing of the classical orders to scale from memory, and of a plan, section, and elevation of a building, particulars of which will be supplied to the candidate.

8. The Examination in Painting, which will require a high standard of achievement, will include tests in—

(*a*) Drawing and painting from life.

(*b*) Painting from the antique, still life, or drapery, at the option of the examiners.

(*c*) Figure composition, to fill a given space, with special reference to mural decorations.

(*d*) History and methods of painting with special reference to the relations of painting to architecture and the industrial arts.

The painting tests may be worked either in oil or water colour

9. The Examination in Modelling will include tests in—

(*a*) Modelling from life of the figure and details.

(*b*) Modelling of drapery and of architectural and ornamental details.

(*c*) Figure composition, with special reference to the decoration of architectural and other settings.

(*d*) Modelled design.

(*e*) History and methods of sculpture, carving and modelling, with special reference to their relations to architecture and the industrial arts.

The test in modelled design will entail the invention of an original design on a given motive, which must be practically adapted to production according to some recognised process, such as wood-carving, stone-carving, metal forging, metal casting, or the like. Each candidate will be required to name in advance the process in relation to which he desires to be tested.

10. The Examination in Pictorial Design for reproduction in black and white or colour will include tests in—

(*a*) Elementary design, bearing on—

(i) the candidate's knowledge of the principles of design in relation to his craft and its history ;

(ii) his knowledge of the enlargement and reduction of designs according to scale ;

(iii) his knowledge of subsidiary matters such as lettering, costume, heraldry, and the like.

(*b*) Figure composition.

(*c*) Original design.

(*d*) History of methods of engraving.

The test in original design will entail the invention of a design on a given motive, which must be practically adapted to reproduction according to some recognised process, such as engraving, etching, woodcutting, lithography, colour-printing, zincotyping, or the like. Each candidate will be required to name in advance the process in relation to which he desires to be tested.

11. The Examination in Industrial Design will include tests in—

(*a*) Drawing and Modelling, if applicable to the craft selected by the candidate, including—

(i) drawing from the antique ;

(ii) drawing from memory of natural objects ;

or (iii) modelling from historic ornament ;

(iv) elementary architecture, including drawing of the classical orders to scale from memory, andof, a plan, section, and elevation of a building particulars of which will be supplied to the candidate.

(*b*) Elementary design, bearing upon—

(i) the candidate's knowledge of the principles of design in relation to his craft and its history ;

(ii) his knowledge of the enlargement and reduction of designs according to scale and of the preparation of working drawings ;

(iii) his knowledge of subsidiary matters such as lettering, costume, heraldry, and the like.

(*c*) Original design.

(*d*) History and styles of ornament, with special reference to the relation of ornament to architecture and to the industrial arts.

The test in the original design will entail the invention of a design on a given motive for a specified purpose, which must be practically adapted to production according to some recognised process either (i) of Handicraft or (ii) of Manutacture. The motive may entail the use of the figure in the case of processes, such as painted glass, in which the figure is ordinarily employed. Each

candidate will be required to name in advance the process in relation to which he desires to be tested. The process must be selected from a list which will be published in the detailed syllabus. Candidates will be required to answer questions on the materials and the tools or machinery ordinarily employed in their process, and to give a rough estimate of the cost of carrying out their designs.

12. The Board will require all candidates, in addition to taking the prescribed tests, to submit note books and other testimonies of study and examples of school work executed during the two years preceeding the examination. These testimonies must include evidence of the candidates' having studied and drawn good historical examples of their craft, and, in the case of candidates in Modelling or candidates taking any form of handicraft for the purpose of the Design Examinations, must include evidence of their practical experience of the technical processes of their craft. The records of successful works submitted in 1912, or any previous year, for the Art Class Teachers' or Art Masters' Certificate will also be taken into account by the Examiners.

13. No candidate will be admitted to the Examination in Drawing, who will be under the age of 17 on the 31st July next following the date of the Examination, or to any of the other Examinations, who will be under the age of 19 on that day ; and no candidate will be admitted to more than one examination in any year.

14. Successful candidates in each Examination will be classified as having (i) passed the Examination ; or (ii) passed the Examination with distinction. No prizes will be awarded.

15. No candidate will be admitted more than thrice to the same examination and no candidate will be admitted to an Examination in which he has already passed with distinction.

16. A fee of 10s. will be charged to candidates for admission to each examination.

TEACHING CERTIFICATES.

10. The Board will issue Certificates to Teachers of Art who have obtained (i) the qualifications detailed below.

18. A Candidate for a Teaching Certificate must have passed the Board's Examination in Drawing and either the Board's Examination in one other subject or the final examination of the Royal Institute of British Architects in Architecture ; but, for the present, the Board will accept in lieu of a pass in Drawing the Art Class Teachers' Certificate, together with the first class successes in Drawing from the Antique and Drawing from Life obtained in 1912 or previous years.

19. He must also have obtained the following general and professional qualifications :—

(i) He must have passed an examination, such as the Board's Preliminary Examination for the Elementary School Teachers' Certificate, or an accepted equivalent, indicating the satisfactory completion of a preliminary general education, or must have submitted other evidence of having received such education ;

(ii) He must be over 19 years of age and have furnished a satisfactory medical certificate in a prescribed form, indicating his fitness for the work of a teacher ;

(iii) During his training he must have completed to the satisfaction of the Board an approved course of pedagogy at an institution recognised for the purpose, affording practice under the supervision of an expert master of method in the teaching of artistic subjects both to adults and to children, by the methods of class-work and individual tuition.

(iv) He must have passed at the close of his course of training an examination in pedagogy and school management, with special reference to the relations of art to industry, and to the place of artistic subjects in systems of education, and must have reached a reasonable literary standard in the papers worked at this Examination. Special Examinations for this purpose will be held by the Board. Each candidate will be charged a fee of 3s. 6d.

20. The Teaching Certificate issued by the Board will set out the qualifying Examinations passed by the candidate, and will specify those (if any) in which he passed with distinction ; and a subsequent entry may be made if the candidate passes any further Examinations in Art. The certificate may, if desired, take the form of an endorsement by the Board upon an approved diploma awarded by the institution at which the candidate has been trained.

SCHOLARSHIPS.

Harris Art Scholarship.

One scholarship of the value of £7 10s. 0d., per annum, tenable for three years, will be awarded annually.

The Scholarships will be open to all Students of the School of Art, who have attended for not less than one year immediately preceding the award, and will be tenable at the Harris Institute. or at any place of Higher Art Education.

The Scholarships will be awarded on the results of the annual examinations, in conjunction with the Student's work of the session.

Should one or more of these Scholarships fall vacant before the full period of three years, two, or three (as the case may be), will be given instead of one, in the year when they lapse.

Free Studentships.

Three Free Studentships to the Day Classes are offered to Students of the School (Day or Evening), who are studying with a view to becoming designers, craft workers, or teachers.

Method of award, the same as for the above.

A number (approximating 18) of Free Admissions to the Evening Classes, will be granted to Students who obtain the highest successes at the annual examinations, or who can produce the best portfolio of work for the previous session.

PRIZES.

The Council of the Harris Institute offer Prizes in the following subjects :—

Set of Studies from Nature, of birds, animals, plants, etc. : 1 Prize.

Shaded Drawing of Ornament from the cast : 1 Prize.

Drawing of an Antique Figure : 2 Prizes.

Drawing a Figure from Life : 2 Prizes.

Set of Details of the Figure : 1 Prize.

Set of Designs for Textiles : 2 Prizes.

Painting from Still Life : 1 Prize.

Painting from Life : 1 Prize.

Modelled Studies : 2 Prizes.

Evening Classes.
Science and Miscellaneous.

EVENING CLASSES.

SESSION COMMENCES ON MONDAY,
THE 20TH SEPTEMBER, 1915.

OBJECTS OF THE SCIENCE AND TECHNICAL SCHOOL.

The aim of the Council, in arranging the work of the Evening Classes, is to provide systematic instruction in the scientific principles applicable to the leading trades and industries of Preston and the District.

The Classes are intended principally for those who, being engaged in industrial occupations in the day time, desire to receive supplimentary instruction in the application of Science and of Art to the trades and manufactures in which they are interested.

It must be distinctly understood that the instruction given in the School is intended to supplement and develop, and not to supersede the knowledge gained by practical experience in the workshop or factory. Trades cannot be taught in the Technical School, the necessary manual skill can only come after long practice in the workshop.

The main object of the instruction is to provide a thorough knowledge of the scientific principles underlying the daily work of the Student, so as to enable him to take that intelligent interest in his work which is so essential to success.

The Classes in the School may be broadly divided into two groups :—

(1) TECHNICAL SUBJECTS.—Most of these bear directly upon the industries of the district. In them the scientific principles upon which the various industrial processes depend are fully explained ; and in several branches a Course of practical training is provided.

(2) SCIENTIFIC SUBJECTS AND MODERN LANGUAGES.—The Courses of work in the Science Classes follow closely the Syllabuses of the Board of Education ; and are also suitable for Students preparing for University Degrees or Scholarships. The work is not restricted to industrial applications, but deals also with theoretical principles and pure science of high educational value.

Students will be admitted to the Specialized Courses in Technical or Commercial Subjects if they possess the Preliminary Technical or Preliminary Commercial Certificate of the Union of Lancashire and Cheshire Institutes, or its equivalent.

Other Students who are desirous of joining the Classes must satisfy the Principal of the Institute that they are able to benefit by the Course to which they seek admission, otherwise they must sit for an entrance examination, and if they fail to reach the prescribed standard, it will be advisable for them to attend the Preliminary Course conducted under the Preston Education Committee, or the Second Years' Technical Course at the Technical School.

ORGANISED COURSES.

Except under very special circumstances, all Students joining the Institute will be expected to undertake a complete Course of work, and Students will not be regarded as fulfilling this condition unless they attend regularly each subject of the Course, and perform the Homework set to the satisfaction of the Lecturer.

Students from Elementary Day Schools will not, as a rule, be ready to undertake Specialized Courses until they have been prepared by two years' preliminary instruction. Courses for the purpose, arranged so as to cover two years, conducted by the Preston Education Committee in their Branch Schools, are as follows :—

PRELIMINARY TECHNICAL COURSE.—*First Year.*

Practical Mathematics.
Practical Drawing.
English.

PRELIMINARY COMMERCIAL COURSE.—*First Year.*

Commercial Arithmetic.
Commercial Correspondence.
Commercial Geography.
English.

PRELIMINARY COMMERCIAL COURSE.—*Second Year.*

Commercial Arithmetic.
Commercial Correspondence.
Commercial Geography.
English.
Book-keeping or Shorthand.


Chemical Laboratory
Harris Institute,
Preston, 1905.
G. DEVEY.

*Preliminary Technical Course.—*Second Year.*

Practical Mathematics.
Practical Drawing.
Experimental Mechanics and Physics.
English.

* *A Preliminary Technical Course* will also be conducted at the Technical School, Corporation Street. Syllabus as prescribed by the Union of Lancashire and Cheshire Institutes.

Third, fourth, and succeeding years' Courses for Commercial and Technical Students will be found under the respective departments.

Special Courses can be arranged for Students who do not come under any of these categories.

Three Subjects from one of the following Sections comprise a Course. Fee 10s. 6d.

Arts.	Science.
ENGLISH	BOTANY.
FRENCH.	CHEMISTRY (Theory and Practical).
LATIN.	MATHEMATICS.
MATHEMATICS.	PHYSICS (Theory and Practical).

Students will be expected to attend regularly and punctually throughout the Session, according to their Course Time Table, do the Homework set, and sit for the Examination, when required.

The Lecturers are authorised to report periodically, through the Principal, as to the attendance and Homework of each Student. The Council shall have power in dealing with Students who are unsatisfactory in these or any other respects to remove their names from the Register without return of Fee.

Fees Per Session.

	£	s.	d.
Preliminary Technical Course, Second Year	0	5	0
Arts and Science, per subject.....	0	7	6
Any complete Technical Course, Third, Fourth, &c., Years.....	0	7	6
Any complete Commercial Course, Third, Fourth, &c., Years.....	0	7	6
If Typewriting be included	0	10	6

An Adult Student who does not desire to take a full Course, and can prove to the satisfaction of the Principal and Lecturer that he can benefit by instruction in a certain subject or subjects, may be allowed to attend the Classes at a Fee of 7s. 6d. per subject, with or without practical work.

Students who enter for Courses must clearly understand that they will be required to attend all the subjects regularly, otherwise they will be compelled to pay a fee of 7s. 6d. for each subject taken. *This rule will be strictly enforced.* In the case of Second Year Technical Course the fee would be 5s.

All Fees must be paid in advance, and Students must obtain the official receipt and show the same to the Lecturer before their names can be entered on the Register.

Registration.

Students who have not previously attended classes at the Institute must see the Principal prior to filling up the enrolment Form. He can be seen for this purpose at the Technical School, Corporation Street, Wednesday and Thursday evenings the 15th and 16th September, and at the Harris Institute on Friday, the 17th. The Staff will also be present on the above nights to advise Students as to Course of Instruction, Text Books, &c.

An Entrance Examination will be held on Friday evening, the 17th September.

All business communications relating to Classes, Examinations, &c., should be addressed to T. R. Jolly, Principal and Secretary.

STAFF.

Book-keeping	R. E. SMALLEY, F.C.A. H. SOUTHWORTH, F.C.A. T. H. BAILEY. A.C.A.
Botany and Geology	H. W. EDMUNDS, B.Sc.
Building Trades	F. J. PYE, A.B.I.C.C., Medallist E. M. PEARSON, A.R.S.I. J. J. ALLEN, Hons. A. C. M. LILLIE, Hons., Medallist W. TAYLOR. F. PINDER, Hons. J. VARLEY, Hons.
Chemistry	R. H. JONES, M.Sc., F.C.S. H. CROFTS, M.Sc.
Commercial Arithmetic	J. RENWICK. J. HASENCLEVER. E. SINGLETON.
Cotton Spinning and Weaving	T. E. MITCHELL, A.M.S.T. R. BILLINGTON, Hons. E. BLINKHORN, Hons. J. E. ADAMSON J. W. BLACKHURST. JNO. GORING. C. JOHNSON.
Physics and Electrical Engineering	G. E. GITTINS, B.Sc., A.I.E.E. T. D. FARRAR, M.Sc. J. D. ATHERTON, Hons. Medallist. A. WOODS, Hons.
English	J. HASENCLEVER.
French and Latin	F. W. JACKSON, B.A.
Geography (Commercial)	T. WILSON.
Harmony	J. TOMLINSON.
Mathematics	J. T. CORKILL, B.A.
Mechanical Engineering Subjects	E. C. MOYLE, A.R.C.Sc., A.M.I.M.E. J. H. BINFIELD, Wh.Ex. F. W. WALKER, 1st Dp. M.E. G. DIMMOCK. S. HORNBY.
Plumber's Work	R. SANDERSON.
Shorthand, Commercial Correspondence, etc.	V. E. COLLINGE, F.Inc., S.T.
Typography	R. AUSTIN, Medallist. R. C. PYE, Hons.
Typewriting	J. HILTON.

Principal and Secretary:

T. R. JOLLY, F.C.I.S.

EVENING CLASSES.

The Classes meeting at Avenham are distinguished by the letter A, those meeting at the Technical School, Corporation Street, by the letter C.

MATHEMATICS. (A).

Lecturer, J. T. CORKILL, B.A.

FEE, 7s. 6d.

Stage I., Monday, 7 to 9-30 (suitable for Certificate Students).

(1) *Arithmetic.*—The principles of arithmetical operations and their application to simple questions. Arithmetic as applied to ordinary questions of Commerce and Trade, including Interest, Percentage, Stocks and Shares, Discount, Exchanges, Metric System of Weight and measures.

(2) *Geometry.*—The properties of Lines, Triangles, and Rectilinear Figures and Circles, as far as they are treated in the First and Third Books of Euclid.

(3) *Algebra.*—Elementary Rules as far as Simple Equations and Problems producing them. Factors; H.C.F.; L.C.M.; Fractions; Graphs; Quadratic Equations.

Stage II., Friday, Geometry and Algebra, 7 to 8-30 (suitable for Matriculation); Trigonometry. 8-30 to 9-30 (suitable for Inter Arts).

(1) *Geometry.*—The properties of lines, rectilinear figures, and circles, as far as they are treated in the first four books of Euclid. The theory of similar figures.

The questions in this subject will generally be given so as to bring out as far as possible the candidate's knowledge of the principles of Geometry. Answers to questions may be given on any system which the student may have followed, provided the reasoning be clear and accurate.

(2) *Algebra.*—The elementary rules of Algebra. Factors. The simplification of algebraical expressions. Simple equations, and problems producing them. Involution and evolution. Surds. Quadratic equations, and problems producing them. Ratio, proportion, and variation. Arithmetical and geometrical progressions.

(3) *Plane Trigonometry.*—Definitions. Measurement of angles by degrees and radius. The trigonometrical functions, and the conversion of one into another. Use the positive and negative signs to denote contrariety of direction. Tracing of the trigonometrical functions in magnitude and algebraic sign through the four quadrants. The arithmetical values of the trigonometrical functions of 30°, 45°, 60°, 75°, 90°, &c. The trigonometrical ratios of the sum and difference of angles, and of the multiples and sub-multiples of an angle.

Logarithms.—Definition. Multiplication, Division, Involution, and Evolution by logarithms. The use of tables of logarithms of numbers, and of sines, cosins, &c., of angles. Tables of proportional parts for numbers and angles.

Triangles.—Solution of all cases of right-angles and oblique triangles, and proofs of the requisite formulæ. Heights and distances. Area of a triangle.

Higher Mathematics, Thursday, 7 to 9 (Suitable for final B.A or B.Sc.)

FIRST PAPER.

(1) *Algebra.*—The theory of indices. Simple cases of the summation of series. The simpler tests of the convergence and divergence of series. The binomial, exponential, and logarithmic series. Partial fractions. Elementary Determinants. Imaginary and complex quantities. De Moivre's Theorem.

(2) *Co-ordinate Geometry of two Dimensions.*—Co-ordinates of a point.

Equations of straight lines, and the treatment of questions relative to their intersection, concurrence inclination, parallelism, perpendicularity, &c.

Equations of circles, their tangents and normals. Questions concerning the intersection of circles, and the determination of circles which satisfy given conditions.

The simpler forms of the equations of the parabola, ellipse, and hyperbola, as determined from various definitions of those curves. The equations of their tangents and normals. The principal properties of their diameters, axes, foci, conjugate diameters, asymptotes.

(3) *Co-ordinate Geometry of three Dimensions.*—Elementary portions.

SECOND PAPER.

(1) *Differential Calculus.*—Limits. Differential co-efficients. Differentiation of simple functions, of inverse functions. Successive differentiation of functions of one variable. Taylor's and Maclaurin's Theorems and their simpler applications. Determination of values of functions when indeterminate in form. Differentiation of a function of a function and of implicit functions. Maxima and minima of functions of one independent variable. Differentiation of functions of two or more independent variables. Applications of above.

(2) *Integral Calculus.*—Meaning of definite integration. Integration of the more frequently occurring functions. Integration by parts. Rational fractions. Formulæ of reduction. Applications of above to areas, &c.

(3) *Elementary Differential Equations.*—Integration of differential equations of the first order and degree. Integration of linear differential equations of the second and higher orders with constant co-efficients.

THEORETICAL INORGANIC CHEMISTRY. (A).

Suitable for Matriculation or Teachers' Certificate.

Lecturer, R. H. JONES, M.Sc., F.C.S.

FEE, 7s. 6d.

Stage I., Tuesday, 7 to 8.

Chemical changes distinguished from temporary physical changes.

Indestructibility of Matter.
Properties of Gases. Action of pressure on gases. Boyle's law.
Charles' law. Graham's law.
Air. Relation of air to flame, and combustion generally.
Oxygen and nitrogen.
Hydrogen. Water.
Laws of chemical combination. Atomic therory. Calculations.
Equivalents.
Mixtures and compounds.

Chlorine. Hydrogen chloride.
Carbon—forms. Coal—coal gas.
Carbon dioxide—carbonates.
Carbon monoxide.
Sulphur—forms. Sulphur dioxide—sulphites.
Sulphur trioxide. Sulphuric acid. Sulphates.
Sulphuretted hydrogen. Sulphides.
Nitrous and nitric oxides.
Ammonia.
Salts—their preparation, properties, and nomenclature.
Non-metals and metals.

The Lectures will be fully illustrated by experiments, apparatus, lantern slides, and models.

THEORETICAL INORGANIC CHEMISTRY (A).

Lecturer, H. CROFTS, M.Sc.

FEE, 7s. 6d.

Stage II., Wednesday, 7 to 8.

Determination of the composition of water, air, hydrochloric acid, ammonia, oxides of nitrogen, carbon monoxide, carbon dioxide, hydrogen sulphide. Laws of combination. Various types of chemical calculations.

Atoms and molecules. Atomic and molecular weights, Vapour densities.

Avogadro's law. Specific and atomic heats. Valency. Dissociation. Classification of the elements.

Water: causes of temporary and permanent hardness in; modes of softening; suitability for domestic purposes.

Hydrogen peroxide. Preparation and properties.

Ozone. Air. Chlorine. Bromine. Iodine. Fluorine. Phosphorus. Arsenic. Antimony. Bismuth.

Boron, silicon, and their important compounds.

Carbon and some compounds, viz.:—Methane, ethylene, acetylene, formic, and acetic acids. Alcohol, &c.

Chemistry of the metals and their important compounds.

The Lectures will be fully illustrated by experiments, apparatus, lantern slides, and models.

PRACTICAL INORGANIC CHEMISTRY. (A).

Teacher, R. H. JONES, M.Sc., F.C.S.

Stage I., Tuesday, 8 to 9-30.

FEE, 7s. 6d. or Free if Theoretical is also taken.

Use and fitting up of simple chemical apparatus,

Action of heat, water, and acids on various substances studied in the lectures.

Preparation of gases studied in the lectures.

Simple quantitative experiments—water of crystallisation, equivalents of magnesium, zinc, iron, silver, and copper.

Weights and volumes of gases evolved in certain chemical re-actions.

Experiments with acids and bases. Preparation of salts. Acidimetry. Alkalimetry.

Experiments for which instructions will be given.

PRACTICAL INORGANIC CHEMISTRY. (A).

Teacher, H. CROFTS, M.Sc.

Stage II., Friday, 7 to 9-30.

FEE, 7s. 6d. ; or Free if Theoretical is also taken.

Reactions of the following metals.—Silver, lead, mercurous, mercuric, bismuth, copper, cadmium, arsenic, antimony, tin, iron, aluminium, chromium, nickel, cobalt, manganese, zinc, barium, calcium, strontium, magnesium, potassium, sodium, ammonium.

Reactions of the following acids.—Sulphuric, sulphurous, thiosulphuric, hydrosulphuric, hydrochloric, hydrobromic, hydriodic, chloric, hypochlorous, hydrofluoric, nitric nitrous, carbonic, boric, silicic, phosphoric, arsenic, chromic, permanganic, hydroxides, peroxides.

Systematic analysis of mixtures containing not more than four positive and negative radicles.

Volumetric analysis.—Acidimetry and alkalimetry. Standard solutions, their preparation and uses. Use of standard permanganate, silver nitrate, and sodium chloride solutions.

Preparation of pure salts and their crystallisation.

PRACTICAL INORGANIC CHEMISTRY. (A).

Teacher, H. CROFTS, M.Sc.

Stage III., Friday, 7 to 9-30.

FEE, 7s. 6d.

Analysis of complicated mixtures and minerals.

Gravimetric and volumetric analysis.

THEORETICAL ORGANIC CHEMISTRY. (A).

Lecturer, R. H. JONES, M.Sc., F.C.S.

FEE, 7s. 6d.

Stage, I., Wednesday, 8-5 to 9-5.

Organic analysis. Vapour density.
Determination of empirical and molecular formulæ.
Hydrocarbons of the methane, ethylene, and acetylene series.
Alcohols. Ethers. Aldehydes. Ketones.
Acids. Amines. Amides. Nitriles.
Amino acids. Lactic acids.
Glycol. Glycerol.
Carbohydrates. Cellulose.
Cyanogen compounds. Urea. Uric acid.

Whenever time permits, the Lectures will be illustrated by experiments.

PRACTICAL ORGANIC CHEMISTRY (A).

Teacher, R. H. JONES, M.Sc., F.C.S.

Stage I., Monday, 7 to 9.

Suitable experiments bearing on the Lectures will be carried out.

BOTANY. (A).

Lecturer, HAROLD W. EDMUNDS, B.Sc.

FEE, 7s. 6d.

Stage I., Tuesday, 7 to 9.

GENERAL MORPHOLOGY, HISTOLOGY, AND PHYSIOLOGY.

I. The differentiation of the plant-body into root, stem, and leaf.

II. The structure of the organs and members.

III. The functions of the various organs; the relation of their structure to their functions.

SPECIAL MORPHOLOGY AND PHYSIOLOGY OF THE ANGIOSPERMOUS FLOWERING PLANT.

The inflorescence and its modes of branching, &c. The morphology of the flower and its organs. The calyx, the sepals, the corolla, the petals, their form and arrangement.

The gynœcium. The structure of the ovule. The processes of pollination and fertilisation. The morphology of the fruit. The structure of the seed, &c.

The concise description of fresh plants, taking the organs in the following order :—

Root.	Corolla.
Stem.	Androœcium (Stamens).
Leaves.	Gynœcium (Pistil).
Inflorescence.	Ovule.
Bracts.	Fruit.
Flower.	Seed.
Calyx.	Embryo.

A knowledge of the flora of the field, the wood, or the hedgerow is now required, and the Students are instructed with reference to the Principles of Classification.

GEOLOGY. (A).

Lecturer, HAROLD W. EDMUNDS, B.Sc.

FEE, 7s. 6d.

Stage I., Wednesday, 7 to 8.

The crust of the globe. Rocks and their classification. Minerals and rocks, their characters and composition. Forms of stratification. Denundation, subærial and marine. Fossils, their nature and mode of preservation. Use of Fossils in distinguishing between marine and fresh water strata. The order of succession of the great geological systems, and the leading characteristics of their British representatives. Volcanic, plutonic, and metamorphic rocks. Mineral veins and ore deposits.

LATIN. (C).

Lecturer, F. W. JACKSON, B.A.

FEE, 7s. 6d.

Thursday, 7-15 to 8-15.

MUSIC (THEORY). (A).

Lecturer, J. TOMLINSON.

FEE, 7s. 6d.

Elementary, Friday, 7 to 8.
Intermediate, Friday, 8 to 9.
Advanced, Wednesday, 8 to 9.

ENGLISH LANGUAGE AND LITERATURE. (A).

Lecturer, J. HASENCLEVER

FEE, 7s. 6d.

Elementary Grade, Wednesday, 7-5 to 8-5.

To write a simple theme or letter—(*all candidates will be required to attempt this*)—of which the handwriting, spelling, and grammar must be good; and to know the elements of English Grammar.

ADVANCED GRADE.

Friday, 8-10 to 9-10.

(1) To write a short essay or letter. *All candidates will be required to attempt this.*
(2) Modes of making inflexional changes in English words.
(3) Formation of English words from one another.
(4) Prefixes and affixes of Latin and Greek origin.
(5) Parsing and analysis.
(6) Shakespeare's "The Tempest."

Questions will be set on the plot and principal characters of the whole of the selected play, the objects being (*a*) to ascertain whether Students have intelligently perused the text, and (*b*) to test their power of expression in clear and idomatic English.

The grammar questions in (2), (3), (4) and (5), will be based upon words, phrases, and gestures which occur in Shakespeare's "The Tempest" (any good annotated edition may be used).

NOTE.—Special attention should be given to parsing and analysis; besides questions on the set book, questions on composition and grammar may be given.

TYPOGRAPHY (A).

Instructors, R. AUSTIN (Medalist) R. C. PYE (Hons.).

FEE, 7s. 6d.

Practical Work, Monday, 7-15 to 8-45 p.m.

Lectures: Honours (Final), Wednesday, 8 to 9 p.m.

Stages I. and II., Wednesday, 7 to 8 p.m.

Grades I. and II. will include the Production of Book Work; casting off MS.; proportions of type to page; making margin; imposition; sheet and half-sheet work; problems in type bodies; Point System; use of ornament in display; classification of job work; composition of colour work; tint blocks; sketching (rough); table work—how to set; paper—machine and hand-made, qualities and weights, equivalent weights; embossing; the principal working parts of hand-presses, platens, cylinders, and perfecting machines; composition and casting of rollers; ink—medium and quick drying; underlaying and overlaying; causes of slurring on press or machine; electrotyping; stereotyping; process blocks; their manufacture and preservation.

The Lectures in the Final Grade will not be limited to any particular syllabus, but will be based upon the groundwork of the Syllabuses for the above Grades, with a wide range of the whole subject of Letterpress Printing, and will include such subjects as the construction of the Platen, Cylinder, Perfecting, and Rotary Machines; process blocks—line and half-tone; inks—coloured and black (treatment of); mechanical composition—their advantages and disadvantages; power—steam, gas, and electric; shaftings and gearing.

General management—principles of estimating; hour costs of labour, including all expenses; material costs and percentages for handling and overhead expenses; methods of cost finding—time sheets, cost sheets, analysis sheets, and book-keeping; hour costs and percentages; weekly cost of production and value of output; supervision of work; keeping track of work in hand. Printing office hygiene.

FRENCH. (C).

Lecturer, F. W. Jackson, B.A.

Fee, 7s. 6d.

Elementary Grade, Tuesday, 8-15 to 9-15.

Intermediate Grade, Tuesday, 7-15 to 8-15.

Advanced Grade, Thursday, 8-15 to 9-15.

Syllabus as prescribed by the Lancashire and Cheshire Union of Institutes.

PRELIMINARY TECHNICAL COURSE—SECOND YEAR

ENGLISH. (C).

Lecturer, J. HASENCLEVER,

Friday, 8-15 to 9-15.

Candidates will be required to write a piece of composition on some subject selected by the Examiner.

PRACTICAL MATHEMATICS AND DRAWING.

Lecturer,

Wednesday, 7-15 to 9-15; Friday, 7-15 to 8-15.

Decimals, Vulgar Fractions, Powers, and Roots, Areas, Elementary Algebra, Ratio, and Proportion, Graphs, Volume.

PRACTICAL DRAWING.

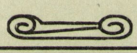
Use of various Drawing Instruments, Scales, Angles, Plane and Curved Surfaces, Triangles, Circles, Solids and Solid Geometry, Hand Sketching of Machine details.

EXPERIMENTAL MECHANICS AND PHYSICS.

Lecturer, J. D. ATHERTON.

Tuesday, 7-15 to 9-45.

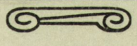
Measurement, Volume, Mass, Relative Densities, Hydrostatics, Statics, Heat.



Building Trades Evening Classes,

INCLUDING

Building Construction, Builders' Quantities, Brickwork and Masonry, Carpentry and Joinery, Structural Engineering, Plumbing, etc.



Building Trades Evening Classes,

including

Building Construction, Builders' Quantities, Brickwork and Masonry, Carpentry and Joinery, Structural Engineering, Plumbing, etc.

BUILDING TRADES.

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Head of Department, F. J. PYE, A.B.I.C.C., Medallist.

Lecturers: E.M. PEARSON, A.R.San.I.
A. C. M. LILLIE, A.R.San.I., Medallist.
R. SANDERSON, Plumbing Department.

Assistants:
J. VARLEY, Honours.
J. J. ALLEN, Honours.
W. TAYLOR.
F. PINDER, Honours.

Students will be admitted to the specialized Courses in Building Trades if they possess the Preliminary Technical Certificate of the Union of Lancashire and Cheshire Institutes, or its equivalent. Other Students who are desirous of joining the Classes must satisfy the Principal of the Institute that they are able to benefit by the Course to which they seek admission, otherwise, they must sit for an entrance examination, and if they fail to reach the prescribed standard it will be advisable for them to attend the Preliminary Course, conducted under the Preston Education Committee, or the Junior Course, J_2., at the Technical School.

In exceptional cases Adult Students may be excused the entrance examinations, provided they can satisfy the Principal of the Institute that they are able to benefit by the Courses to which they seek admission.

Examinations in each year of the Course will be held by the Institute at the close of the session. Students who are successful at these examinations will be entitled to a scholarship and admission to the next year of the course.

In the final year of each Course examinations will be held by the Institute, in conjunction with external examiners.

On the result of these examinations, together with proper attendance at all subjects of the Course, and the production of such satisfactory evidence as is furnished by school records, class work, homework, note books, drawing and laboratory books, a Course Certificate will be issued by the Institute which

may be endorsed by the Board. Successes at approved External Examinations of the Lower or Higher Stages and Examinations of the City and Guilds of London Institute in Technology may be recorded upon such Course Certificate.

Candidates for the Board's Examinations must be over 17 years of age on the 31st July following the examination. Further a candidate for admission to a Higher Examination of the Board will be required to furnish a certificate of having completed a satisfactory amount of Laboratory work (where Laboratory work is required) and to submit his Laboratory note books signed and certified by the teacher.

ORGANISED COURSES.

Except under special circumstances, all Students joining the Institute will be expected to undertake a complete Course of work, and Students will not be regarded as fulfilling this condition unless they attend regularly each subject of the Course, and perform the homework set to the satisfaction of the Lecturer.

Students from Elementary Day Schools will not, as a rule, be ready to undertake specialized courses until they have been prepared by two years' preliminary instruction. Courses for the purpose arranged so as to cover two years, will be conducted by the Preston Education Committee in their Branch Schools, or the corresponding Junior Course, J_2., which will be conducted for the present in the Technical School

BUILDING COURSE.

SENIOR COURSE.

First Year (S_1)

FEE FOR COURSE, 7s. 6d.

DAY.	SUBJECT.	TIME.	TEACHERS.	ROOM
Monday	Building Science, 1st	7-30 to 9-30	E. M. Pearson. W. Taylor.	2
Tuesday	Building Construction, 1st	7-30 to 9-30	E. M. Pearson. J. J. Allen. F. Pinder.	2
Wednesday .	Mathematics & Geometry 1st	7-30 to 9-30	E. M. Pearson. W. Taylor.	2

Second Year (S_2)

FEE FOR COURSE, 7s. 6d.

DAY.	SUBJECT.	TIME.	TEACHERS.	ROOM
Monday	Building Science 2nd	7-30 to 9-30	E. M. Pearson. W. Taylor	2
Wednesday...	Mathematics & Geometry 2nd	7-30 to 9-30	E. M. Pearson. W. Taylor.	2
Friday.....	Building Construction 2nd ...	7-30 to 9-30	E. M. Pearson. J. Varley	2

Third Year (S_3).

FEE FOR COURSE, 7s. 6d.

DAY.	SUBJECT.	TIME.	TEACHERS.	ROOM
Friday.....	Building Construction 3rd ... and any two from	7-30 to 9-30	E. M. Pearson. J. Varley.	2
Tuesday	Brickwork & Masonry.....	7-30 to 9-30	A. C. M. Lillie.	2
Wednesday...	Geometry	7-30 to 9-30	E. M. Pearson.	2
Thursday	Carpentry and Joinery.....	7-30 to 9-30	E. M. Pearson. J. Varley. J. J. Allen.	2
Thursday ...	Materials, Hygiene and Sanitation.....	7-30 to 9-30	A. C. M. Lillie.	7

ADVANCED COURSE.

Fourth Year (A_1).

FEE FOR COURSE, 7s. 6d.

DAY.	SUBJECT.	TIME.	TEACHERS.	ROOM
Wednesday .	Building Construction, 4th ... and any two from	7-30 to 9-30	F. J. Pye.	17
Monday	Builders' Quantities	7-30 to 9-30	A. C. M. Lillie.	17
Tuesday	Brickwork and Masonry	7-30 to 9-30	A. C. M. Lillie.	2
Tuesday	Structural Engineering.....	7-30 to 9-30	F. J. Pye.	17
Thursday ...	Carpentry and Joinery.....	7-30 to 9-30	E. M. Pearson	2

Fifth Year (A_2).

FEE FOR COURSE, 7s. 6d.

DAY.	SUBJECT.	TIME.	TEACHERS.	ROOM
Friday.....	Building Construction, 5th ... and any two from	7-30 to 9-30	F. J. Pye.	17
Monday	Builders' Quantities	7-30 to 9-30	F. J. Pye.	15
Tuesday	Brickwork and Masonry	7-30 to 9-30	A. C. M. Lillie.	2
Thursday ...	Carpentry and Joinery.....	7-30 to 9-30	E. M. Pearson.	2
Thursday ...	Structural Engineering.....	7-30 to 9-30	F. J. Pye.	17

CARPENTRY AND JOINERY COURSE.

First Year.

FEE FOR COURSE, 7s. 6d.

DAY.	SUBJECT.	TIME.	TEACHERS.	ROOM
Monday	Building Science, 1st	7-30 to 9-30	E. M. Pearson. W. Taylor.	2
Tuesday	Building Construction, 1st .	7-30 to 9-30	E. M. Pearson. J. J. Allen. F. Pinder.	2
Wednesday	Mathematice & Geometry 1st	7-30 to 9-30	E. M. Pearson. W. Taylor.	2

Second Year.

FEE FOR COURSE, 7s. 6d.

DAY.	SUBJECT.	TIME.	TEACHERS.	ROOM
Friday	Building Construction 2nd ...	7-30 to 9-30	E. M. Pearson. J. Varley	2
Wednesday...	Mathematics & Geometry 2nd	7-30 to 9-30	E. M. Pearson. W. Taylor	2
Thursday	Carpentry and Joinery.....	7-30 to 9-30	E. M. Pearson. J. Varley. J. J. Allen.	2

Third Year.

FEE FOR COURSE, 7s. 6d.

DAY.	SUBJECT.	TIME.	TEACHERS.	ROOM
Friday.....	Building Construction 3rd ...	7-30 to 9-30	E. M. Pearson. J. Varley.	2
Wednesday...	Geometry	7-30 to 9-30	E. M. Pearson.	2
Thursday	Carpentry and Joinery.....	7-30 to 9-30	E. M. Pearson	2

BRICKWORK AND MASONRY COURSE.

First Year.

FEE FOR COURSE, 7s. 6d.

DAY.	SUBJECT.	TIME.	TEACHERS.	ROOM
Monday	Building Science, 1st	7-30 to 9-30	E. M. Pearson. W. Taylor.	2
Tuesday	Building Construction, 1st ...	7-30 to 9-30	E. M. Pearson. J. J. Allen. F. Pinder.	2
Wednesday .	Mathematics & Geometry, 1st	7-30 to 9-30	E. M. Pearson. W. Taylor.	2

Second Year.

FEE FOR COURSE, 7s. 6d.

DAY.	SUBJECT.	TIME.	TEACHER.	ROOM
Monday.....	Building Construction, 2nd...	7-30 to 9-30	E. M. Pearson. J. Varley.	2
Wednesday.	Mathematics & Geometry, 2nd	7-30 to 9-30	E. M. Pearson. W. Taylor.	2
Tuesday ...	Brickwork & Masonry	7-30 to 9-30	A. C. M. Lillie.	2

Third Year.

FEE FOR COURSE, 7s. 6d.

DAY.	SUBJECT.	TIME.	TEACHERS.	ROOM
Friday	Building Construction, 3rd...	7-30 to 9-30	E. M. Pearson. J. Varley.	2
Wednesday.	Geometry	7-30 to 9-30	E. M. Pearson.	2
	or			
Thursday ...	Materials Hygiene and Sanitation	7-30 to 9-30	A. C M. Lillie.	7
Tuesday ...	Brickwork & Masonry	7-30 to 9-30	A. C. M. Lillie.	2

BUILDING CONSTRUCTION.

First Year.

In this stage instruction will be given in the elementary principles of construction, as applied to the various materials used in the building trades; the meaning of the terms used; properties and characteristics of building materials in common use so far as is necessary to a proper understanding of ordinary constructional methods.

Simple cases of bonding of brick and stone walls, with their foundations, etc., Fireplaces, fender walls and trimmer arches. The finishing of openings in brick and stone walls, lintels, arches, sills, etc., brick and stone dressings as quoins, copings, strings, cornices, etc.; joints and finishing in stonework.

Planning of single floors with method of trimming for fireplaces and stairs. Details of joints in carpenters' and joiners' work.

Types of wood roofs, of moderate span, suitable for various coverings, as boarding, corrugated iron, and slates.

Roof coverings as weather boarding, slates, etc., the method of laying and fixing same.

Ledged and braced, framed and filled-in, and panel doors, and methods of hanging.

Fixed sashes, sashes to open outwards, and sliding or double hung sashes.

Simple plumbers' work, as gutters, valleys, rolls, drips, and flashings.

Typical sections of rolled steel, as used for constructional steelwork, and simple applications of these as generally adopted in floors, roofs, etc.

Cast iron beams and cantilevers, flitched beams.

Instruction will be supplemented whenever possible by actual examples or models, of the materials and method of jointing and using, and attention will always be drawn to examples similar to those dealt with in class, to be found in the school or district.

Second Year.

In addition to the subjects named above, in most of which more difficult cases will be treated, the course will include :—

A more detailed description of the various building materials.

Brick walls stone walls with brick backings cavity walls Various forms of damp proof courses etc.

Types of brick and stone arches not previously dealt with. Various methods of bonding brickwork, broken bond, bond at angles, junctions and piers. Fireplace openings. Flues.

Simple centres for arches of moderate span.

Double and framed floor.

Common and bricknogged partitions.

Small flats and roofs up to 45 feet span.

Slating and tiling, and method of treating same at eaves, ridge, verges, hips, and valleys.

Plumbers' work in roofs and flats.

Simple stairs in wood.

More advanced cases of joinery, as in panel doors, casement windows opening inwards, ditto with mullions and transomes, etc.

Details of ordinary fireproof floors, i.e., rolled steel joists and concrete.

Third Year.

Elementary exercises in the calculation of the strength of materials.

The calculation of the quantities of materials that would be required for the carrying out of a certain piece of work.

The best known stones and bricks, and their characteristics.

The conversion and seasoning of timber.

Excavations in various kinds of soils, including strutting and planking.

Concrete foundations for walls and piers; the bonding of piers of various sizes. Simple concrete construction.

Bases of walls under various conditions. Hollow walls and the various methods of bonding them together; the junctions of walls of various thicknesses at different angles. Various finishings of stone walls dressings, etc. The materials used for damp proof courses.

Simple fireproof construction in floors and roofs, including the better known patent fireproof floors.

The ordinary forms of wood and stone stairs.

More advanced examples of external and internal doors, sash doors, windows, and finishings to same.

Design and construction of timber roof trusses suitable for domestic and small public buildings.

The nature, quality, and weight of the commoner kinds of roof coverings.

Elementary drainage, the laying and jointing of ordinary stoneware, drain pipes.

Plumbers' work, including baths, sinks, waterclosets, and their connections.

Plastering to walls, ceilings, and partitions, including the various kinds of laths, the composition of the various coats.

The usual forms of scaffolding.

Dead shores, and needling, raking and flying shores.

Centres for brick and stone arches of various shapes and moderate span.

The various forms of rivets and examples of riveted joints applied to steel construction.

Simple steel construction as roof trusses for small spans, ordinary steel framework and built up girders.

The general principles of loaded beams, the use of the triangle and polygon of forces, in order to determine practically the resultant in magnitude and direction, and to resolve such a resultant into its component forces ; the determination of the stress in simple braced structures.

Fourth Year.

The Course of instruction will include the consideration of buildings of all kinds and sizes. In the examination the candidate will be expected to show that he has a fair knowledge of the principles of Physical Science as illustrated in relation to building construction. He should be able to design simple roof trusses and beams and to draw their stress diagrams ; how to provide for the stresses in various parts of a building, and the methods of inspecting and testing cement, timber, iron, and steel ; and the use of formulæ.

In the various sections of the Course, exercises in calculating quantities of materials will be continued as in the preceeding Stage.

The class lessons and drawing practice will include the consideration of :—

Foundations—natural and artificial, upon land and under water, damp sites and their treatment. Brickwork, including all kinds of bonding, setting out bond in frontages, &c. Underpinning, &c.

Terra cotta and artificial stone ; their manufacture and use.

Principles of sanitation ; drains, traps, gulleys, disconnecting chambers, sewers, their ventilation and drain connections, iron drains. Drain testing and ventilation.

Masonry. Character of various stones used in building, and localities where found, how to test for quality and bed, fitness of various stones for different atmospheres, weight generally, approximate strength and chemical composition ; stone stairs, composite walls, arches.

More detailed knowledge of scaffolding, including gantries, elaborate centering, framing for concrete walls and modern methods of hoisting materials, roofing up to 60 feet span. Timber: its seasoning, diseases, causes of decay, and means of preserving it. Roof timbering, open, hammer beam, and composite trusses. Modern iron trusses, including trussed purlins; all roof finishings, including slating, tiling, plumbing, etc., sky-lights and lanterns. Wood stairs of all kinds, including handrailing, and the higher class of joiners' work, in hard and soft woods suitable for the finishings of public buildings, and other important work.

Ventilating and heating; hot water supply; provisions for gas and electric supply, in so far as these may effect the structure of the building; water supply; lightning conductors; various kinds of glass and glazing; plastering in all its branches.

Cast iron, wrought iron, and steel. Properties, uses, strength, weight, and preservation. Safe working stresses; factors of safety.

Designs for ties, struts, stanchions, and columns; Bending moment and shearing force diagrams. Stresses in beams and girders corresponding to given conditions of loading. The design of beams and girders.

Determination of stresses in the members of framed structures by means of reciprocal figures, and application to braced girders, cantilevers, and roof trusses. Details of construction of braced girders, plate girders, roof principals, and braced stanchions, etc.

Design of riveted joints, pin joints, and bolted joints; general design of the structure for a steel frame building. Ferro-concrete, with application to columns, floors, roofs, beams, and walls.

Design of retaining walls, fireproof floors, and deep foundations.

Specifications for any of the materials used in building construction, including iron, steel, concrete, terra-cotta stone, timber, etc. Method of testing and judging their quality.

Fifth Year.

In addition to more advanced examples of all subjects enumerated in the Syllabus for the Forth Year, instruction will be given in the designing and carrying out of special construction in all classes of buildings.

Complete specifications for various sections of the Building Trade.



BUILDING CONSTRUCTION CLASS ROOM,
TECHNICAL SCHOOL, PRESTON.

MATHEMATICS AND GEOMETRY, 1ST.

Arithmetic—

Contracted multiplication and division. Use of rough checks in arithmetical work. Vulgar and decimal fractions, square roots, and squares of numbers. Ratio and proportion.

Percentages. Duo-decimals, as used in builders' work. Expressing feet and inches as decimals of a yard ; quarters and pounds, as decimals of a hundred-weight ; and shillings and pence, as decimals of a £.

Comparisons between British and Metric systems of units of length and area.

Mensuration—

The rules for the areas of circles, triangles, parallelograms, and all irregular figures, with practical application. Determination of the areas of surfaces as walls, roofs, etc. ; plotting large areas from data given, as from a surveyors field book. Surfaces of solids, such as cones, cylinders, prisms, and pyramids.

Use of squared paper for plotting and measuring areas.

Algebra—

Students will be taught the use of symbols, so as to understand and use any formulæ. To substitute numerical values for the symbols, and to transpose and simplify algebraic formulæ and expressions.

Multiplication and division, factors, and problems, leading to simple equations. Graphic solution of equations.

Geometry—

Tests for accuracy of drawing instruments.

The drawing of parallel and perpendicular lines by various methods. The drawing and measurement of angles with application to the Building Trade. Bisection of lines and angles.

The construction of quadrilaterals and irregular polygons from adequate data of sides, angles, and diagonals.

Complementary and supplementary angles.

The principles of right angled triangles. The construction of any triangle having given three elements.

Similar triangles. The equal and proportional division of lines, the construction and use of scales. Mean proportionals, etc.

Problems relating to curves, lines, and points, *e.g.*: to find the centre of a circle to pass through three points; to touch two given lines, etc.; to draw tangent and normals; to find the point of contact.

The construction of regular polygons having given (*a*) length of side (*b*) angle between two sides, (*c*) circumscribing or inscribed circle; application of above problems on circles and regular polygons to setting out arches, mouldings, simple tracery, ornaments and geometrical design.

Problems requiring a knowledge of the properties of the angles in a semicircle or any segment of a circle, *e.g.*: to trace a segment of a circle when the centre is inaccessible, the use of the semicircle in obtaining a right angle, etc.

The areas of triangles, quadrilaterals, regular and irregular Polygons.

The length of the circumference and the area of a circle. Experimental and arithmetical proofs.

The properties of the ellipse and problems relating thereto.

Application in setting out elliptical arches, etc.

The principles of orthographic projection and meaning of the terms used. Plan. and elevation of plane figures from given data. Plans, elevations, and sections, of solids, and application to simple architectural and building drawings. Problems relating to lines, finding their true length, inclination and traces.

Problems relating to surfaces, true shape, etc. Simple inclined planes.

The development of the surfaces of solids as roofs, embankments, etc.

The principles of oblique and isometric projection, with application to builders' work.

Drawing to scale, plan and elevation, from given isometric or oblique sketches of common objects or solids, and vice versa.

Dimensioned freehand sketches and making scale drawings from same.

MATHEMATICS AND GEOMETRY, 2ND.

In addition to a good knowledge of the subjects mentioned in the First Year Syllabus, this course will include :—

Arithmetic—

The meaning of common Logarithm ; use of Logarithms in making calculations involving multiplication and division ; powers and roots. Evuluation of formulæ by means of logarithms.

Use of constants of labour in estimating builders' work.

Mensuration—

Determining the volume of solids such as cones, cylinders, spheres, pyramids, and regular and irregular prisms.

Calculating the weight of girders, columns, etc.

Weight and cost of solids of irregular form, including brick and stone work, timber, and builders' work in general.

Algebra—

Multiplication of binomials by inspection, taking out a common factor, differences of two squares. Simple algebraic fractions.

Evaluation of more difficult formulæ.

Solution of simultaneous and quadratic equations.

Plane Geometry—

More difficult problems relating to the construction of scales, the properties of circles and the setting out of tracery.

The enlargement and reduction of curved and rectilineal figures, as mouldings, stair brackets, etc.

The determination of sine, cosine, and tangent, by construction and measurement, and the setting out and measurement of angles by tables of sines, etc., and by scale of chords.

Simple examples of geometrical loci.

Solid Geometry—

More difficult cases of inclined planes and simple cases of oblique planes.

The intersection of planes and the angle, between them with application to building problems, as roof cuts, etc.

The intersection and development of straight and curved surfaces on plane surfaces, such as dormers with curved roofs, pyramidal ventilators, and oriels.

True shape and bevels for splayed window linings, angle, and raking moulds ; bevels and joints in stone and brick arches, and simple vaulting.

GEOMETRY.

Plane Geometry—

More difficult problems on the work done in this section during previous years.

Problems involving the properties of circles.

The ellipse, parabola, and hyperbola, with their tangents and normals.

The setting out of tracery, including the method of determining the cuspings.

The construction of scrolls, volutes, and spirals.

Solid Geometry—

The oblique plane and planes defined by scale of slope.

Problems relating to these as intersections and rabatments.

Contact and interpenetration of cylinder, cone and sphere.

The intersection of planes, with application to such problems as relate to the surfaces of angle turrets and hipped roofs, roofs irregular in plan with adjacent sides of different pitch, embankments.

Interpenetrations and developments, such as conical, domical, and other curved roofs with shafts of various sections passing through.

Moulded arches and splayed jambs.

Domes, niches, and pendentives, in stone and brick, with their joints and moulds.

Oblique arches, developments and bevels.

Circle on circle splayed window linings.

Elevation and development of strings of geometrical stairs.

Handrailing, elevation, falling moulds, face moulds, and bevels.

Vector Geometry—

The link polygon. Conditions of equilibrium of a system of forces in one plane. Force diagrams for various braced structures. Graphical solutions of problems relating to walls subjected to wind or water pressure. Line of resistance of arches symmetrically loaded. Bending moment and shear diagrams of beams and cantilevers variously loaded.

BUILDING SCIENCE, 1ST.

Properties of materials, porosity, density, relative density, elasticity, capillarity, etc.

Pressure of the atmosphere, fluid, pressure.

The action of pumps and siphons.

Nature and effect of heat on bodies ; quantity of heat and how measured ; specific heat ; high specific heat of water, evaporation and condensation, transfer of heat.

Units of force, representation of forces by lines, measurement and balancing of forces, composition and resolution of forces, rectangular components of a force ; the parallelogram triangle and polygon of forces, Bow's notation.

The three orders of levers, the bell crank lever. Moments of a force.

Determination of the centre of gravity of areas experimentally.

Composition of the air ; properties of oxygen ; carbon dioxide ; oxidation and combustion.

Water as a solvent ; hard and soft waters.

Limestone and its calcination ; the meaning of quicklime, slaked lime, fat or rich lime, hydraulic lime. Composition and setting of mortar.

In this course Students will, wherever possible, verify by experiment the general properties of the common building materials ; the effect of heat on bodies ; atmospheric pressure and its result ; the action of water on various limes, and the laws of force on bodies in equilibrium, as shown by the triangle and polygon of forces ; the principle of moments, the reactions due to a beam variously loaded, and the stresses set up in a simple roof truss.

BUILDING SCIENCE, 2ND.

Resultant of non-concurrent forces ; *i.e.*, forces not meeting at a point, also of parallel forces, funicular polygon, reactions at the supports of a beam.

Determination of centres of gravity by experimental and graphical methods.

Beams. Relative stiffness and strength under different conditions of loading and supporting. Variation of deflection, with span breadth and depth. Complete test of a beam to breaking.

Laws of friction, co-efficient of friction. Angles of repose. Effects of friction on structures.

Machines. Simple pulley blocks, lever. Wedge and screw. screwjack, lifting crab, cranes. Mechanical advantage and efficiency.

Use of squared paper. Plotting of curves showing results of experiments, *e.g.*, the relation between loads and effort, stress and strain, etc.

Properties and strength of materials used in construction, as timber, steel, iron, etc., in compression and tension. Stress, strain, elasticity.

In this Course Students will find experimentally the co-efficient of friction of various materials. The relation between breadth, depth, span, and load in beams. The modulus of elasticity of steel, timber, etc. The mechanical advantage and efficiency of simple pulley blocks, etc.

STRUCTURAL ENGINEERING.

First Year.

Loads on structures.—Weights of various materials of construction. Dead and live loads. Wind pressure in ordinary cases.

Bending moment.—The calculation and graphical illustration by scale diagrams of bending moment due to simple cases of loading, as, for example, systems of concentrated loads, uniformly distributed load and uniform load over a portion of the span, in the case of simply supported girders.

Shearing force.—Diagrams of shearing force corresponding with the above cases of bending moment.

Moment of resistance.—Calculation of exact and approximate moments of resistance for girders of simple sections. Graphical method of estimating moment of resistance for girders, rolled joists and troughing. The relation between moment of inertia, radius of gyration and moment of resistance of a girder section.

Practical details.—Details of riveted joints, practical arrangement of plates, joints and riveting in the simpler forms of plate and lattice girders.

The necessity for observing economy by the adoption of certain practical details and not adhering too closely to theoretical design.

Calculation of efficiency of simple riveted joints.

Roof trusses.—The various types of V trusses, and spans for which they are suitable. Calculation of stresses due to dead load by method of sections, and the obtaining of stresses by means of stress diagrams. Wind pressures; wind stress diagrams.

Detailed arrangements of joints in simple trusses.

Girders.—The general method of designing a plate girder for a given span and load.

The stresses in braced girders of uniform depth under dead loads.

Masonry structures.—Retaining walls and small span arches. Foundations for brick and masonry walls. Safe pressures on foundations in different classes of earth. Intensity of pressure on foundations of retaining walls. Line of resistance or resultant pressure in retaining walls and masonry dams.

Materials.—A general knowledge of the properties and strengths of stone, brick, cement, mortar, concrete, cast iron, wrought iron, and steel.

Second Year.

More difficult cases of the subjects mentioned in the First Year together with :—

Loads.—Rolling loads and their effect on structures, as distinguished from that of dead loads. Dynamic or " impact " effect, and suitable allowances therefore at varying speeds.

Bending moment.—Bending moment diagrams for cantilevers fixed girders and continuous girders. The theorem of three moments and its graphical solution by the aid of " characteristic points."

Shearing force.—Shearing force diagrams corresponding with the above cases of bending moment ; maximum and mean shear on a girder section. The determination of principle stresses on tructures.

Deflection of girders.—Method of calculating deflection or obtaining the same by graphical methods in the case of beams of uniform section under various conditions of loading. Discrepancy between theoretical and actual deflection in practical structures. Elastic deflection and deflection due to " set " of built-up riveted structures. Maximum amount of deflection desirable in various structures. Camber.

Braced girders.—Stresses in braced girders of varying depth, such as the lattice bow, N or Linville truss, Pratt truss, Baltimore truss, various types of bowstring girders and cantilevers of varying depth, under dead and rolling loads.

A more intimate knowledge of the relative economy of various types. Economical depth and span. Dead weight of girders.

Relative advantages and disadvantages of riveted and pin-connected structures.

Details of ordinary types of bridges.—The various types of flooring in general use, such as troughing, cross-girders with or without longitudinals, flat, curved and buckled floor plates, and their weights. Types and weights of permanent way in railway-bridges, and of pavements, jack arching and troughing for highway bridges.

Deflection and expansion bearings for long spans.

Detailed connections for struts and ties in large braced girders.

Overhead wind bracing and sway bracing.

Wind Pressure.—Stresses due to lateral wind pressure, both on the stationary structure and moving load. Great importance of wind pressure on large and lofty structures. Some knowledge of results of experiments on wind pressure.

Roofs.—The stresses in other types of roofs, such as "ridge and furrow," cantilever roofs and arched roofs of large span.

Detailed construction of same.

Long Compression Members.—The theory of column strength. Columns under eccentric and central loads. Impossibility of securing ideal conditions for exact central loading in practice. Results of actual tests on full-sized columns. Discrepancies between theory and "practical" formulæ based on results of tests. Round-ended, flat-ended, and fixed-ended columns.

Columns of special design for accommodating crane-girders on one or both sides at different heights, together with roof girders.

Design of long struts in large braced structures.

Long crane jibs and legs of high piers.

Grillage foundations for tall pillars.

Arches.—The three-hinged arch under various loadings. The disadvantages attending the use of two-hinged and rigid arches of large span, with some knowledge of the theory of the same.

Suspension Bridges.—The stresses in the flexible and stiffened types of suspension bridges.

Materials and Costs.—A more intimate knowledge of the strength of materials. Suitable specifications for materials for various works, and tests for same. A general knowledge of the probable cost of different parts of a structure under average conditions of site, supply, transport and erection.

The best methods of protecting stone, iron and steel from weathering and corrosion.

Ferro-Concrete.—A general knowledge of the principal systems of ferro-concrete construction, as applied to buildings, arched

bridges, tanks, piles and conduits. Simple calculations of such structures, in so far as they may be calculated with any degree of accuracy. The beam theory as applied to ferro-concrete beams and floors. Strength of ferro-concrete piles. Materials and specifications for ferro-concrete.

HYGIENE AND SANITATION.

As Relating to Building Construction.

The Site: Aspect—elevation. Hill, plain, and valley.

Winds. Rainfall. Humidity.

Soil and subsoil, and their drainage.

Pollution of subsoil. Sanitary precautions as to healthiness of site.

Ground air and ground water and their pollution.

Materials considered as to their perviousness to moisture.

Conductivity of heat. Durability. Strength, Working. Fire resisting, and Cost, etc.

Construction and materials from a Hygienic standpoint, used in foundations in various soils. Solid and hollow walls; partitions; damp-proof courses. Basement and ground floors, in timber and concrete, etc. Roof coverings, gutters, flashings, etc.

Drainage. The proper conditions of good drainage. Materials and Construction. Laying. Ventilation. Syphonage. Disconnecting. Typical drainage plans. Drain testing, and inspection of drainage, work and appliances. Cesspools. Septic tanks, etc.

Sanitary fittings. Waste pipes and connections. Disinfection and disinfectants.

Disposal of surface and drain water. Collection and disposal of refuse and sewage.

Water. Sources of supply. Physical characteristics of various waters. Hard and soft water for domestic purposes. Requirements of supply. Mains, pipes, fittings, and storage. Sources of contamination and protective precautions. Filtration, softening, and other purifying processes.

Ventilation. Air movements, Sources of pollution, principles of ventilation, air space allowed and required, renewal of air, crowding in space and in buildings. Methods of, and appliances for ventilation.

Heating: Open fires, stoves, hot water, steam, gas, etc.

Lighting: Angle of daylight illumination, size, and position of windows. Artificial lighting, advantages and disadvantages of each.

Sanitary Inspection, etc. Surveys and reports, etc.

BUILDERS' QUANTITIES.

First Year.

Students will not be allowed to take up this subject unless they have, at least, attended a Second Years' Course in Building Construction.

Taking off; squaring dimensions, reducing same; abstracting billing.

The mode of measurement of the following:—

Earthwork, including earth surface excavation. Ditto for trenches and basements; strutting and planking for same. Concrete for foundations, floors, and walls, etc.

Drainage, including inspection chambers, pipes, junctions, traps, connections to sewers, etc.

Brickwork in motar and cement, including party walls, chimney breasts and stacks, trimmer, relieving and gagued arches; facings and pointings, strings, and base courses, damp courses, boundary walls, copings, etc., battered and circular work.

Masonry, Walling of various kinds ,arches, plain and moulded; square and spandril steps, thresholds, hearths, paving, templates, coping, etc., dressings as sills, heads, strings, cornices, etc. Moulded work in general.

Slating and Tiling, straight, circular, or vertical, including the finishings of ridges, hips, and valleys, etc.

Carpentry: Floors, flats, roofs, partitions, centres, etc.

Joinery, including windows, doors, and finishings in general, grounds, etc. Block and batten flooring.

Plumbing, including gutters, cesspools, flashings, flats, and all roof work. Water supply and waste water pipes.

Smith and Ironfounder. Rolled steel joists and girders, with connections, casements, cast iron columns, pipes, gutters, and fittings.

Plasterers' Work, including cornices, enrichments, soffits, walls and ceilings; Keene's cements in angles, dadoes, skirtings, etc., Portland cement in rendering floors and skirtings.

Painting on iron, woodwork, or walls—external or internal; distempering, graining, staining and varnishing, lettering, etc.

Glazing, including lead lights, patent glazing, etc.

Second Year.

To take off quantities, abstract, and bill from scale drawings, a section of work comprising any of the following branches of the Building Trade.

Excavation, Concrete, and Drainage work.

Bricklaying and Masonry. Slating and Tiling.

Carpentry and Joinery, Ironmongery.

Smiths' and Ironfounders' Work. Steel Work.

Plasterers' Work. Plumbing and Zinc Work.

Gas and Hot Water Fitting.

Painters' and Glaziers' Work.

And price the same in accordance with local rates.

Specifications.

CARPENTRY AND JOINERY.

GRADE II.

The proportions of the various parts of Carpenters' and Joiners' work, such as doors, windows, floors, roofs, etc.

The proportions, tenons, and dovetails should bear to the thickness and width of material, with due regard to strength, the correct design of joints to resist strain in roof trusses, scarfing, bolts, straps, keys, etc., used to secure joints.

Setting out rods and material, showing shoulder lines, etc., of panelled and framed and braced doors, door frames, jamb linings, French casements, double-hung sashes and cased frames, and all ordinary joiners' work.

Doglegged and open newel stairs, proportion of tread and riser, details of construction and methods of support.

Hinges, and the modes of applying them ; centre pins, back flaps, butts, and various kinds of spring hinges. Centres as applied to pivot hung sashes. Working drawings, showing the path of different parts of the work to obtain clearance.

The size and position of pulleys in double-hung sash frames, including ordinary and clockweight hanging.

The preparation and fixing of weather boarding and weather boards, the position and proportions of throatings, condensation grooves, etc., in skylights, sills, and all woodwork exposed to the weather.

Finding bevels for hip rafters, jack rafters and purlins, also the method employed to place bevel lines direct upon the work without making a drawing of the same.

The use of the steel square in practical roof work.

The preparation and fixing of woodwork, such as grounds, lining. architraves, bracketings, beads, etc., with necessary grooves and bevels for plaster.

Gutters, cesspools, rolls, drips, mouldings, finials, etc., for plumbers; boarding, battens, tilting fillets, etc., for slaters and tilers.

The design and construction of centres for brick and stone arches, segmental, circular, elliptical and gothic, up to 15ft. span, with method of supporting, easing, and striking them.

Fixing shuttering for walls and floors in reinforced concrete.

The development and measurement of the surfaces of simple solids with the necessary allowances for waste, etc.

Intersection of mouldings at different angles, also of straight and circular mouldings lying in one plane, enlarging and diminishing mouldings and stair brackets, determining the true section of vertical angle bars, and raking mouldings over square plans.

The mechanical principles required in framing simple roof trusses, timber partitions, trussed girders, etc; determining the stresses in the various members by graphic statics.

The mechanical principles and practical methods of strengthening beams and girders, by flitching, trussing, etc.

Nature and properties of the various kinds of wood used in carpentry and joinery, their defects; the places from which the various woods are obtained. Methods of seasoning and preservation of timber, mode of converting timber for general builders' work.

FINAL.

Candidates for the Final Grade must have passed in a previous year in Grade II (or Ordinary Grade).

In addition to a more advanced knowledge of all the subjects mentioned in the Syllabus of Grade II., this Course will cover the setting out of geometrical curves, such as ellipse, parabola, and hyperbola, and the best practical way of obtaining their parallels, normals and tangents.

The various methods of constructing large centres for semi, segmental, elliptical and other arches, and the methods employed for fixing, easing, and striking them.

Different forms of timbering for foundations, and reinforced concrete work, scaffolding, staging and gantries, shoring, derrick towers, etc., with a clear knowledge of their requirements to ensure safety.

Bridges, temporary buildings, framed structures, and half timber work.

Circular work. Method of constructing strings for geometrical stairs, ribs and mouldings in circular work by bending, building up, laminating, grooving, etc.

Construction of fittings for churches, museums, public buildings, shops and domestic work, such as pew stalls, showcases, shop fronts, fitments for butler's pantry, housekeeper's room, etc.

Moulds, bevels and developments required for soffits in straight and circular walls, also for ribs in groins, domes, niches, pendentrives and work of double curvature.

Handrailing ; the theory and use of tangent planes and falling lines, preparing face moulds and bevels, and the method of applying them, method of setting out handrail scrolls, etc., the development of strings for geometrical stairs.

The Intersection of raking mouldings over oblique and curved plans, and the methods of determining varying sections.

Calculations of stresses in timber beams and cantilevers under various loads, effective designing of joints in beams, joists, and constructional carpentry.

The conversion of timber to obtain the maximum strength and stiffness or display, the various types of figure, for which certain woods are noted.

Planning stairs, taking dimensions from buildings and measurements for work. Working from scale drawings and preparing details, suggesting how various parts may be put together.

BRICKWORK AND MASONRY.

First Year.

Bricks : the names, nature, and properties of the various kinds of bricks in general use, and the purpose for which each kind is specially fitted. The various modes of manufacturing bricks, and testing their quality for different purposes.

Lime : nature and properties of the different kinds and their use. Cement : the methods of making, and means of testing. Sand : the relative advantages and disadvantages of pit, river, and sea sand. Proportions of the above for making good mortar. Concrete : its ingredients, method of preparation and uses.

Stone : description of the various classes of building stones, and their characteristics. Modes of distinguishing sandstones

from limestones. Reasons for preferring one to the other in various climates. Varieties of stone suitable for internal work. Precautions to be adopted in excavations in various soils. Mode of laying drain pipes.

Foundations: the width and height of the footings required for walls of different thicknesses, and for various kinds of earth. Damp-proof courses, the materials used for these, and their practical purpose. Air bricks. The best method of ventilating underground floors. Dry areas, and the method of constructing and keeping them free from wet.

Bond in brickwork. Plans of alternate courses at the angle of walls of different thicknesses, showing English and Flemish bond. Irregular bond. Raking Bond. Bond of acute and obtuse angles. Gauged brickwork.

Brick walls with stone facing. Stone walls with brick backing. Hollow walls, the methods of constructing and bonding them. Plans of openings in the same. The method of constructing fireplaces, and arrangement of flues. Bond in chimney shafts. Rendering, parging, and coring arches. Names of the different kinds and mode of construction. Bond in arches, and the description of their several parts, such as soffit, skewback, etc.

Tiling. Paving. Pointing: the comparative merits and demerits of various kinds. Proper composition of black mortar, etc.

Rubble work. Ashlar. Flint work. Bonding stones. Precautions to be adopted in setting stonework. Mode of ascertaining natural bed. Reason why this is important.

Quoins, copings, cornices, and mode of hoisting large stones and precautions to be adopted in setting them. Heads and sills.

Arches, circular, segmental, elliptical, plain and moulded, intersection of moulded arches, with moulded or splayed jambs. Straight arches with secret and joggle joints. Mouldings, their names and forms, intersection of mouldings at different angles. Enlarging and diminishing mouldings.

The usual types of stone stairs, with the various methods of constructing and supporting.

The general mechanical principles involved in brickwork and masonry, the resistance to crushing, and the average weight per foot cube. The strength of brick and stone piers set in mortar and cement.

The method of measuring brickwork, stonework, tiling, paving, concrete, etc., and the material required for a given quantity of work.

Second Year.

In addition to a more advanced knowledge of the subjects mentioned in the First Year., lessons will be given in the following Subjects :—

Management of works.

Rules governing the bonding of brickwork. Foundations for engineering work in general, in water logged soil, and under water.

Shoring, underpinning, scaffolding.

House drainage, as required to be done by the bricklayer, and sewer construction.

Tunnelling. Vaulting : name and decsription of the various kinds, and method of construction. Construction of circular and octagonal bays, niches, domes, oriels, etc., and drawings to illustrate the same.

Buttresses, flying buttresses, their purpose and mode of construction ; spires, etc.

Setting out intricate bonding in buttresses, piers, pilasters, cornices, etc., and in gauged brickwork generally.

Moulded and ornamental brickwork.

Geometrical stairs, and the method of setting out the curves.

Window tracery, generating lines, intersection of mouldings position of joints.

Terra cotta ,its manufacture, and application to buildings.

The principal orders and styles of architecture.

PLUMBING.

Third Year.

FEE FOR COURSE, 7/6.

TIME TABLE.

DAY.	SUBJECT.	TIME	TEACHERS.	ROOM
Monday	Building Science, 1st	7-30 to 9-30	E. M. PEARSON W. TAYLOR	2
Tuesday.....	Plumbing. Theory and Drawing, Grade I.....	7-15 to 9-15	R. SANDERSON	7
Wednesday ...	Mathematics & Geometry, 1st	7-30 to 9-30	E. M. PEARSON W. TAYLOR	2

Fourth Year.

FEE FOR COURSE, 7s. 6d.

TIME TABLE.

DAY.	SUBJECT.	TIME.	TEACHERS.	ROOM
Monday	Plumbing, Practical, Grade II	7-15 to 9-15	R. SANDERSON	7
Tuesday	Building Construction, 1st...	7-30 to 9-30	E. M. PEARSON J. J. ALLEN F. PINDER	2
Wednesday ...	Plumbing, Theory and Drawing, Grade II	7-15 to 9-15	R. SANDERSON	7

Fifth Year.

FEE FOR COURSE, 7s. 6d.

TIME TABLE.

DAY.	SUBJECT.	TIME.	TEACHERS.	ROOM
Monday	Plumbing, Practical including Lead Burning, Final.	7-15 to 9-15	R. SANDERSON	7
Thursday	Materials, Hygiene and Sanitation	7-30 to 9-30	A. C. M. LILLIE	7
Friday	Plumbing, Theory and Drawing, Final	7-15 to 9-15	R. SANDERSON	7

PLUMBING.

GRADE I (Theory and Drawing).

Geometry and Drawing.—The cutting out of sheet lead in various forms for covering dormers, cesspools, dome and turret roofs. Making simple plans, elevations and sections, and rough dimensioned sketches of various details in plumbers' work. Capacity of pipes, cisterns, and cylinders, &c.

Application of Elementary Physics to Plumbers' Work.—Expansion and contraction due to change of temperature. Frost-burst. Hot-water circulation. Heating apparatus. Elasticity of metals. Strength of pipes and boilers. Calculation of bursting pressure and safe load. Flow of metals, as of lead under great pressure, or in lead bossing. The principles of workshop appliances.

Alloys, Solders, &c.—Properties, composition and preparation of different kinds of solders and alloys used in plumbers' work. Fusing points. Means of purification. Fluxes, &c.

The various Tools used by Plumbers.—Their use and maintenance. Reasons for the forms and materials of given tools.

Lead Burning.—Its special advantages. Different methods in use. Precautions to be taken in their use.

The composition and use of cements used in plumbers' work

The use of Cast and Milled Sheet-lead.—The advantages and disadvantages of each. The use of cast and drawn lead pipes, bends, traps, &c. Tinned and tin-encased pipes. Methods of protecting metals.

Roof Work.—The cutting and straightening of sheet-lead Lead bossing. The proper formation of gutters, flats, valleys, dormers, turrets, domes, &c., in order to render them damp and water proof. The arrangement of woodwork to secure this object. Flashings, soakers, &c., for rendering weather-proof the junctions of roofs, walls, and chimneys. Methods of conveying rain water from roofs.

GRADE II (Theory and Drawing).

Geometry and Drawing.—Finding the true length of hips, stepped or raking flashings and other sloping work from a roof plan, either algebraically or by geometry. The development of plain turrets and methods of setting out the covering surface of same. Other regular solids. Measurement and setting out of angles. Making working drawings (full size or to scale) to show the arrangement of soil or other large pipes for a single sanitary fitting.

Application of Science to Plumbers' Work.—Water ; soft, hard, sea, and mineral waters, and their effect upon pipes, cisterns, &c. Temporary and permanent hardness. Contamination and purification of water. Head of water. Flow of water in channels and pipes. Calculation of velocities. The syphon, pumps, and hydraulic ram. Movement of air or gas through pipes. The oxy-hydrogen and air-hydrogen blow-pipe ; and the use of compressed gas in cylinders, as applied to plumbers' work.

Cold Water Supply.—Connection of pipes to mains. Methods of fixing pipes. House cisterns : their construction and fittings ; valves, taps, water waste preventers, flushing tanks, stop and draining cocks, warning pipes, water hammer, air traps, water meters, filters, practical means of protection against frost, tracing leakage.

Hot Water Supply.—Systems of supply, storage, and arrangements for best results. Safety arrangements. The cause and prevention of collapse of cylinders. Cause and prevention of incrustation. Cause and prevention of boiler explosions, their different forms of safety valves. The relations of temperature and pressure.

Pipe Fitting.—The cutting, bending, screwing, jointing, and fixing of iron, copper, and other metal pipes used for hot and cold water supplie1, waste pipes, &c.

Sanitary Appliances in common use and the Principles of their action.—Forms and materials for baths, lavatories, sinks, urinals, water-closets, and their fittings. Forms and principles of the various traps used in plumbers' work and the relative advantages. Waving out and syphonage of traps, and methods of preventing the same.

Drainage.—The fitting up and arrangement of soil and waste pipes. Laying out of drainage. Material. Size. Fall. Traps. Inspection and disconnecting chambers. Ventilation of drains, soil, and waste pipes.

PRACTICAL.

Marking off and cutting out sheet lead. Pipes bending and wiping joints on lead pipes up to 3-inch diameter. Lead bossing, including internal and external angles up to 6 inches high, and how to execute simple work in leadburning.

FINAL (Theory and Drawing).

Geometry and Drawing.—The development of domes, turrets, and finials and other rounded or hollow roofs, with the lines necessary for finding the true shape of a piece of metal for roof covering.

Setting out, full size or to scale, all kinds of internal plumbers' work, setting out on plan the proper positions of cesspools, rolls, drips, and other lead work on roofs. Making sketches and working drawings.

Hot Water Supply and Heating.—Methods of obtaining large supplies of hot water. Calorifiers. Water heaters. Heating buildings by hot water or steam. High and low pressure systems. Sizes of pipes and boilers. Radiating surface of heaters. Heating surface of boilers.

Ventilation.—Different systems of ventilation for private dwelling-houses and public buildings. Pressure and vacuum systems.

Sanitary Appliances.—The arrangement and fitting of sanitary appliances in hospitals and other public buildings.

Drainage.—Setting out, construction, and principles of town and country house drainage. Construction of sewers. Storm overflows. Sewage gases and ventilation. Methods of sewage disposal for isolated country houses. Access to and cleansing of drains. The testing of soil-pipes, drains, &c., by smoke, water, chemicals, or air pressure.

Plans and Specification.—The preparation of specifications and quantities, and making of working drawings to scale. Measuring work. Local authorities' bye-laws and regulations.

PRACTICAL.

The bending and jointing of all sizes of lead pipes. Mixing of rain-water pipe heads. Lead bossing. Covering of finals, &c.

Lead burning as required for chemical purposes.

BUILDING SCIENCE, 1ST., ETC.

(See Page 125).

GEOMETRY AND MATHEMATICS, 1ST.

(See Page 121.)

BUILDING CONSTRUCTION, 1ST.

(See Page 116).

MATERIALS, HYGIENE AND SANITATION.

(See Page 130).

Mechanical Engineering Evening Classes.

Mechanical Engineering Evening Classes.

MECHANICAL ENGINEERING DEPARTMENT.

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Head of Department :—E. C. Moyle, A.R.C.Sc., A.M.I.Mech.E., Wh.Ex.

Lecturers :—J. H. Binfield, Wh.Ex.

F. W. Walker, Dip. M.E.

Assistants for Drawing Office and Laboratory :—

G. Dimmock, Senior Course Certificate.

S. Hornby, Senior Course Certificate.

Admission to Senior Course.

Before admission to the Senior Course the Student must either have attended a Secondary School up to the age of 15, or have taken a Junior Part-time Grouped Course, or must give alternative evidence of equivalent attainments by passing an entrance examination.

Students cannot expect to benefit by the Course unless they possess the above qualifications. It will be advisable for those who fail to reach this standard to attend the Preliminary Course conducted by the Preston Education Committee.

In exceptional cases adult students may be excused the Entrance Examination provided that they can satisfy the Principal of the Institute that they are able to benefit by attending the Course.

Senior Course Certificate.—Conditions of Award.

Internal examinations in the final year of the Senior Course will be held by the Institute in conjunction with an extenal examiner. On the results of these examinations, together with proper attendance at all subjects of the Course, and the production of such satisfactory evidence as is furnished by school records, class work, homework, note books, and laboratory books, a Senior Course Certificate will be awarded by the Council of the Institute, and endorsed by the Board of Education.

Successes at External Examinations in Mechanical Engineering, held by the Board of Education and City and Guilds of London Institute, will be recorded upon the Certificate, but these successes are not necessary for the award of the Certificate.

Equipment.

The Mechanical Engineering Laboratory is provided with apparatus for experimental work in connection with applied mechanics, strength of materials, hydraulics, mechanism, and heat engines.

The engine room contains a semi-portable boiler with a working pressure of 150lb. per square inch. This draws its feed water from a measuring tank, and supplies steam to a compound horizontal engine of 35 h.p., and two smaller vertical engines.

The compound engine is fitted up specially for experimental work, so that steam consumption trials can be carried out under a variety of conditions.

The engine may be run condensing or non-condensing, and the power given out by the engine can be determined by mechanical or electrical methods.

The independent surface condenser is arranged for experimental work.

The laboratory also contains a gas engine of 25 h.p., fitted with apparatus for complete power and consumption trials.

In addition to the above the laboratory is equipped with smaller pieces of apparatus for the carrying out of the experiments indicated in the Syllabus for the different years of the Course.

TIME TABLE AND SYLLABUS OF WORK.

JUNIOR COURSE.

First and Second Year. *See page —, General Prospectus.*

SENIOR COURSE.

First Year (S.I.). FEE 7s. 6d.

TIME TABLE.

SUBJECT.	DAY.	TIME	LECTURER.
Practical Mathematics	Monday.....	7-30 to 9-30	J. H. Binfield
Engineering Drawing	Tuesday or Thursday ...	7-30 to 9-30	J. H. Binfield
Engineering Science	Tuesday or Thursday ...	7-15 to 9-45	F. W. Walker

SYLLABUS.

PRACTICAL MATHEMATICS.

Linear measurement and degree of accuracy abtainable in draughtsmanship and in the workshop.

Decimal and vulgar fractions. Percentages and averages. Contracted methods in multiplication and division of decimals, with reasons for employing such methods. Square root. Employment of rough checks in all arithmetical work, especially in regard to the position of the decimal point.

Symbols, denoting quantities or operations to be introduced at any part of the course where necessary. Substitution of numerical values in simple formulæ. Use of brackets and evolution of formulæ. Solution of simple and simultaneous equations algebraically and graphically. Use of squared paper in various kinds of problems. Ratio and proportion. Arithmetical, geometrical, and algebraical treatment.

Angular measurement. Degree; radian; sine; cosine; tangent. Use of square and protractor. Illustrations and verification of the most important rules relating to triangles and circles.

Areas of rectangle, parallelogram, triangle, trapezoid, circle, segment and sector of a circle. Simple examples of enlarging or reducing figures. Rules for finding the areas of irregular figures. Areas of similar figures.

Rules of indices. Logarithms. Use of logarithm tables.

Volumes and weights of simple solids.

Engineering Drawing.

General introduction to the drawing of engineering details. Plans and elevations. Methods and conventions of projecting views. Arrangements of drawing. Conditions which must be satisfied by working drawings.

Making dimensioned sketches of machine details, using models and actual portions of machinery. Production of working drawings from these sketches; making working drawings from information concerning dimensions and conditions to be satisfied.

Fastening of machine parts. Use and proportions of bolts, studs, screws, keys, rivets, and cotters. Joints in structural work and boiler plates. Knuckle joints. Stays.

Supports. Footsteps; pedestals; wall boxes; brackets and hangers.

Pulleys; couplings; clutches.

Conversion of circular motion into reciprocating motion; cranks and eccentrics.

Workshop processes.

Engineering Science.

A large proportion of the time will be spent in laboratory work in connection with the following, so that students will acquire notions of the subject chiefly through experiment.

Measuring instruments.

Ideas of force illustrated by the straining action of force on matter.

Friction treated simply.

Equilibrium of a body under parallel and non-parallel forces. Representation of forces by lines. Triangle and Polygon of forces. Velocity ratio, and force ratio or mechanical advantage. Simple machines. Efficiency; work; power. Velocity and acceleration

Practical examples on the above work.

General construction of a simple steam engine and Lancashire boiler. Details of parts. Slide valve.

Nature of heat; temperature; specific heat and its applications.

Solid, liquid, and vapour states of matter. Boiling point; sensible and latent heat. Specific volume. Use of steam tables or chart. Mechanical equivalent of heat.

Change of volume and pressure of gas with temperature.

Steam engine indicator; mean effective pressure and horse power.

Second Year (S.2). FEE 7s. 6d.

TIME TABLE.

SUBJECT.	DAY.	TIME.	LECTURER.
Practical Mathematics	Monday.....	7-30 to 9-30	F. W. Walker
Engineering Drawing	Wednesday....	7-30 to 9-30	J. H. Binfield
Engineering Science	Friday	7-15 to 9-45	F. W. Walker and J. H. Binfield

SYLLABUS.

A more extended knowledge of the work of the First Year, together with the following:—

PRACTICAL MATHEMATICS.

Use of logarithms in evaluating more difficult formulæ. Napierian logarithms. Mensuration of the pyramid and sphere. Surfaces and volumes of solids of revolution. Volumes of irregular solids.

Trigonometrical ratios of angles of any magnitude. Simple problems on the solution of triangles. Use of squared paper in solving equations and determination of laws. Algebraical solution of quadratic equations. Graphs plotted from equations. Rates of Increase. Slope of a straight line. Average slope of a curve between two points. Actual slope at a point. Meaning of $\frac{dy}{dx}$

Engineering Drawing.

Transmission of energy ; pulleys with different types of arms ; guide pulleys ; striking gears ; friction clutches ; couplings ; couplings to connect two shafts not in the same straight line ; toothed gearing ; shapes and proportions of wheel teeth ; correct setting out of wheel teeth ; bevel ; wheels ; cams.

Pipes and pipe joints ; methods of making joints steam-tight and water-tight ; manholes and mudholes ; provision for expansion in pipes ; proportions of flanges and number of bolts required ; bends, tees, unions, sockets, etc. ; types of valves for steam and water pipes ; areas through valves ; relation of lift of valve to sectional area of pipe.

Packing ; methods of packing pistons, plungers, etc., in hydraulic machinery ; cup leathers ; methods of making valve rods and piston rods steam tight ; glands and stuffing boxes ; metallic packing.

Machine frames and machine details ; general ideas regarding the shapes and proportions of machine frames having regard to : the various parts to be supported, the motions of the working parts, accessibility, adjustment and renewal of working parts, etc. ; slide valves ; pistons and rods ; crossheads and slippers ; connecting rods ; eccentrics in halves ; mechanical details of electrical machinery ; methods of lubricating working parts.

Boilers and boiler details ; general ideas on the construction of boilers of the stationary, locomotive and marine types ; methods of staying ; longitudinal, gusset, and girder stays ; boiler mountings.

General properties of the various materials used in construction ; workshop processes ; the importance of keeping the nature of the materials and the workshop processes in view in machine design.

Engineering Science.

Work and Power. Diagrams of work ; horse power ; dynamometers ; Potential and Kinetic energy ; conservation of energy ;

mechanical, electrical, and thermal relations; space average of a force; word done by a torque; transmission of energy by gearing belts and ropes.

Friction. Solid; angle of friction; lubrication; power absorbed by friction in bearings; heat generated.

Equilibrium of bodies at rest. More difficult problems on triangle and polygon of forces.

Kinematics. Curves of displacement, velocity and acceleration. Relative velocity.

Angular displacement, velocity and acceleration. Centripetal acceleration; centrifugal force. Cams.

Motion and force. Momentum and Impulse; time average of a force; impact; motion of connected bodies.

Flywheels. Governors.

Hydrostatics. Intensity of pressure at any depth; total pressure; centre of pressure.

Hydraulics. Pressure energy, kinetics energy and total energy of water; fluid resistance; hydraulic transmission of energy, pump, accumulators and hydraulic press.

Steam Engines. Motion of a slide valve in relation to eccentric and crank.

Lap, lead, and angle of advance.

Crank positions at cut off, release, and compression. Hypothetical indicator diagram.

Measurement of power efficiency and fuel used. Use of steam tables. Dryness of steam.

Boilers. General arrangement and construction of stationary locomotive, and marine boilers. Combustion. Equivalent evaporation.

Auxiliary machinery.

Calorific value of coal and gas.

Gas Engine. Otto cycle. Explosive mixtures. Indicator diagrams; horse power and efficiency.

LABORATORY.

Forces in simple structures.

Determination of relationship between effort, load, friction, mechanical advantage and efficiency of machines.

Simple flywheel and pendulum experiments.

Friction experiments. Coil friction.

Mechanics. Motion of piston, crank, slide valve, and eccentric.

Displacement curves for piston and valve.

Hydraulics. Flow of water through orifices and notches, and determination of coefficient of discharge. Loss of head.

Determination of steam dryness by a separating calorimeter and surface condenser.

Temperature and pressure of saturated steam.

Calorific values of coal and gas.

Indicator diagrams. Determination of mean effective pressure and indicated horse power.

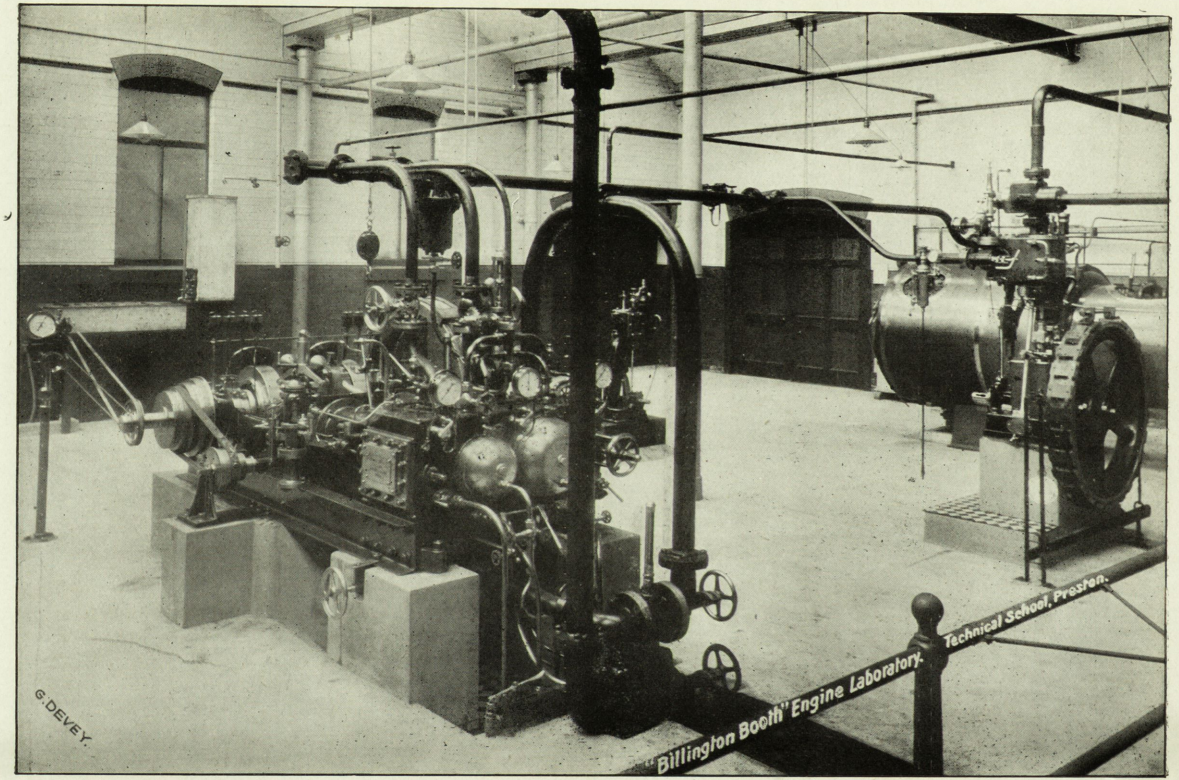
Determination of brake horse power and mechanical efficiency.

Steam and gas consumption.

Third Year (*S*.3). FEE 7s. 6d.

TIME TABLE.

SUBJECT.	DAY.	TIME.	LECTURER.
Engineeing Science—Mechanics ...	Monday.....	7-15 to 8-15	E. C. Moyle.
Practical Mathematics	Tuesday	7 30 to 9-30	J. T, Corkill
Engineering Science—Heat Engines	Wednesday ...	7-15 to 8-15	E. C. Moyle.
Engineering—Laboratory	Monday.....	8-15 to 9-45	E. C. Moyle.
	Wednesday....	8-15 to 9-45	E. C. Moyle


G. DEVEY.
"Billington Booth" Engine Laboratory. Technical School, Preston.

Syllabus.

A more extended knowledge of the work of the Second Year together with the following :—

Engineering Science.

Mechanics.

Stress and Strain.—Classification of stresses and strains. Simple tension, compression and shear moduli of elasticity and rigidity. Elastic limit and yield point. Ultimate strength and factor of safety. Stress-strain diagrams. Resilience. Effect of repeated and alternating stresses. Sudden loading. Stresses in compound bars subject to tensile and compressive straining actions. Stresses due to change of temperature. Strengths of joints. Stresses in thin shells and rotating rims.

Bending.—Bending moment and shearing force diagrams (including graphical methods). Theory of bending, and assumptions involved. Derivation of the formulæ—

$$\frac{P}{Y} = \frac{M}{I} = \frac{E}{R}$$

Proof of the expression for the maximum reflection of a uniform beam subjected to a constant bending moment. Values of the maximum deflection in the six standard cases. Breaking load of rectangular beams. Change of stress conditions when beams are bent beyond the elastic limit.

Torsion.—Theory of twisting and assumptions involved. Derivation of the formulæ—

$$\frac{f}{r} = \frac{T}{J} = \frac{N\ominus}{l}$$

Application to hollow and solid shafts. Stress produced in the round wire of a helical spring carrying an axial load. Extension and compression of helical springs.

Struts.—Strength of a strut. Rankine-Gordon formula to illustrate the effect of form of cross section, length of strut, and manner of fixing the ends.

Graphic Statics.—Stresses in articulated structures. Reciprocal diagram. Development of link polygon.

DYNAMICS.—Analogies between linear and angular motion of bodies in connection with the measurement of work, power, and energy. Application to the study of speed regulation of engines. Torque diagrams. Inertia forces. Objects of fly-wheels and governors. Controlling force and speed diagrams for the Watt, loaded and spring types of governor. Effect of friction. Sensitiveness, power, and defects of a governor. Balancing rotating masses.

HYDRAULICS.—Pressure and velocity changes along stream lines. Fluid friction and other resistances. Loss of head in a pipe. Hydraulic gradient. Discharge from a long pipe. Hydraulic transmission of energy.

HEAT ENGINES.

ENERGY.—Heat energy and the conservation law. First law of Thermodynamics—Joules equivalent. General notions regarding energy transformations as the object of all Heat Engines.

FORMATION OF STEAM.—Fuels. Composition and calorific value. Combustion. Air supply in boilers. Draught. Transference of heat energy to water. Relation of heating surface to grate area. Circulation and its effect on rate of evaporation. Use of steam tables. Calculation of heat required to form wet steam, dry saturated steam and superheated steam. Heat losses in boilers. Standard evaporation unit.

THE STEAM PLANT.

POWER AND ECONOMY.—(*a*) Measurement of power. Indicated, brake, and electrical horse power. Steam consumption per horse power hour developed in the cylinder, at the crank shaft, and at the dynamo.

Mechanical and thermal efficiencies, Over-all efficiency.

Heat balance sheet. Ideal engine. Limitations to the amount of heat energy that can be converted into mechanical energy. Elementary notions concerning the Second law of Thermodynamics. Adiabatics and Isothermals. Entropy. Simple treatment of the temperature-entropy diagram for water steam.

Constant volume lines. Rankine cycle. Complete and incomplete expansion. Efficiency ratio.

Missing steam. Economical effects of jacketting, superheating, compounding, and drainage.

Hypothetical indicator diagram. Calculation of work per cubic foot of steam. Benefits and defects of expansion, Effect of back pressure, engine friction, friction of shop shafting, condensation, and cost of engine on the most economical cut off. Diagram factor, and its use illustrated by simple problems in design.

VALVES AND VALVE GEARS.—Slide valve. Balanced valves and double-ported valves. General treatment of one of the following valve diagrams—Zeuner, Reuleaux, Bilgram, or harmonic. Reversing gears. General principle of link motion and radical gears illustrated by the action of Stephenson, Gooch, Joy, Hackworth, and Walschært or Deeley gears.

Effect of " linking up " on indicator diagram. Valve setting from indicator diagram. Trip gears. Corliss valves and drop valves Expansion valves.

STEAM TURBINE.—Fundamental rules. Elementary notions regarding transformation from pressure energy to kinetic energy of steam. Theoretical velocity of efflux of steam from a nozzle by the entropy chart.

Distinction between impulse and reaction turbines. Velocity and pressure compounding.

CONDENSERS.—Various types. Modern improvements in condensers and air pumps. Effect of vacuum on economy of engine. Limitations placed on increasing vacua by extra cost of plant. Economical vacua for reciprocators and turbines.

INTERNAL COMBUSTION ENGINE.

GAS ENGINE.—Otto cycle. Quality and quantity governing. Influence of mixture strengths and ignition. Water circulation. Heat balance sheet. Examples on efficiency and power. An elementary notion of suction and pressure producers. Composition of gas.

OIL AND PETROL ENGINE.—Fuels and their composition. Carburettors. Special methods of indicating high speed engine. " Reflecting " indicators.

COST OF POWER.—Examples illustrating the comparative cost of power production in the case of steam, gas, and oil engines. Interest and depreciation on capital charge. Establishment charges.

Mechanical Engineering. Laboratory.

Experiments to determine Moduli of elasticity and rigidity of different materials, using various methods. Friction experiments. Link polygon. Energy in a fly wheel. Determination of moments of inertia of girder sections. Pendulum experiments.

Relation between temperature and pressure of steam. Heating value of coal, oil, or gas by calorimeter. Evaporation in steam boiler. Efficiency of boiler. Measurement of coal and water used.

Indicated and brake horse-power of steam engine.
Steam consumed and mechanical efficiency.
Testing of indicator springs and pressure guages.
Indicating the steam engines under different loads.
Use of planimeters in averaging indicator diagrams.
Determination of the dryness of steam by calorimeter.
Mechanical efficiency and gas consumption of gas engines.
Heat lost in jacket and exhaust.
Experiments with injectors, feed pumps, and lubricating oils.

Practical Mathematics.

Equations and Graphs.—Evaluation of complex formulæ involving fractional and negative indices, common and Napierian logarithms, trigonometrical functions, etc., graphical solutions of equations of higher degree than the quadratic, and equations involving fractional indices, plotting of functions, including :—

$$y = ax^n, y = ae^{bx}, y = a \sin (bx + c);$$

graphical determination of maxima and minima; determination of laws of the form :—

$$y = ax^n, y = ae^{bx}, pv^n = c, \text{ from}$$

observed values of the variables.

Binomial Theorem.—The general expansion of a binomial expression; binomial approximations; expansion of e^x.

Differentiation.—Slope of a straight line; average slope of a curve between two points; the symbol $\frac{\delta y}{\delta x}$; exact slope of a curve at any point; the symbol $\frac{dy}{dx}$; determination of $\frac{\delta y}{\delta x}$ from tabulated values of x and y; differentiation of ax^n from first principles; maxima and minima by differentiation; differentiation of ae^x and alog x; simple applications of differentiation to geometrical, mechanical and physical problems.

INTEGRATION.—Integration regarded as the inverse of differentiation or as a process of summation ; the symbols :—

$$\sum_{x=a}^{x=b} y\,dx, \qquad \int y\,dx, \qquad \int_a^b y\,dx,$$

determination of the approximate value of $\int_a^b y\,dx$ from tabulated values of x and y ; integrals of ax^n, $\frac{1}{x}$ and e^x.

Application of integration to determine areas of plane figures, surfaces and volumes of solids, centres of gravity and moments of inertia of laminœ and solids.

MENSURATION.—Surfaces and volumes of solids of revolution ; theorems of Guldinus.

CENTRE OF GRAVITY.—Centre of gravity of an arc of a circle regarded as a thin wire ; centres of gravity of laminæ of the following forms :—triangle, trapezium, sector and segment of a circle ; beam and girder sections, including I, I, L, L, T, U, □,

MOMENT OF INERTIA.—Moments of inertia of laminæ of the following forms :—rectangle, triangle, circle, annulus, beam and girder sections, etc.; theorems relating to parallel and rectangular axes.

VECTORS.—Scalar and vector quantities; addition and substraction of vectors; applications to displacements, velocities, etc.

Trigonometry.—Simple problems on solution of triangles. Proofs of fundamental formulæ, as :—

$$\sin (A + B) = \sin A \cos B + \cos A \sin B.$$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Area of a triangle $= \frac{1}{2} ab \sin C$.

ADVANCED COURSE.

For those who have passed the Senior Course and wish to obtain the " Higher " Course Certificate.

Fourth Year (*A*.1). FEE 7s. 6d.

TIME TABLE.

SUBJECT.	DAY.	TIME.	LECTURER.
Practical Mathematics	Tuesday	7-15 to 9-15	J. T. Corkill
Engineering Design	Wednesday....	7-30 to 9-30	J. H. Binfield.
Engineering Science	Friday	7-15 to 9-15	E. C. Moyle.

SYLLABUS.

PRACTICAL MATHEMATICS.

Differential and Integral Calculus.

Differentiation and Integration of the following:—
$y = ax^n$; $y = ae^{bx}$; $y = a \cos (bx + c)$; $y = a \sin (bx + c)$;
$y = A \log (x + a)$.

Differentiation of a Product or Quotient of two functions, or function of a function. Integration by parts, by substitution and other simple devices, length of curves, areas of surfaces, and volumes of solid by integration. Solution of easy differential equations.

Illustrations of the use of the calculus in many kinds of study, more especially in physics and engineering. When x and y are tabulated, to find for a particular value of x the value of dy/dx.

Special attention to be paid to graphical methods of integration, using squared paper; the construction by graphical methods of curves from a given law of slope, this law being given by means of a curve, or by a simple Algebriac expression, or by means of a simple differential equation.

More advanced knowledge of Trigonometry.

Fourier analysis.

ENGINEERING DESIGN.

In this stage students are required to decide for themselves the form and dimensions of the parts and to set these down as a finished working drawing.

BEARING AND FRAMES.—Proportions of pedestals and hangers suitable for various working conditions ; ball bearings ; roller bearings ; ring oiled bearings. The following are types of exercises that may be dealt with under this head, convenience in moulding, machining, and assembling being taken into consideration :—

Given the position of a shaft with reference to a machine frame or roof girder, to *design and draw* a suitable pedestal or hanger to support the shaft.

Given the positions of two, or more, shafts of a machine, to design and draw suitable pedestals for supporting the shafts from the frame ; or to *design and draw* a suitable frame to incorporate the bearings for the shafts.

Given sketches or other information concerning a mechanism or machine part such as ; a governor, a simple valve gear, a clutch and gear, a strap fork gear, etc., to *design and draw* brackets for supporting these from adjacent parts of a machine or engine frame.

Given an arrangement of bevel gearing, or worm and worm wheel, to *design and draw* a suitable stand or case for supporting the same.

MACHINE PARTS AND ENGINE DETAILS DESIGNED TO RESIST SHEAR, DIRECT STRESS, BENDING, OR WEAR.—Cotter joints ; riveted joints ; boiler shells ; pipes and pipe flanges ; flanged couplings ; crank pins ; crosshead pins ; slipper crossheads ; eccentrics and eccentric straps ; pin joints for eccentric rods ; connecting rod ends, etc.

CYLINDERS AND VALVES.—Strength of cylinders ; arrangement of ports and passages in steam cylinders to give suitable velocity of steam ; proportions of valves ; slide valves ; grid valves ; double-seated valves ; stop valves, pump valves ; a small hydraulic press, etc.

TOOTHED GEARING.—Proportion of spur and bevel wheels ; involute and cycloidal teeth ; given a tooth of one wheel, to design a tooth of another wheel to gear with it ; sprocket wheels.

CAMS.—Design of cams to produce (*a*) uniform motion, (*b*) uniformly accelerated motion, (*c*) simple harmonic motion ; effect of roller and lever ; application of cams to steam and gas engines.

STRUCTURES.—Determination of the dimensions of cast-iron beams and rolled steel joists, etc., to support given loads; form and dimensions of members required io braced frames ; design of riveted and pin joints in simple cases of roof trusses, lattice girders, etc.

Engineering Science.

The portions of the work taken up will vary with each year, and Sections of the following work will be dealt with.

Mechanics.

Materials.—Stress. Strain. Principal stresses and strains. Ellipse of stress. Principal planes. Poissons' ratio. Mechanical properties of materials. Resilience and fluctuating stresses.

Shock. Wohlers experiments. Limiting range of stress.

Theory of bending. Contraflexure. Relation between curvature, slope and deflection. Graphical determination of deflection and slope from bending moment diagrams.

Built-in and continuous beams.

Direct and bending stress combined.

Pillars columns, and struts. Euler's theory.

Rankine Gordon formulæ.

Twisting theory; combined bending and twisting. Rankine, St. Venant, and Guess formulæ. Springs.

Strengths of shells and thick cylinders.

Shrinkage and mounting stresses. Forced fits.

Strength of rotating rim, and disc.

Application of theory to design of turbine rotors and discs. Testing machines.

Graphical statics involving force not coplanar.

Structures.—Framed structures. Firm, deficient, and redundant frames. Reciprocal figures. Strain energy method of finding stresses and deflections. General conditions of stability in a masonry structure. Proof of the middle-third Rule. Stability of walls, chimneys, and buttresses. Suspension bridge. Stresses in loaded cable. Reinforced concrete beam theory.

Machines.—Kinematics and Kinetics of machines. "Higher" and "lower" pair. Kinematics chain of elements. Criterion.

Classification of mechanisms and inversion of Kinematic chain.

Instantaneous centre.

Velocity and acceleration (linear and rotary).

Analogies between linear and rotary motion.

Velocity and acceleration diagrams. Gyroscopic action.

Calculation of the rate of precession.

Applications.

Vibrations of elastic structures. Critical speed.

Dunkerley's Rule. Flexible shaft of Laval terbine.

Epicyclic gearing and applications to different speed gears. Fly wheel theory.

Transmission of power by belts and effect of centrifugal force. Wheel teeth. Sliding and rolling contact. Mechanical integrators.

Balancing of machinery. Graphical methods.

HYDRAULICS.—Flow of perfect fluid. Bernoullis Theorem. Loss of head. D'Arcy's formulæ. Chezy formulæ. Action of jet on vanes.

Impulse and reaction turbines. Centrifugal pumps.

Rectangular and triangular gauge notches.

Hydraulics transmission of power.

Hydraulic pressure machine and reciprocating pumps.

HEAT ENGINES.

Radial gears and link motions. Analysis of the motion Meyer valve gear, and valve diagram. Velocity of valve at cut off.

The laws of Thermodynamics. Temperature—Entropy and Mollier diagrams.

Steam turbines. Application of the Mollier diagram to the design of velocity and pressure compounded steam turbines, and the diverging nozzle.

Theory of the reversed heat engine and refrigerating machines. Vapour compression machines. Coefficient of performance. Bell-Coleman machine.

Rankine cycle, for well-dry saturated steam and superheated steam. Effect of friction in increasing the dryness of the steam at the end of expansion in a steam turbine.

Efficiency ratio.

Actual behaviour of steam in the cylinder.

Wall action. Condensation and re-evaporation.

Curve on the indicator diagram representing water present during expansion.

Influence of speed, size and ratio of expansion.

Advantages of compound expansion and superheating.

Calculations of air supplied from analysis of the flue gas.

Internal combustion engines. Thermodynamic efficiency. Standard cycles. Air standard cycle.

Light spring diagrams and estimation of pump horse power.

Calculations relating to heat transference between the working substance and the jacket water.

Fifth Year (*A*.2). FEE 7s. 6d.

The Syllabus of work will include the work not dealt with in the Fourth Year, under the heading of Mechanics and Heat Engines, together with the subjects of Mathematics and Works Organization, Costing and Estimating.

EXHIBITIONS, SCHOLARSHIPS, AND PRIZES.

The following advantages are open to be competed for by Students of the Institute :—

Thirty Whitworth Exhibitions of the value of £50 each are awarded annually to Students of Mechanical Engineering.

Royal Scholarships, value £50 per annum, and tenable for three years at the Royal College of Science, South Kensington, awarded on the results of the Board of Education Examinations. Full particulars and Entry Forms for these and other Prizes and Scholarships may be obtained from the Head of the Department.

TEXT BOOKS, NOTE BOOKS, AND INSTRUMENTS REQUIRED.

FIRST YEAR.

TEXT BOOKS.

	s.	d.	
"Practical Arithmetic and Mensuration," by F. CASTLE..	1	6	net
"Algebra," Part II, by HALL AND WOOD...	0	7	net
"Examples of Machine and Engine Details," by J. H. BINFIELD.	1	0	net
"Machine Construction and Drawing," by INGHAM. ...	1	6	net
"Applied Mechanics for Beginners," by DUNCAN ...	1	11	net
"Steam and other Engines", by DUNCAN.	3	9	net

NOTE BOOKS.

PRACTICAL MATHEMATICS :—

2 Students' Note Books, $\frac{1}{10}$ in. ruling	0	4	net
1 Technical Note Book, $\frac{1}{10}$ in. ruling	0	4	net

ENGINEERING DRAWING :—

	s.	d.	
2 Students' Note Books, $\frac{1}{8}$ in. ruling	0	4	net

INSTRUMENTS.

Drawing Instruments, set squares, protractor, pencils (H.H. and H.H.H.) and rubber.

MECHANICS AND HEAT ENGINES.

2 Students' Note Books, $\frac{1}{10}$ in. ruling	0	4	net
1 Technical Note Book, $\frac{1}{10}$ in. ruling	0	4	net
1 Laboratory Note Book	0	9	net

SECOND YEAR.

TEXT BOOKS.

"Practical Mathematics for Beginners," by CASTLE ...	1	11	net
"Machine Drawing," Part III, by JONES...	3	0	net
"Steam Engineering," by W. W. PULLEN	4	0	net

NOTE BOOKS.

Same as First Year.

THIRD AND FOURTH YEAR.

TEXT BOOKS.

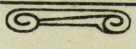
	s.	d.	
"Applied Mechanics," by A. Low	... 7	6	net
"Applied Mechanics," by J. PERRY	... 5	8	net
"Practical Mathematics," by SAXELBY.	... 4	11	net
"Steam, Gas, and Oil Engines," by J. PERRY ...	... 7	6	net

NOTE BOOKS AND INSTRUMENTS,

Same as Second Year.



Physics and Electrical Engineering Department Evening Classes.



Physics and Electrical Engineering Department.

Head of Department: G. E. GITTINS, B.Sc. (Lond.), A.I.E.E.
Assistant Lecturers: D. FARRAR, M.Sc. (Vict.)
J. D. ATHERTON (Honours Medallist).
A. WOODS (Honours City and Guilds).

INTRODUCTION.

The Classes in this Department fall in two divisions:—
Physics and Electrical Technology.

The Classes in Pure Physics are the Elementary and Advanced Courses in General Physics, Heat, Light, Sound, Magnetism and Electricity. A Special Course in Experimental Mechanics and Physics forms part of the Second Year Preliminary Technical Course obligatory for all students entering on the study of a Trade subject.

Internal examinations in the final year of each course will be held by the Institute in conjunction with external examiners. On the result of these examinations, together with proper attendance at all subjects of the course, and the production of such satisfactory evidence as is furnished by school records, class work, homework, note books, drawings, and laboratory books. A Course Certificate will be issued by the Institute, which will be endorsed by the Board. Success at approved External Examinations, including the Board's Science Examinations, of the Lower or Higher stages, and Examinations of the City and Guilds of London Institute in Technology may be recorded upon such Course Certificates.

Candidates for the Board's Examinations must be over 17 years of age on the 31st of July following the examination. Further a candidate for admission to a Higher examination of the Board, will be required to furnish a certificate of having completed a satisfactory amount of Laboratory work (where Laboratory work is required), and to submit his Laboratory note books signed and certified by the teacher.

LABORATORY NOTE BOOKS.

Students taking a Laboratory Course must provide themselves with a Regulation Note Book (which may be obtained from the Custodian), in which to enter an account of each experiment performed. It is imperative that Students should keep a permanent record of their work, and the Teachers have instructions to examine the Note Books before starting a Student on a new experiment.

Students will be admitted to the Specialized Course in Electrical Engineering if they possess the Preliminary Technical Certificate (*Second Year*, J_2) of the Union of Lancashire and Cheshire Institutes, or its equivalent.

Other Students who are desirous of joining the Classes must satisfy the Principal of the Institute that they are able to benefit by the Course to which they seek admission, otherwise they must sit for an entrance examination, and if they fail to reach the prescribed standard, it will be advisable for them to attend the Preliminary Course conducted under the Preston Education Committee.

In exceptional cases, Adult Students may be excused the Entrance Examination, provided they can satisfy the Principal of the Institute that they are able to benefit by the Courses to which they seek admission.

EQUIPMENT.

The Electrical Engineering Laboratory is provided with the following experimental plant :—

One motor-generator set direct coupled, the generator side being compound wound with the shunt field divided into sections 4 K.W. capacity.

Two three-phase rotary converters, direct coupled, 4 K.W. capacity.

One motor alternator set, rotating field type, fitted with connections for one-phase, two-phase, or three-phase supply. 5 K.V.A. capacity.

One three-phase induction motor with squirrel cage rotor. 3 B.H.P.

One three phase induction motor with wound rotor, fitted with brake tackle. 2 B.H.P.

One single phase induction motor, with wound rotor. $1\frac{3}{4}$ B.H.P.

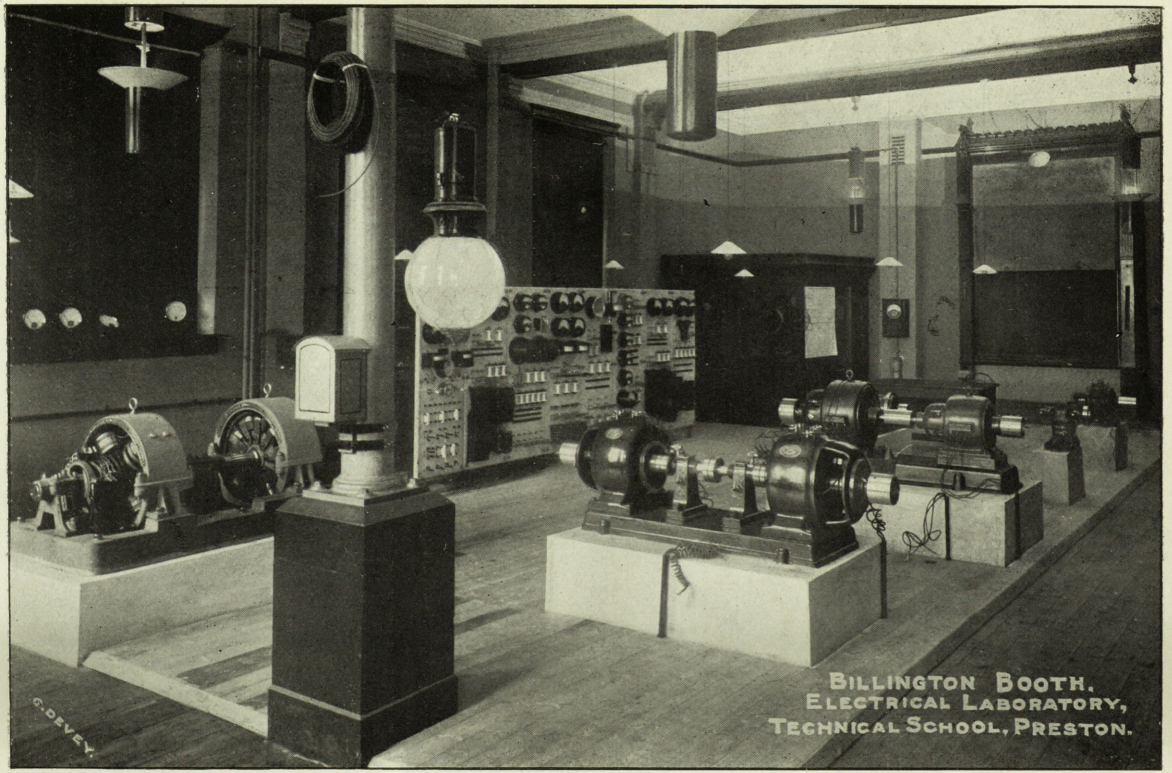
One $\frac{1}{2}$ H.P. C.C. Motor, fitted with water cooled brake drum.

For use with the above plant, there is a full supply of measuring instruments, by various makers.

The Dark Room is equipped with a Simmance-Abady Flicker Photometer, Pentane Standard, and a number of precision meters.

For the work in Physics, the apparatus is sufficiently varied to meet the requirements of the London B.Sc. Examination.

Students from Elementary Day Schools will not, as a rule, be ready to undertake Specialized Courses until they have been prepared by two years' preliminary instruction. Courses for the purpose arranged so as to cover two years will be conducted by the Preston Education Committee in their Branch Schools.



BILLINGTON BOOTH.
ELECTRICAL LABORATORY,
TECHNICAL SCHOOL, PRESTON.

A Junior Course for Second Year Students only will also be held at the Technical School, Corporation Street. The Syllabus is that of the Union of Lancashire and Cheshire Institutes.

Second Year (J_2).

FEE FOR COURSE, 5s.

TIME TABLE.

DAY.	SUBJECT.	TIME.	LECTURER.	Room
Tuesday	Experimental Mechanics & Physics	7-15 to 9-45	D. Farrar	11 & 1
Wednesday	Practical Mathematics & Drawing	7-15 to 9-15	A. Woods	8
Friday	Practical Mathematics & Drawing	7-15 to 8-15	A. Woods	5
Friday	English	8-15 to 9-15		5

SYLLABUS.

EXPERIMENTAL MECHANICS AND PHYSICS.

1. *Measurement.*—Length and area; comparisons of British and metric systems; measurement of the length of curved lines; how to measure approximately to the hundredth of an inch; the vernier and sliding gauge.

2. *Volume.*—Determination of volumes of spheres, cones, and cylinders, etc., by direct measurements and by displacement of water; determination of volume of irregular solids by displacement of water.

3. *Mass.*—Relation between mass and weight; units of mass; relation between British and metric systems; gravitation; the spring balance; the ordinary balance; areas and volumes determined by weighing.

4. *Densities.*—Weights of equal volumes of various liquids and solids; relation between volume, density, and mass; Archimedes' determination of relative densities by weighing in air and water; determination of relative densities of liquids by relative density or specific gravity bottle, by hydrometer, and by the U-tubes upright and inverted.

5. *Hydrostatics.*—Fluid pressure; head of water; siphons; pressure of gases; atmospheric pressure; the barometer; Boyle's law.

6. *Statics.*—Ideas of force; push and pull; resultant and equilibrant of two forces at a point; parellel forces; equilibrium of three parallel forces leading up to the lever

7. *Heat.*—Effect of heat and cold on bodies; forms of matter, solids, liquids, and gases; the chief properties of matter; expansion of solids, liquids, and gases; melting and boiling points; thermometers, their construction and use; distinction between heat and temperature; evaporation and condensation; capacity of bodies for heat; transmission of heat by conduction and convection.

PRACTICAL MATHEMATICS.

1. *Decimals.*—The four rules taught by measurements and drawings from lines and objects; the foot-rule divided into inches and tenths and the metre-rule divided into centimetres and millimetres being used; comparison of British and metric measures; averages and methods of approximations.

2. *Vulgar Fractions.*—The usual rule to be taught by measurements and drawings of objects; reduction of vulgar to decimal fractions and vice versa; expressing one quantity as the fraction of another.

3. *Powers and Roots.*—Squares and cubes; meaning of thee terms "Power," "Index"; exercises in finding the square roots of arithmetical quantities.

4. *Area.*—Standards of area; areas of plane rectilinear figures, rectangles, triangles, and quadrilaterals; relation between the sides of a right-angled triangle; proofs by cutting out, counting squares on squared paper, etc.; areas of circles and curved surfaces, *e.g.*, cylinders and cone; use of squared paper in determining areas; problems on perimeters and areas, *e.g.*, cost of painting and papering rooms; covering floors.

5. *Algebra.*—Substitution of arithmetical values in mensuration; physical and other scientific formulæ; meaning and use of the signs + and —.; addition, subtraction, multiplication, and division; use of brackets; the formulæ $(x+a)\ (x+b)=x^2+x\ (a+b)+ab.$

$(x+a)\ (x+b)=x^2+x\ (a-b)-ab.$

$(x+a)^2=x^2+2ax+a^2.$

$(x+a)\ (x-a)=x^2-a^2$ with their applications; easy fractions simple equations of one unknown quantity and problems producing them.

6. *Ratio and Proportion.*—Proportion treated arithmetically; mean proportional, third proportional; geometrical and arithmetical means; percentages.

Ratio and proportion treated algebraically; $\frac{a}{b}=\frac{c}{x}$ and $\frac{a}{b}=\frac{x}{c}$, etc. variation $y=kx$ and $y=k/x$, etc.

7. *Graphs.*—Graphs; the use of squared paper; plotting curves (*a*) in cases of strict proportion (*b*) in cases where one value varies as another but not in strict proportion; problems worked by graphs.

8. *Volume.*—Standards of volume; relative densities, water being used as the standard; measurement and calculations of regular solids, sphere, cone, and cylinder, with practical applications; weight and cost of solids of regular form, *e.g.*, brickwork, timber, etc., when the relative density and cost of unit volume are given.

Practical Drawing.

1. *Instruments.*—Use of the various drawing instruments, including the calipers and protractors; how to test the accuracy of rulers and set squares.

2. *Scales.*—The use and construction of scales; the protractor; scales frequently used in engineering, building, etc.; finding distances, areas, etc., on scale drawings; copying drawings to given scales.

3. *Angles.*—Bisection of lines, arcs, and angles; comparison of angles; opposite and adjacent angles; the right angle, complementary and supplementary angles; perpendiculars; the use of set squares; the construction of angles of 60°, 45°, and 30°; the use of the protractor.

4. *Plane and Curved Surfaces.*—How to test a plane; planes at right angles; the spirit level; the try square; the plumb rule; definition of plane figures; triangles, regular quadrilaterals; pentagon, hexagon, etc.; construction of squares and rectangles; mensuration of plane figures by use of squared paper.

5. *Triangles.*—The construction of triangles from given data of sides and angles; the chief properties of triangles; use of squared paper in finding their area; relation between sides of a right-angled triangle; proofs by means of squared paper.

6. *Parallel Lines.*—How to draw them; their chief properties; how to draw parallelograms; their properties; their relation to rectangles; their areas determined by squared paper; division of straight lines into a number of equal parts or into a given ratio.

7. *Polygons.*—The construction of polygons from adequate data of sides, angles, and diagonals; their chief properties and their areas; reduction of rectilineal figures to triangles of equal area.

8. *Circles.*—Problems relating to lines and circles, *e.g.*, finding centres, drawing tangents; mensuration of circle; problems relating to angles in a semi-circle; to describe a circle of given radius under certain given conditions, *e.g.*, to touch a given line or circle at a given point, to pass through one point and to touch a line or circle; the construction of squares both inside and outside a given circle.

9. *Solids and Solid Geometry.*—Chief properties of the simpler geometrical solids; the elementary principles of orthographic projection; plans and elevations and sections of simple solids.

10. *Hand-Sketching.*—How to make neat freehand dimensioned sketches from models or actual simple machine details, and to use calipers and rulers to take dimensions of the same; also to make simple drawings either full size or to any simple scale.

ENGLISH.

To write a short composition.

(*a*) Letter writing; letters of friendship, business correspondence.

(*b*) Essay writing; personal experience, description of objects, etc.

ELECTRICAL ENGINEERING ORGANISED SENIOR COURSES.

The scheme of work for the Senior Course Certificate has been approved by the Board of Education, and, except under very special circumstances, all students joining the classes in Electrical Engineering will be expected to undertake a complete Course of instruction, and they will not be regarded as fulfilling this condition unless they attend regularly each subject of the Course, and perform the homework set, to the satisfaction of the Lecturer.

First Year (S_1). FEE 7s. 6d.

TIME TABLE.

SUBJECT.	DAY.	TIME.	LECTURER.	Room
Practical Mathematics	Wednesday	7-15 to 9-15	J. D. Atherton	13
Engineering Drawing	Tuesday or Thursday	7-30 to 9-30	J. H. Binfield	12
Engineering Science	Tuesday or Thursday	7-15 to 9-45	F. W. Walker	18

SYLLABUS.

PRACTICAL MATHEMATICS.

Linear measurement and degree of accuracy obtainable in draughtsmanship and in the workshop.

Decimal and vulgar fractions. Percentages and averages. Contracted methods in multiplication and division of decimals, with reasons for employing such methods. Square root. Employment of rough checks in all arithmetical work, especially in regard to the position of the decimal point.

Symbols, denoting quantities or operations to be introduced at any part of the course where necessary. Substitution of numerical values in simple formulæ. Use of brackets and evolution of formulæ. Solution of simple and simultaneous equations algebraically and graphically. Uses of squared paper in various kinds of problems. Ratio and proportion. Arithmetical, geometrical, and algebraical treatment.

Angular measurement. Degree; radian; sine; cosine; tangent. Use of square and protractor. Illustrations and verification of the most important rules relating to triangles, and circles. Areas of rectangle, parallelogram, triangle, trapezoid, circle, segment and sector of a circle. Simple examples of enlarging or reducing figures. Rules for finding the areas of irregular figures. Areas of similar figures.

Rules of indices. Logarithms. Use of logarithm tables.

Volumes and weights of simple solids.

ENGINEERING DRAWING.

General introduction to the drawing of engineering details. Plans and elevations. Methods and conventions of projecting views.

Arrangement of Drawing. Conditions which must be satisfied by working drawings.

Making dimensioned sketches of machine details, using models and actual portions of machinery. Production of working drawings from these sketches; making working drawings from information concerning dimensions and conditions to be satisfied.

Fastening of machine parts. Use and proportions of bolts, studs, screws, keys, rivets, and cotters. Joints in structural work and boiler plates. Knuckle joints. Stays.

Supports. Footsteps; pedestals; wall boxes; brackets and hangers. Pulleys, couplings, clutches, Conversion of circular motion into reciprocating motion; cranks and eccentrics.

Workshop processes.

ENGINEERING SCIENCE.

A large proportion of the time will be spent in laboratory work in connection with the following, so that the students will acquire notions of the subject chiefly through experiment.

Measuring Instruments. Ideas of force illustrated by the straining action of force on matter.

Friction treated simply. Equilbrium of a body under parallel and non-parallel forces.

Representation of forces by lines. Triangle and Polygon of forces.

Velocity ratio and force ratio or mechanical advantage. Simple machines. Efficiency, work, power, Velocity and acceleration. Practical examples on the above work.

General construction of a simple steam engine, and Lancashire boiler. Details of parts, Slide valve. Nature of heat; temperature; specific heat and its applications.

Solid, liquid, and vapour states of matter.

Boiling point; sensible and latent heat.

Specific volume. Use of steam tables and chart.

Mechanical Equivalent of heat.

Changes of volume and pressure of gas with temperature.

Steam engine indicator; mean effective pressure and horse power.

Second Year (S_2). FEE 7s. 6d.

TIME TABLE.

SUBJECT.	DAY.	TIME.	LECTURER.	Room
Practical Mathematics	Monday.....	7-15 to 9-15	J. D. Atherton	13
Engineering Drawing	Wednesday	7-30 to 9-30	J. H. Binfield.	12
Technical Electricity I.....	Thursday ...	7-15 to 9-45	D. Farrar	11 & 1

SYLLABUS.

PRACTICAL MATHEMATICS, INCLUDING ELECTRICAL CALCULATIONS.

Logarithms. Equations and problems involving them. Algebraic manipulations generally. Elementary trigonometry. Calculation of areas and volumes. Graphical methods and use of squared paper. Determination of laws. Use of tables of sines, cosines, and tangents. Position of a point in space. Elementary differentiation and integration.

Application of the above processes to the solution of electrical problems, including resistance of conductors. Ohm's law and its applications. Sizes of cables.

ENGINEERING DRAWING.

Transmission of energy; pulleys with different types of arms; guide pulleys; striking gears; friction clutches; couplings; couplings to connect two shafts not in the same straight line; tooth gearing; shapes and proportions of wheel teeth; correct

setting out of wheel teeth; bevel wheels; cams. Pipes and pipe joints, methods of making joints steam tight and water tight; manholes and mud-holes; provision for expansion in pipes; proportions of flanges and number of bolts required; bends, tees, unions, sockets, etc.; types of valves for steam and water pipes; areas through valves; relation of lift of valve to sectional area of pipe. Packing; methods of packing pistons, plungers, etc., in hydraulic machinery; cup leathers; methods of making valve rods and piston rods steam tight; glands and stuffing boxes; metallic packing.

Machine frames and machine details; general ideas regarding the shapes and proportions of machine frames having regard to the various parts to be supported; the motion of the working parts, accessibility, adjustment and renewal of working parts, etc.; slide valves; pistons and rods; crossheads and slippers; connecting rods; eccentrics in halves; mechanical details of electrical machinery; methods of lubricating working parts.

Boilers and boiler details; general ideas on the construction of boilers of the stationary, locomotive and marine types; methods of staying; longitudinal, gussett, and girder stays; boiler mountings.

General properties of the various materials used in construction; workshop processes; the importance of keeping the nature of the materials and the workshop processes in view in machine design.

TECHNICAL ELECTRICITY, I.

Magnets and magnetic fields; uses of magnets; simple cell; polarisation and local action; examination of the evidences of the existence of a current in a circuit; the ohm, the volt, the ampere; Application of Ohm's law. Properties of the electric current—heating, chemical and magnetic effects. Measuring instruments—simple types of galvanometers, ammeters, and voltmeters, and the principles upon which they work. Secondary cells—elementary theory of. Electro magnetic induction. Simple dynamo and motor.

LABORATORY.

Making of artificial magnets; mapping lines of force; Field due to a solenoid; Attractive force of electro-magnet. Practice in the use of such instruments as the Galvanometer, Ammeter, Voltmeter, Wheatstone bridge. Construction of simple pieces of apparatus.

Verification of Ohm's Law. Determination of specific resistance. Measurement of E.M.F. by simple potentiometer. Electro chemical equivalents; mechanical equivalent of heat by an electrical method.

Third Year (S_3). FEE 7s. 6d.

TIME TABLE.

SUBJECT.	DAY.	TIME.	LECTURER.	Room
Practical Mathematics	Thursday	7-15 to 9-15	J. D. Atherton.	13
Technical Electricity II.	Tuesday .	7-15 to 9-15	G. E. Gittins.	5
Technical Electricity (Lab) II	Friday ...	7-15 to 9-15	G. E. Gittins. J. D. Atherton.	3

SYLLABUS.

PRACTICAL MATHEMATICS AND ELECTRICAL CALCULATIONS.

A more extended knowledge of the work of the Fourth Year, together with the following :—

Trigonometry.—Proofs of fundamental formulæ, as :—

$$\text{Sin (A + B)} = \text{Sin A. Cos B + Cos A. Sin B.}$$

$$\text{Sine Rule or } \frac{\text{Sin A}}{\text{Sin B}} = \frac{a}{b} \text{ for triangle.}$$

$$\text{Area of a triangle} = \tfrac{1}{2}\, a\, b \sin C.$$

Mensuration.—More advanced work. Solids of revolution.

The plotting of functions on squared paper, including such as $y = ax^n$; $y = ae^{bx}$; $y = a \sin (cx + d)$; $y = ae^{bx} \sin (cx + d)$.

Testing observed results for laws like $pv^n = c$; $y = a + bx^2$; $xy = bx + cy$.

Maximum and minimum problems. Vectors. Scalar and Vector products.

Proofs of the rules for finding the differential co-efficient of y with respect to x, that is $\frac{dy}{dx}$ when y and x are related in the following ways :—

$y = ax^n$; $y = ae^{bx}$; $y = a \cos (bx + c)$; $y = a \sin (bx + c)$; $y = \text{A} \log (x + a)$.

Differentiation of a product or quotient of two functions, or function of a function.

Integration.—The expressions for the integrals of

$$ax^n,\ ae^{bx},\ \text{A}/(x + a),\ \text{A} \sin (ax + b),\ \text{A} \cos (ax + b).$$

Integrating by parts and by substitution and other simple devices. Finding areas of curves and surfaces and volumes requiring these integrals.

Calculations on the magnetic circuit. Coil Winding problems. Line efficiencies. Traction problems. Problems in Distribution.

TECHNICAL ELECTRICITY, II.

The electric circuit—Units, primary and derived; ampère, volt, ohm, coulomb, Watt, Joule. Calculations involving these and the mechanical units of power and work.

Electrical properties of materials—Conductors and insulators.

The magnetic circuit—Properties of iron and other magnetic materials; magnetising force, flux density and permeability. Field winding calculations.

The C.C. Generator; simple types of armature windings; determination of E.M.F., output and efficiency. Armature reaction; load characteristics; parallel running of shunt and compound wound machines; factors affecting commutation; interpoles; Hopkinson tests.

C. C. Motor—Different types; Torque, output and efficiency; characteristics; starters and regulators.

Auxiliary machines—Balancers, Battery feeder and reversible boosters.

The alternating current circuit—Graphic representation of varying quantities; wave form; sine curves; maximum and R.M.S values; vector and scalar quantities; the Henry; effects of self induction and capacity; problems on series and parallel grouping of resistance, self induction and capacity; power and power factor; elementary theory of the alternator; the Polyphase circuit; the induction motor; the transformer; circle diagrams.

Electric lamps—Carbon and metal filament lamps; arc lamps; photometry.

Secondary batteries—Construction, care and management of storage cells; industrial applications.

The transmission and distribution of electrical energy—principles and problems connected therewith.

LABORATORY.

Practice in the use of the P.O. box and testing set; potentiometer and Kelvin balance; measurement of low resistance; location of faults in cables; meter testing; tests on secondary cells; photometry; open circuit curves; load characteristics for shunt,

series and compound wound generators; running tests on C.C. motors; Parallel and series Hopkinson tests; measurement of capacity, self-induction, hysteresis, permeability; running tests on transformers, converters and A.C. motors; temperature tests; Synchronising.

ELECTRICAL ENGINEERING.

Advanced Courses.

These Courses are arranged for those Students who have obtained the Senior Course Certificate and who are desirous of continuing for a further period of two years. For the Session 1915-16 provision is made for the A_1 Course only.

Fourth Year. A_1. Fee 7s. 6d.

Time Table.

DAY.	SUBJECT.	TIME.	LECTURER.	Room
Thursday	Technical Electricity III.	7-15 to 9-15	G. E. Gittins	5
Tuesday ...	Electrical Laboratory	7-15 to 9-45	A. Woods.	3
Monday....	Practical Mathematics *or*.....	7-15 to 9-15	G. E. Gittins	5
Wednesday	Engineering Science (Heat Engines)	7-15 to 9-45	E. C. Moyle.	12

SYLLABUS.

Practical Mathematics.

Elementary Differential Calculus, including:—successive derived functions and differentials; the nth derived functions of sin ax, cos ax, e^{ax} sin $(bx + c)$ etc.; Taylor's and Maclaurin's theorems; maxima and minima of functions of one variable; mechanical and electrical problems; Tangents and normals to plane curves; subtangents and subnormals; curvature; integration; integration by substitution; integration by parts; definite integrals; areas of plane curves; rectification.

Elementary differential equations. Applications of the Calculus to some electrical problems.

The elements of Vector Algebra and its application to the alternating current circuit.

TECHNICAL ELECTRICITY, III.

Numerical and mathematical work in the design, working and testing of C.C. machines; theory of the alternator and its regulation; theory of the transformer; the Synchronous motor; improvement of power factors; conversion of alternating current to continuous current; the rotary converter and motor converter; induction motor; circle diagrams.

Laboratory Work.

Exhaustive tests on generators and motors; separation of losses in transformers; core losses and frequency; Hopkinson tests on generators and transformers; paralleling of A.C. generators. Synchronous motor, effect of field excitation on the P.F.; induction motor used as asynchronous generator; testing of rotary converters; photometry; optical methods of measuring slip; Use of the potentiometer and Kelvin balance; Use of the Platinum Thermometer in conjunction with the Callendar Griffiths Bridge; measurement of capacity and self Induction; estimation of leakage factors.

ENGINEERING SCIENCE.

Heat Engines

Construction of steam boilers. Steam, gas, and oil engines, and their details.

Hypothetical indicator diagram. Work done per cubic foot of steam. Effect of back pressure, friction, condensation, and cost of engine on the best cut off.

Slide valves and valve setting. More difficult problems.

Zeuner, Rouleaux, Bilgram, and Harmonic diagrams.

Reversing gears. Link and radial valve gears, such as the Stevenson, Joy, Hackworth, and the Walschœrt gear. Effect of "linking up" on the indicator diagrams. Valve setting from indicator diagram.

Balance valve; double ported slide valve; Corliss valve; drop valve and trip gears.

Speed regulation. Torque diagrams; inertia forces; object of flywheels; governors; object of governor; controlling force and speed diagram for the Watt, loaded and spring types.

Effect of friction; sensitiveness, power and defects of a governor Relay governing.

Balancing of engines. Balancing rotating masses.

Balancing reciprocating masses assuming simple harmonic motion. Balancing locomotives.

Compounding. Estimation of sizes of cylinders.

Various forms of energy. First law of thermodynamics.

Calorific value of fuels.

Properties of steam. Steam tables. Heat energy contained in a given weight of dry saturated steam, of wet steam, of steam superheated to a given temperature.

Distribution of the energy contained in one pound of coal. Thermal and over-all efficiency.

Temperature—Entropy diagram for water-steam.

Calculations relating to steam dryness and specific volume. Notions of the second law of Thermodynamics. Limitation to the amount of heat energy that can be converted into mechanical energy. Adiabatics and Isothermals.

Rankine cycle. Estimation of steam used per I. H.P. hour. Efficiency ratio. Velocity of efflux of steam from a nozzle using the entropy chart.

Steam turbines. Fundamental rules.

Construction and elementary theory.

Velocity and pressure compounding.

Internal combustion engines. Otto cycle.

Influence of ratio of gas to air. Calorific value of gas by calculation and experiment, and reduction to normal temperature and pressure.

Higher and lower heating values. Hypothetical diagrams for a gas engine. Thermal efficiency.

Efficiency ratio (air standard).

Characteristic equation of a gas.

Suction gas, its production and composition.

Petrol engine, carburettors; oil engine.

Flash point of oil.

Mechanical Engineering. Laboratory.

Relation between temperature and pressure of steam. Heating value of coal, oil, or gas by calorimeter. Evaporation in steam boiler. Efficiency of boiler. Measurement of coal and water used.

Indicated and brake horse-power of steam engine.

Steam consumed and mechanical efficiency.

Testing of indicator springs and pressure gauges.

Indicating the steam engines under different loads.

Use of planimeters in averaging indicator diagram.

Determination of the dryness of steam by calorimeter.

Mechanical efficiency and gas consumption of gas engines.

Heat lost in jacket and exhaust.

Experiments with injectors, feed pumps, and lubricating oils.

Elementary Physics.

Lecturer: D. Farrar, M.Sc.

Monday—7-15 to 9-45.

The Course of Instruction will be arranged to suit Students working for the Preliminary Science Examination of the London School of Dental Surgery; the joint Matriculation Board in Physics; the First Examination in Physics for the Degree of Bachelor of Medicine, and of Surgery of the Victoria and Liverpool Universities.

The Syllabus will include—

General Physics.

Units of length, mass and time. Definitions of velocity, momentum, acceleration, force, and work. Distinctions between solids, liquids, and gases. Specific gravity, atmospheric pressure, Barometers. Air and water pumps. Syphon. Boyle's Law. Diffusion. Osmotic pressure. Dialysis. Capillary phenomena.

Heat.

Temperature and its measurement; expansion of solids, liquids, and gases; calorimetry; change of state; hygrometry transmission of heat.

Light.

Photometry; velocity of light; reflection and refraction of light; mirrors and lenses; optical instruments; dispersion and colour.

Sound.

Wave motion; transmission of sound; methods of determinining its velocity; reflection of sound; pitch and musical intervals; vibration of strings; resonance.

Magnetism and Electricity.

Magnetism.—Properties of magnets; artificial magnets, how made; the mariner's compass; the earth as a magnet.

Current Electricity.—The elementary cell. Polarisation. Local action. Bunsen. Daniell, and Leclanché cells. The storage cell. Properties of a current, heating effect, chemical effect, and magnetic effect; the measurement of currents by various methods. Resistance and its measurement.

Electrostatics.—Positive and negative electrification; electrostatic induction; gold leaf electroscope; the electrophorus; the electric field; tubes of force; condensers; potential.

Laboratory Work.

Heat.—Construction of thermometers. Determination of coefficients of expansion, specific heats, latent heats, temperature of Bunsen flame; boiling points and melting points; dew point and relative humidity. Verification of Boyle's law.

Light.—Use of photometer. Verification of laws of reflection and refraction. Determination of focal lengths of lenses and mirrors; refractive index. Use of spectrometer.

Sound.—Verification of laws of vibrating strings (by sonometer). Comparison of frequencies of vibration of tuning forks. Determination of velocity of sound in air, and of wave length. Resonance tubes. Determination of frequency of vibration by means of syren.

Magnetism.—The making of artificial magnets; mapping lines of force; location of magnetic poles; determination of angle of dip; strength of magnetic fields; comparison of magnetic moments.

Current Electricity.—Use of galvanometers, Wheatstone's bridge, post office box, potentiometer; verification of laws of electrolysis, Ohm's law; determination of specific resistances, internal resistances of cells, electro-motive forces, electro-chemical equivalent, mechanical equivalent of heat.

Electrostatics.—Use of gold-leaf electroscope, electrophorus, and proof plane—investigation of potential; capacity of charged conductors; seat of charge; distribution of charge on surface of a conductor—charging by induction; investigation of indirect charges; making and use of condensers.

Advanced Physics.

Lecturers: G. E. Gittins, B.Sc., A.I.E.E.

D. Farrar, M.Sc.

Wednesday—7-15 to 9-45.

This Class will be arranged to suit the requirements of Students reading for a Pass Degree in Science of London University. The Lectures will be followed by suitably arranged work in the Laboratory.

Syllabus.

Units, primary and derived. Motion in a circle. Moments of inertia. Simple harmonic motion. Pendulums—simple, compound and cycloidal. Young's Modulus. Friction. Viscosity of liquids and gases. Capillarity and surface tension. Elementary theory of attraction. Potential,

Sound.

Velocity and pressure in sound waves. Calculation of velocity from elasticity and density. Quality of sound. Stationary vibration. Determination of frequencies. Musical scale. Temperament. Resonance. Interference. Beats.

Heat.

General theory of heat. Theory of exchanges. Laws of thermo-dynamics. Properties of ideal gases. Liquefaction of gases.

Light.

Optical instruments. Achromatic combinations. The wave theory. Interference. Diffraction. Polarisation.

Magnetism and Electricity.

Magnetic moments. Methods of determining magnetic declination, dip, and horizontal force. Permeability, hysteresis, diamagnetism. The magnetic circuit. Condensers. Theory and use of electrometers. Units. Resistance and its measurement. Effect of temperature on resistance. Electrolysis. Thermo-electricity.

ELECTRICITY FOR TEXTILE STUDENTS.

Lecturer: A. Woods.

Monday—7-30 to 9-30.

This Course has been arranged to meet the requirements of Textile Students who are taking up the study of Electricity in its application to the Electrical Drive in Textile Factories. See 3rd Year Textile Courses, S_3.

The Subject will be dealt with in a practical manner, and the Lectures freely illustrated by experiments and lantern slides.

The Syllabus will include:—

Units (primary and derived).

Magnets and their properties.

Magnetic materials and their use in the construction of generators and motors.

The production of an electric current.

The secondary cell.

Heating and Magnetic effects of electric current.

Ohm's Law, and its applications.

General principles of Electro-Magnetism.

Elementary principles of D.C. dynamos and motors.

Alternating current motors.

Driving of Mules, Ring Frames, Looms, etc.

Convenience of working with electric drive.

Cost of power.

Checking power.

Outlay on spares.
Safety, cleanliness, and reliability.
Individual and grouped drive.
Motor starters.
Wiring of motors and dynamos.
Switches and fuses.
Methods of speed variation of motors.
Methods of testing B.H.P., and efficiency.
Losses in machines and shafting.
Factory lighting.

The practical work will include the running and testing of the D.C. and A.C. generators and motors in the Electrical Laboratory, and the use of the shed motors to determine losses in belts, shafting, and the power required to drive different machines under various conditions of load.

Text Books Required.

Junior Course (Second Year).

"A Class Book of Physics," Parts 1, II, III, by R. A. Gregory and H. E. Hadley ... ... 2 0 net
"A First Book of Practical Mathematics," by T. S. Usherwood and C. J. A. Trimble ... ... 1 6 net
"Practical Drawing," by J. Birkett and T. H. Hartley ... ... 1 0 net

First Year, S_1.

	s.	d.	
"Practical Mathematics for Beginners," by F. Castle.	1	11	net
"Examples of Machine and Engine Details," by J. H. Binfield	1	0	net
"Machine Construction and Drawing," by Ingham ...	1	6	net
"Applied Mechanics for Beginners," by Duncan ...	1	11	net
"Steam and other Engines," by Duncan	3	9	net

Note Books.

	s.	d.	
4 Students' Note Books, $\frac{1}{10}$in. ruling.			
2 Students' Note Books, $\frac{1}{8}$in.. ,,.			
1 Technical Note Book, $\frac{1}{8}$in. ,,.			
2 Technical Note Books, $\frac{1}{10}$in. ,,. Total	2	0	net
1 Standard Type of Laboratory Book	0	9	net

INSTRUMENTS.

Drawing instruments, set squares, protractor, pencils (HH and HHH) and rubber.

Second Year, S_2.

"Machine Drawing," Part 4, by JONES...	3	0	net
"Technical Electricity," (Davidge & Hutchinson) ...	4	2	net
"Practical Mathematics," (Saxelby)	4	11	net

Note Books and Instruments same as First Year.

Third Year, S_3.

"Practical Mathematics" (Saxelby)	4	11	net
"Alternating Currents," by ALFRED HAY	6	0	net
"Exercises in Electrical Engineering," (MATHER AND HOWE)	1	6	net

Note Books and Instruments same as First Year.

First Year, A_1.

"Calculus for Engineers'" (Perry)	7	6	net
"Steam, Gas and Oil Engines," (Perry)	7	6	net
"Alternating Current Machinery" (Barr & Archibald)	12	6	net
"Continuous Current Machine Design" (Cramp) ...	5	0	net
"Practical Alternating Currents" C. F. SMITH	6	0	net

Note Books and Instruments same as First Year.

TEXT BOOKS IN PHYSICS.

ELEMENTARY.

"Heat, Light and Sound," (Jones)	1	11	net
"Magnetism and Electricity for Beginners," (Hadley)	1	11	net
"A Class Book of Physics," Parts I, II, III, GREGORY AND HADLEY	2	0	net

ADVANCED.

"Advanced Heat," (Edser)...	3	6	net
"Advanced Light (Edser)	4	6	net
"Advanced Magnetism and Electricity." (Hadley) ...	4	6	net
"Sound," (Catchpool)	3	6	net
or "Watson's Physics,"	7	11	net

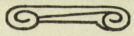
Works of Reference.

" Dynamo Design " (Hobart).
" Electric Motors " (Hobart).
" Dynamo Electric Machinery " (Thompson).
" Transformers," (Kapp).
" Vectors & Vectors Diagrams Applied to the Alternating Current Circuit," (Cramp & Smith).





Textile Evening Courses.



Textile Department.

Head of Department: T. E. MITCHELL, A.M.S.T., Hons. Medallist.

Lecturer and Demonstrator (Spinning): ROBT. BILLINGTON, Hons.

Lecturers and Demonstrators: J. E. ADAMSON, Hons.
E. BLINKHORN, Hons.
J. W. BLACKHURST, Hons.
J. GORING, Hons.
C. JOHNSON, Hons.

Students will be admitted to the Specialized Textile Courses if they possess the Preliminary Technical Certificate of the Union of Lancashire and Cheshire Institutes, or its equivalent.

Other Students who are desirous of joining the Classes must satisfy the Principal of the Institute that they are able to benefit by the Course to which they seek admission, otherwise they must sit for an entrance examination, and if they fail to reach the prescribed standard, it will be advisable for them to attend the Preliminary Course conducted under the Preston Education Committee, or the 2nd Years' Technical Course at the Technical School.

In exceptional cases adult Students may be excused the entrance examinations, provided they can satisfy the Principal of the Institute that they are able to benefit by the Courses to which they seek admission.

The Institute will hold examinations in each year of the Course. On the result of these examinations, together with proper attendance at all the subjects of the course, and the production of such satisfactory evidence as is furnished by school records, classwork, homework, notebooks, and laboratory books, a Course Certificate will be issued by the Council of the Institute.

The City and Guilds of London Institute have now recognised the courses of instruction given in the department as qualifying students for their full Technological Certificate. Students who have passed the 1st, 2nd, and 3rd year course examinations together with a satisfactory amount of homework are eligible for the award of the Full Technological Certificate if they have also passed in the following examinations held by the City and Guilds authorities :—

Spinning Course: Cotton Spinning, Final Grade.

Plain and Fancy Weaving (Desiging Course), Weaving, Sec. A., Principles of Art, &c., Final Grade.

Plain and Fancy Weaving (Manufacturing Course), Weaving, Sec. B., Final Grade.

ORGANISED COURSES.

Except under special circumstances, all Students joining the Institute will be expected to undertake a complete Course of work, and Students will not be regarded as fulfilling this condition unless they attend regularly each subject of the Course, and perform the homework set to the satisfaction of the Lecturer.

Students from Elementary Day Schools will not, as a rule, be ready to undertake Specialized Courses until they have been prepared by two years' preliminary instruction. Courses for the purpose, arranged so as to cover two years, will be conducted by the Preston Education Committee in their Branch Schools.

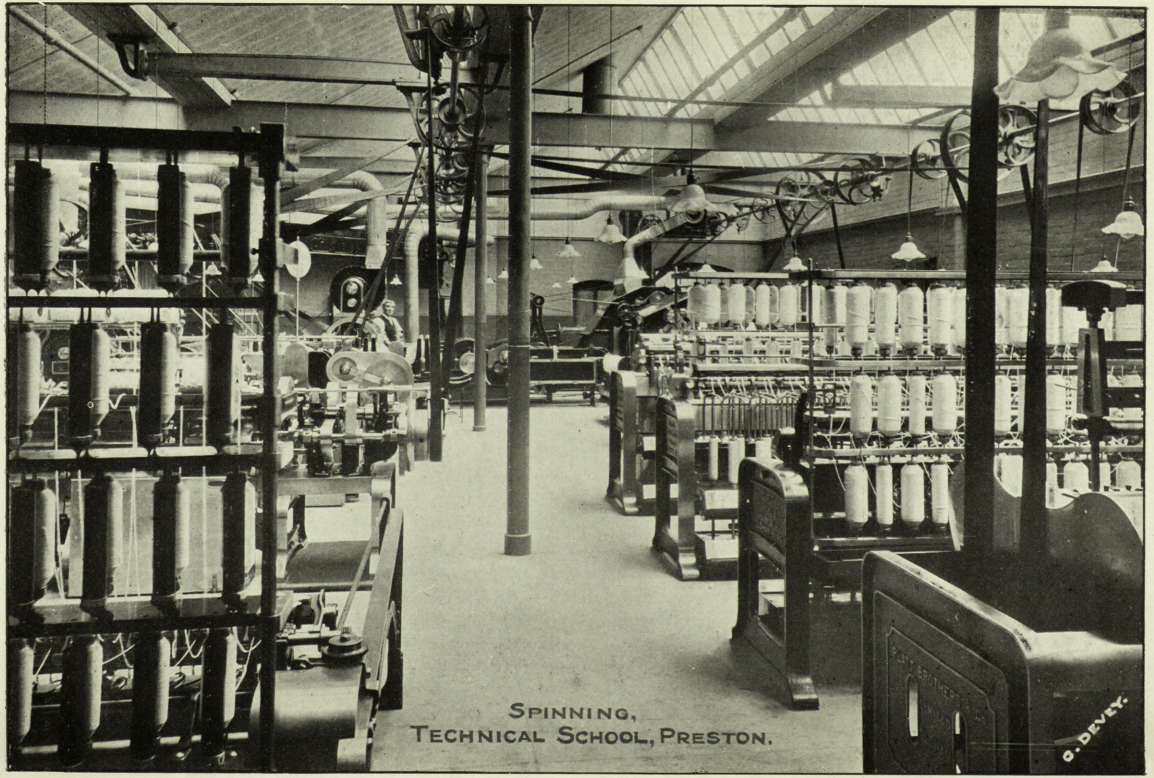
COTTON SPINNING.

First Year.

FEE FOR COURSE, 7/6

TIME TABLE.

DAY.	SUBJECT.	TIME	TEACHER.	ROOM.
Wednesday	Cotton Spinning Lect.	7-15 to 8-15	R. Billington.	Lect. Hall
,,	,, ,, Pract.	8-15 to 9-30	R. Billington.	Shed
Tueday ...	Textile Mechanics ...	7-15 to 9-30	T. E. Mitchell & Assist	6a
Thursday .	Pract. Mathematics .	7-15-to 8-15	C. Johnson.	6a
,,	Handsketching	8-15 to 9-30	C. Johnson.	Shed



SPINNING,
TECHNICAL SCHOOL, PRESTON.

SYLLABUS.

Cotton Spinning.

A brief survey of the cultivation, preparation, and distribution of cotton

The physical properties of cotton ; structure, length, diameter, colour of different varieties.

The objects of cotton mixing ; the methods of mixing, and the construction and operation of the machines used for the purpose.

The principles of cotton cleaning ; the construction and working of opening and scutching machinery ; the functions of the various parts ; accessory apparatus used in connection with the machines.

The principles of cotton carding ; the characteristics of the machines used ; the construction and operation of carding machines ; the functions of the different parts ; the construction of the clothing used ; methods of grinding and stripping ; accessory appliances.

The principles of drawing ; the objects aimed at ; the construction and operation of drawing machines.

All calculations in connection with the above-named machines.

Cotton Spinning Practical.

The Student will examine microscopically the principal textile fibres of commerce. Study of the machinery and accessories included in this course. Mixing and testing of cottons and slivers in order to determine the difference between the actual and calculated results. Obtaining the speed of the various organs of the machinery included in this course. Stripping and grinding of the Revolving Flat Card. Timing, Setting, and practical manipulation of Bale Breaker, Hopper Feed, Lattice Feeder, Exhaust Opener, Scutcher, Card and Draw Frame.

Textile Mechanics.

Measuring Instruments. Ideas of force, mass, weight, density, Graphical representation of Forces. Work, diagrams of work, horse power. Composition and resolution of forces. Triangle and polygon of forces. Principle of moments. Simple and compound levers. Bell crank and bent levers. Trains of wheels. Velocity ratio, mechanical advantage, efficiency. Constant number or dividend. Wheel and axle. Inclined plane and screw. Friction. Cam Construction.

Textile Mechanics Laboratory.

In this Course the student will deal experimentally with the matter dealt with in the lecture.

Practical Mathematics.

Brief revision of Decimal and Vulgar fractions. Percentages. Persentage loss and regain. Contracted multiplication and division. Rough checks. Square root. Areas of simple plane figures, regular and irregular. Volume and Weight of simple solids.

Use of symbols. Algebraic expressions and use of brackets. Numerical substitution in simple formulæ. Simple and simultaneous equations. Indices. Use of common logarithms.

Use of squared paper for various purposes.

Hand Sketching and Scale Drawing.

Use and care of drawing instruments. Hand sketching and dimensioning of simple details from the spinning machinery. Drawing of line sketches from the machinery to illustrate the driving and gearing of each machine dealt with. Exercises in drawing to scale from the dimensioned hand sketches.

Second Year.

Fee for Course, 7/6.

TIME TABLE.

DAY.	SUBJECT.	TIME.	TEACHER.	ROOM.
Monday....	Cotton Spinning Lect	7-15 to 8-15	R. Billington.	Lect.Hall
„	„ „ Pract.	8-15 to 9-30	R. Billington.	Shed.
Wednesday	Textile Mechanics ...	7-15 to 9-30	J. E. Adamson	15 & Mech. Lab
Tuesday ...	do. Engineering Drawing	7-30 to 9-30	J. H. Binfield	

Cotton Spinning.

The preparation of slivers for combing; the machines used for that purpose. The objects of combing; the construction of combing machines and their action.

The mode of producing rovings ; the construction and action of the machines used ; the functions and operations of the various parts ; variations in the construction of the different machines in the series ; accessory appliances.

The methods of twisting rovings and the essential features of good yarn.

The construction and action of the mule ; definition of the stages of the entire operation ; the functions of the principal parts of the machine ; the effect of each stage upon the material ; the methods of driving mules.

The construction of ring and flyer spinning frames and their operation ; the principles of their action ; the varieties in construction of different parts ; the bobbins used.

Calculations of speeds, drafts, twist, &c., in connection with the above machines, and the determination of the counts of yarns.

Cotton Spinning Practical.

Testing of slivers, roves, and yarn in order to determine the difference between the actual and calculated results. Study of the machinery and accessories included in this course. Speed of parts. Timing, setting, and practical manipulation of Sliver lap machine, comber, fly frames, ring frame and mule.

Textile Mechanics.

Potential and Kinetic energy. Energy stored in flywheels. Work done by torque. Momentum and impulse. Motion in a circle. Friction in bearings and lubrication. Link mechanisms, curves of displacement, velocity and acceleration, with special reference to the loom slay. Transmission of energy by ropes and belts. Guide pulleys. Epicyclic trains of wheels and differential motions. Special forms of gearing. Scutcher and fly frame cones. Action of ring frame traveller. Action of mule quadrant. Picking and other cams.

Textile Mechanics Laboratory.

In this course the students will deal experimentally with the matter dealt with in the lectures.

Textile Engineering Drawing.

General introduction to the drawing of machinery details. Plans and elevations. Methods and conventions of projecting

views. Arrangements of drawing. Conditions which must be satisfied by working drawings.

Making dimensioned sketches of machine details, using models and actual portions of textile machinery. Production of working drawings from these sketches ; making working drawings from information concerning dimensions and conditions to be satisfied.

Fastening of machine parts. Use and proportions of bolts, studs, screws, keys, rivets, and cotters. Knuckle joints.

Supports. Footsteps ; pedestals ; wall boxes ; brackets and hangers.

Pulleys ; couplings ; clutches.

Conversion of circular motion into reciprocating motion ; cranks and eccentrics.

Third Year.

FEE, FOR COURSE, 7/6.

TIME TABLE.

DAY.	SUBJECT.	TIME.	TEACHER.	ROOM.
Thursday .	Cotton Spinning—Lecture, &c..	7-30 to 9-30	T. E. Mitchell	16
Friday	do. Practical .	7-30 to 9-30	R. Billington.	Shed
Monday....	Textile Electricity....	7-30 to 9-30	A. Woods	3 and 5

COTTON SPINNING.

Section A.

CARDROOM PROCESSES.

The geographical positions of the cotton-fields of the world ; the area within which cotton can be commercially cultivated ; the physical conditions necessary to its growth and their influence upon the character of the fibre.

The preparation of cotton for the market ; ginning and packing ; the construction of gins and their operation : the proportions of lint and seed ; the influence upon the marketed fibre of faulty ginning and packing.

Classes and counts of yarn for which each variety of cotton is suitable.

The terms and conditions on which raw cotton is bought; the method of selecting it when purchasing; the defects usually existing, and their effect upon the value. Tests for the moisture in cotton, and the permissible limit. The commercial purpose of mixing cotton. Testing of cotton for all usual purposes, at all processes in a cotton-spinning mill, up to and including fly-frames.

The erection, repair, adjustment, practical manipulation, and general maintenance in good working order of all machines and accessories involved in cotton-spinning, up to and including fly-frames.

The construction of all machines referred to in paragraph 5.

Cost of production, labour charges, and advanced calculations on the machinery and processes involved.

The character and quantity of waste produced in the working of the machines, and its utilisation. The construction, use, and manipulation of the machinery required in the preparation of cotton waste for spinning.

The selection, drafting, specification, methods of driving, proportioning practical mill arrangements, setting-out, and starting-up of all machines required in a cotton-spinning mill for the preparation of all quantities, counts, and descriptions of cotton roving.

The material, operations, and apparatus involved in roller-covering; the preparation of drawing rollers for work and the accessory appliances used.

Section B.

SPINNING AND SUBSEQUENT PROCESSES.

The production of doubled yarns; the machinery used. The preparation of yarn for doubling; the characteristics of each variety. The modes of treating doubled yarn for different purposes, and the machinery employed therein. Thread manufacture.

The production of fancy cotton yarns, such as cork-screwed, knop, and flake threads.

The uses to which cotton yarn is put; the characteristics required for each purpose. The methods of making up yarns for various markets; reeling and bundling machinery. Winding and warping.

The terms and conditions of sale of yarn. Conditioning of yarn. Defects in yarn and their remedies. The testing of cotton yarns for all purposes.

The erection, repair, adjustment, practical manipulation and general maintenance in good working order of all machines used in spinning and subsequent processes.

The operations of winding and warping and the machinery employed therein.

Quantities and character of waste made and the utilisation of such waste. The final processes in the spinning of waste, and the machines required. The character of the yarns produced, and the purposes for which they are suitable.

The selection, drafting, specification, proportioning, methods of driving, practical mill arrangement, setting-out and starting-up of all machines employed in spinning and subsequent processes.

The construction of all machines employed in the processes to which Section B refers.

Cost of production, labour charges, and advanced calculations on the machinery and processes employed

Methods of lighting, heating, humidifying, ventilating, and fire prevention and extinction.

Practical Spinning.

Students will cover the ground of previous courses, but in greater detail, particularly in regard to the causes of and remedies for defects in yarn. Instruction and Practice in timing, setting, adjustment, fixing, and practical manipulation of the machinery. Students will have the opportunity of dismantling portions of machinery, with a view to study and practice in rebuilding the same.

Electricity for Textile Students.

This course has been arranged to meet the requirements of Textile students who are taking up the study of Electricity in its application to the Electrical Drive in Textile Factories.

The subject will be dealt with in a practical manner and the Lectures freely illustrated by experiments and lantern slides.

The Syllabus will include:—Units (primary and derived). Magnets and their properties. Magnetic materials and their use

in the construction of generators and motors. The production of an electric current. The secondary cell. Heating, and magnetic effects of electric current. Ohms Law and its applications. General Principles of Electro-Magnetism. Elementary principles of D.C. dynamos and motors. Alternating current motors. Driving of Ring Frames, Looms, &c. Convenience of working with electric drive. Cost of power. Checking power. Outlay on spares. Safety, cleanliness, reliability. Individual and grouped drive. Motor starters. Wiring of motors and dynamos. Switches and fuses. Methods of speed variation of motors. Methods of testing B.H.P. and efficiency. Losses in machines and shafting. Factory Lighting.

The practical work will include the running and testing of the D.C. and A.C. generators and motors in the Electrical Laboratory, and the use of the shed motors to determine losses in belts, shafting, and the power to drive different machines under various conditions of load.

TEXT BOOK.

"Technical Electricity, by H. T. Davidge and R. W. Hutchinson. (*The University Tutorial Press*)..... 3/6 net.

COTTON WEAVING.

Designing Course.—First Year.

FEE FOR COURSE, 7s. 6d.

TIME TABLE.

DAY.	SUBJECT.	TIME.	TEACHER.	ROOM.
Monday....	Cotton Weaving, alternate weeks with Design, Dissection, and Calculation	7-15 to 9-30	T. E. Mitchell and C. Johnson.	6a
Tuesday ...	Textile Art	7-15 to 9 15		
Thursday .	Pract. Mathematics .	7-15 to 8-15	C. Johnson.	6a
„ ...	Practical Weaving & Handsketching.	8-15 to 9-30	E. Blinkhorn and J. W. Blackhurst	6

Manufacturing Course—First Year.

FEE FOR COURSE, 7/6

TIME TABLE.

DAY.	SUBJECT.	TIME.	TEACHER.	ROOM.
Monday....	Cotton Weaving, alternate weeks with Design, Dissection, and Calculation	7-15 to 9-30	T. E. Mitchell and C. Johnson.	6a
Tuesday ...	Textile Mechanics Lecture	7-15 to 8-15	T. E. Mitchell	6a
,, ...	Practical Weaving & Hand Sketching...	8-15 to 9-30	E. Blinkhorn and J. W. Blackhurst	6
Thursday .	Pract. Mathematics .	7-15 to 8-15	C. Johnson.	6a
,, .	Practical Mechanics .	8-15 to 9-30		6a

COTTON WEAVING.

The different forms in which cotton yarns may be supplied to the manufacturers, as in cops, on ring bobbins, in hanks, in cones or cheeses, in balled warps, and upon warper's beams.

The basis of counting cotton, worsted, wollen, linen and silk yarns.

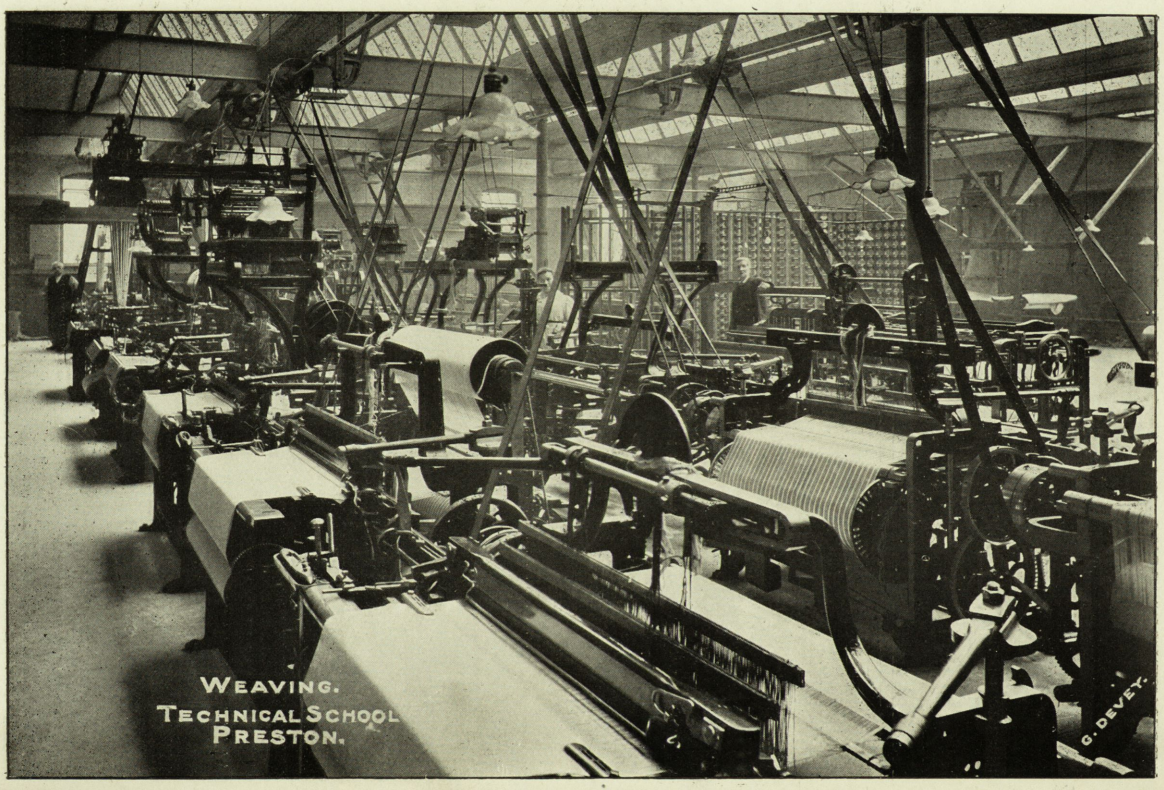
Calculations relating to the testing of counts and the folding of cotton yarns, and also the conversion to equivalent counts of the above yarns.

Fundamental weaves as plains, twills, satins and their derivatives; honeycomb, huckaback, corkscrew, crepe, and similar weaves. The construction of patterns by combination and rearrangement.

The designing of small fancy weaves requiring not more than 20 shafts and arranged in the form of stripes, spots and all-over effects. The development of such weaves by the introduction into the warp of coloured yarns; also extra warp, crammed dents, and varied counts.

Various types of healds and reeds, heald knitting, and casting-out calculations. Different methods of counting reeds.

Calculations necessary in order to ascertain the amount of material contained in, or required to make, a certain quantity of cloth.


WEAVING.
TECHNICAL SCHOOL
PRESTON.
G. DEVEY.

The hand loom mounted with treadles or dobbies. Its advantages for pattern production.

The power loom, its primary and secondary motions:— Shedding by means of tappets and dobbies, tappet construction. Over and under motions applicable to tappets, cone picking, beating up, single box, fast or loose reed, rope or chain and lever let-off and ordinary taking-up motions. Shuttles, pickers, picking bands, check and buffer straps. Temples of various makes and arrangements.

Design, Dissection, and Calculation.

Practice in designing and working out stripes, checks, and other weaves dealt with in the course. Analysis of all types of fabrics specified in the course in order to determine the methods of interweaving, and scheme of colouring; also drafts, and peg or lifting plans for the same. Exercises in textile calculation.

Textile Art.

Freehand Drawing and simple exercises in colour study. Arrangements of stripes and simple effects suitable for the weaves dealt with in the course. Geometric patterns. Simple combinations of form suitable for weaving purposes.

Textile Mechanics.

Measuring Instruments. Ideas of force, mass, weight, density Graphical representation of forces. Work, diagrams of work, horse power. Composition and resolution of forces. Triangle and polygon of forces. Principle of moments. Simple and compound levers. Bell crank and bent levers. Trains of wheels. Velocity ratio, mechanical advantage, efficiency. Constant number or dividend. Wheel and axle. Inclined plane and screw. Friction. Cam construction.

Textile Mechanics Laboratory.

In this course the Student will deal experimentally with the matter dealt with in the lecture.

Practical Mathematics.

Brief revision of decimal and vulgar fractions. Percentages. Percentage loss and regain. Contracted multiplication and division. Rough Checks. Square root. Areas of simple plane figures regular and irregular. Volume and weight of simple solids. Use of symbols. Algebraic expressions, and use of brackets.

Numerical substitution in simple formulæ. Simple and simultaneous equations. Indices. Use of common logarithms. Use of squared paper for various purposes.

Practical Weaving and Hand-Sketching.

Hand-sketching of various details of weaving mechanism. Designing and weaving of small fancy weaves within the scope of the tappet and dobby looms. The production of stripes, etc., on the "cross over" principle. Timing and setting of primary and minor motions of a power loom. Lag pegging. Instruction and practice in the setting and building of ordinary and box plate tappets, together with the laying of chains for oscillating tappet.

Designing Course.—Second Year.

Fee for Course, 7s. 6d.

TIME TABLE.

DAY.	SUBJECT.	TIME.	TEACHER.	ROOM.
Monday....	Cotton Weaving alternate weeks with			16
„ .	Design, Dissection, and Calculation	7-15 to 9-30	T. E. Mitchell and C. Johnson.	16
Tuesday ...	Textile Art	7-15 to 9-15		
Friday	Practical Weaving & Handsketching	7-15 to 9-30	E. Blinkhorn and W. J. Blackhurst.	6

Manufacturing Course.—Second Year.

Fee for Course, 7s. 6d.

TIME TABLE.

DAY.	SUBJECT.	TIME.	TEACHER.	ROOM.
Monday....	Cotton Weaving alternate weeks with			16
„ ...	Design, Dissection and Calculation	7-15 to 9-30	T. E. Mitchell and C. Johnson.	16
Wednesday	Textile Mechanics ...	7-15 to 9-30	J. E. Adamson	15 & Mech. Lab.
Friday	Practical Weaving & Handsketching ...	7-15 to 9-30	E. Blinkhorn and J. W. Blackhurst	6

Cotton Weaving.

The structure of brocades made from one or more wefts, also of diapers, and one-sided and reversble damasks.

The structure of Bedford cords, piques, welts, toilets, patent satins, matelasses and all types of warp and weft backed fabrics.

The structure of compound fabrics of two or more warps and wefts, as in tapestries and figured repps.

Lappet and swivel fabrics and the appliances for weaving.

The structure of gauze or leno fabrics and Madras muslins, and the methods of weaving them.

The structure of fustian fabrics, cords, and velveteens, and the methods of cutting them. Looped and cut pile fabrics.

The various makes of jacquards, as single lifts, centre shed, double lift with single or double cylinders, and open shed. Stop motions applicable to the same.

The jacquard harness as used for simple fabrics and the method of adapting it to suit different reeds and the calculations for the same.

Calculations to ascertain the weight of material required for the fabrics mentioned in this course.

Design, Dissection, and Calculation.

The analysis of all fabrics which are included in the course, in order to determine particulars of their structure, such as weave, draft, and lifting plan. Also the making of new designs for similar fabrics which may be woven in the looms in the practical portion of the course. Practice in textile calculations necessary for the fabrics in this course.

Practical Weaving and Hand-Sketching.

Hand-sketching of the various details of weaving mechanism included in the course, and the general study of the weaving mechanism upon the various hand and power looms. Pegging of lags, laying of tappets and chains, cutting and lacing of cards from the students own design. Weaving of designs upon the hand and power looms. Instruction in the timing, setting and fixing of power loom details, dobbies, and jacquards.

Textile Art.

Drawing.—Drawing, tracing, transferring, enlarging, reducing, and copying designs. Drawing in water colour and body colour.

Colour.—Theory of colour; colour matching; harmony and contrast; tone, tint, hue, and shade; effect of juxtaposition; value of broken colour and the weaver's means of getting it; colouring a given pattern in various ways; application of colours to stripes, checks, spots, and simple diapers; effects of colour as determined by the character and treatment of the yarns; the need for constant reference to colour as seen in nature.

Design.—The planning and design of pattern; leading lines and distribution of parts and masses and the general arrangement; the various types of patterns as geometric, interlacing, counterchange, sprig, and floral.

Nature Study.—The study of natural forms and colours with a view to shew their application to textiles.

Adaptation.—The adaptation of design in a textile or other material to the requirements of a different textile.

Textile Mechanics.

Potential and Kinetic energy. Energy stored in fly wheels. Work done by torque. Momentum and impulse. Motion in a circle. Friction in bearings and lubrication. Link mechanisms, curves of displacement, velocity and acceleration, with special reference to the loom slay. Transmission of energy by ropes and belts. Guide pulleys. Epicyclic trains of wheel and differential motions. Special forms of gearing. Scutcher and fly frame cones. Action of ring frame traveller. Action of mule quardant. Picking and other cams.

Textile Mechanics Laboratory.

In this course the students will deal experimentally with the matter dealt with in the lectures.

Designing Course.—Third Year.

Fee for Course 7s. 6d.

TIME TABLE.

DAY.	SUBJECT.	TIME.	TEACHER.	ROOM.
Friday	Cotton Weaving (Applied Design) ..... alternate weeks with	7-15 to	T. E. Mitchell and	16
„	Applied Design (Tutorial)	9-30	C. Johnson	16
Tuesday ...	Textile Art	7-15 to 9-15		
Wednesday	Practical Weaving ...	7-15 to 9-30	E. Blinkhorn	6

Manufacturing Course.—Third Year.

FEE FOR COURSE 7s. 6d.

TIME TABLE.

DAY.	SUBJECT.	TIME.	TEACHER.	ROOM.
Friday	Cotton Weaving (Applied Design) ..... alternate weeks with	7-15 to 9-30	T. E. Mitchell and C. Johnson.	16
,,	Analysis, Costing and Calculation			16
Monday....	Textile Electricity....	7-30 to 9-30	A. Woods	3 & 5
Wednesday	Practical Weaving ...	7-15 to 9-30	E. Blinkhorn	6

COTTON WEAVING (APPLIED DESIGN).

The nature and properties of the different fibres used for manufacturing processes and the methods of distinguishing one from another.

The limitations of, and influence upon, ornamentation imposed by the nature of the materials and the processes and mechanisms for its expression.

Practical application of colour to striped, checked and figured fabrics.

Pencil drawings and painted designs which may be produced by means of tappets and dobbies.

Trade methods of preparing original sketch designs for jacquard figured effects, the transfer of such designs to point paper. The use and objects of various rulings of design paper.

The application of design to looped and cut pile textures. The influence of jacquard and the harness upon the procedure.

The application of design to all kinds of compound fabrics (*a*) when ordinary jacquards and harnesses are employed (*b*) when special jacquards and harnesses are employed.

The application of design to brocade, tapestry, and repp fabrics, also the creation of texture involved by such application. The modifications imposed by jacquard, harnesses, and stitching warps and wefts.

The application of design to gauze fabrics. Modifications of the methods due to the type and position of jacquard machines, also to harnesses employed.

Card-cutting instructions for the designs included in the preceeding clauses.

Cutting of cards from designs. Card repeating machines, and manual and mechanical card lacing.

The planning of tie-ups for jacquard harnesses. The special advantages of jacquard mountings when combined with healds, as used in striped designs, and for quiltings, alhambras, compound, and other fabrics.

The selection of suitable yarns, reeds, and picks for typical fabrics mentioned in this and the preceding courses.

Analysis of all fabrics included in this course. Candidates, when analysing the woven specimens, may use samples of yarns and a fine balance with a view to determining the counts of the yarns correctly.

Applied Design (Tutorial).

Practical application of design and ornament to woven textures, the selection of suitable weaves for the development of the various details. The preparation of the practical work required from students taking this course.

Textile Art.

The Basis of Design.—The planning of pattern; proportion and scale; drawing from memory; treatment of pattern for borders, corners, and fillings in their relation to each other.

Colour.—The effect of proportion and relative strength of colours in a design; how colour affects a pattern—making or marring a design according as it brings one feature of it or another into prominence; the softening of harsh effects; the emphasising of forms by contrasting tone and colour.

Adaptation.—The adaptation of natural form to ornament and its treatment with a view to its use in repeated, centred, dropped, and other variously arranged patterns.

Styles of Ornament.—The study of, and practice in, the protion of such types of patterns as geometric, interlacing, counterchange, scroll, sprigs, arabesque, floral, and animal.

Traditional and Historic Styles.—The study of such styles as Byzantine, Saracenic, Sicilian, Persian, Indian, Chinese, Italian, Spanish, French, Flemish, German, and English.

Suitability of Design.—The suitability of certain types of pattern for such textiles as dress materials, brocades, damasks, tapestries, carpets according to their use as hangings, furnitures, and other coverings, or as clothing.

Preparation of Design.—The making and colouring of sketch designs in due scale, having regard to the purpose for which they are intended and to the materials in which they are to be reproduced.

Practical Weaving.

Each Student must obtain from the looms a collection of not more than 12 woven samples illustrating colour combinations and weave effects. Each sample must be of sufficient length to show adequately a few repeats of the design, and each Candidate must submit two specimens from each of six, or three from each of four, of the undermentioned groups (twelve specimens in all), but one jacquard design will be regarded as equivaent to two dobby designs.

Group 1. Original weaves suitable for fabrics intended to be bleached, such as may be used for underclothing, bed drapery, table covers, and window curtains.

Group 2. All classes of coloured and Fancy shirtings.

Group 3. Blouse and dress materials suitable for summer wear.

Group 4. Blouse and dress materials of heavier textures and darker colourings than those included in Group 3, and intended for winter wear.

Group 5. Heavy cotton textures, such as towellings, bath sheets, dressing gowns, stiped and check blankets, and rugs.

Group 6. Skirtings, spotted vestings, backed trouserings, fancy cords and velveteens, and other textures intended for clothing.

Group 7. Fabrics such as piques, welts, toilets, matelasses, and other similar structures, both white and coloured.

Group 8. Fabrics in which two or more figuring warps or figuring wefts are employed, as in tapestries and repps.

Group 9. Fabrics such as leno, lappet, warp pile, and distorted weaves.

Group 10. Compound fabrics such as Scotch carpets and patent satins.

Group 11. Fabrics such as dhooties, apron cloths, skirtings, alhambras, and swivels.

Group 12. Fabrics such as brocades, diapers, damasks, and other similar structures.

COTTON WEAVING (MANUFACTURING).

Machines for winding from cops, bobbins, cones, cheeses, hanks, or warps, to warper's bobbins, or to pirn bobbins, or tubes.

Warping and warping machinery, beam warping, chaining, mill warping, sectional, with the necessary calculations relating to the machines and processes.

Sizing and sizing machinery. Size ingredients, their respective puposes and their chemical action upon each other and upon the threads. Size mixing, and machinery for the same. Sizing, brushing, stretching, and drying of hanks. The dresser sizer, the ball sizer, the slasher sizer. Cylinder *versus* air drying. Calculations relating to the foregoing.

Scotch dressing and long chain beaming for coloured goods. Yorkshire dressing. The beaming of warps. Drawing-in, tying or twisting and gaiting the warp.

The relative manufacturing advantages of yarns made from dyed raw cotton and sliver; also when dyed in the cop, cone, cheese, hank, chain, ball warp,and on the back beam.

The selection and productiveness of preparatory and weaving machinery for specified classes of work, such as plain, twill, checked and fancy cloths, in any practical combination.

Jacquards of special build, such as twilling, cross border, leno, pile and twin machines. Setting out, building, and dressing harnesses for gauze, tapestry, compound and pile textures. Scale and pressure harnesses.

Picking mechanism other than the cone; taking-up and warp delivery motions for both regular and irregular wefting. The centre weft fork. Automatic weft supply mechanism and warp stop motions.

Multiple box motions.

Approximate speeds and adjustments of the machinery mentioned in this course. The defects likely to occur at each process, and the methods of correcting them.

The methods of testing yarns for fibrous matters, for count, strength, regularity, moisture, foreign matters and defects. Cloth testing, to ascertain weave, count, reed, pick, strength, elasticity and percentage of foreign matter.

Calculations relating to cloth structures. The costing of cloth, including wages, departmental and other expenses.

Defects in fabrics caused by faulty preparation of the yarns, or faulty manipulation in the loom, and by unequal balancing of the warp and weft.

The most desirable situation for a weaving mill; the best and most economical forms of lighting, heating, ventilating, and humidifying mill buildings, and the selection, arrangement, and driving of machinery with a view to producing the most economical results. Methods of guarding against accidents peculiar to manuturing. Provisions against fire, such as sprinklers, fire-proofing and general care.

Textile Electricity.

This course has been arranged to meet the requirements of Textile students who are taking up the study of Electricity in its application to the Electrical Drive in Textile Factories.

The subject will be dealt with in a practical manner and the Lectures freely illustrated by experiment and lantern slides.

The Syllabus will include:—Units (primary and derived). Magnets and their properties. Magnetic materials and their use in the construction of generators and motors. The production of an electric current. The secondary cell. Heating and magnetic effects of electric current. Ohm's Law and its applications. General principles of electro-magnetism. Elementary principles of D.C. dynamos and motors. Alternating current motors. Driving of Ring Frames, Looms, etc. Convenience of working with electric drive. Cost of power. Checking power. Outlay on spares. Safety, cleanliness, reliability. Individual and grouped drive. Motor starters. Wiring of motors and dynamos. Switches and fuses. Methods of speed variation of motors. Methods of testing B.H.P. and efficiency. Losses in machines and shafting. Factory Lighting.

The practical work will include the running and testing of D.C. and A.C. generators and motors in the Electric Laboratory, and the use of the shed motors to determine losses in belts, shafting, and the power to drive different machines under various conditions of load.

Text Book (see Page 199).

Analysis, Costing, and Calculation.

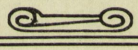
Analysis of fabrics in order to ascertain all particulars necessary for the reproduction of the same. Calculation with reference to the preparatory machinery and processes. Departmental costs. Costing of cloth. Cloth structure calculations. Effect of alterations in weight, reed, pick, counts, or pattern.

Practical Weaving.

Sketching and study of preparatory and weaving mechanism embraced in the course. Practical work upon the preparatory machinery. Instruction and practice in the laying of pattern chains or cards for multiple box motions. Card saving devices. Weaving designs upon hand and power looms. Practice in the timing, setting, and fixing of power loom details, dobbies, and Jacquards.

Fourth and Subsequent Years of Each Course.

In the Fourth and subsequent years of each Course special provision is made to suit the needs of each student.



Commercial Evening Courses.



COMMERCIAL DEPARTMENT.

STAFF.

SUBJECT.	LECTURER.
Arithmetic (Commercial)	J. RENWICK. J. HASENCLEVER. E. SINGLETON.
Accountancy	R. E. SMALLEY, F.C.A.
Book-keeping	H. SOUTHWORTH, F.C.A T. H. BAILEY, A.C.A.
Commerce (Theory and Practice of)	V. E. COLLINGE, A.C.I.S.
Commercial Law	V. E. COLLINGE, A.C.I.S.
English and Commercial Correspondence	J. HASENCLEVER.
French	F. W. JACKSON, B.A.
Geography (Commercial)	T. F. WILSON.
Shorthand (Ad. Theory and Speed)	V. E. COLLINGE, A.C.I.S.
Typewriting	JAMES HILTON.

INTRODUCTION.

Classes in preparation for the Examinations of the Union of Lancashire and Cheshire Institutes, and, in some cases, of the Royal Society of Arts, will be held in the above subjects, syllabuses of which follow the Time Tables.

Students will be admitted to the specialized Courses in Commercial Subjects if they have gained the Preliminary Commercial Certificate of the Union of Lancashire and Cheshire Institutes, or its equivalent.

Other Students who are desirous of joining the Classes must satisfy the Principal of the Institute that they are able to benefit by the Course to which they seek admission; otherwise they must sit for an entrance examination. If they fail to reach the pass standard, it will be advisable for them to attend the preliminary Courses conducted under the Preston Education Committee.

Except under very special circumstances, all Students joining the Institute will be expected to undertake a complete Course of Work, attend regularly each subject of the course, and perform the prescribed homework to the satisfaction of each Lecturer.

Students from Elementary Day Schools will rarely be ready to undertake specialized Courses until they have been prepared by two years' preliminary instruction. Courses for this purpose, arranged so as to cover two years, will be conducted by the Preston Education Committee in their Branch Schools.

Third Year Grouped Courses.

FEE FOR COURSE, 7s. 6d.; IF IT INCLUDES TYPEWRITING, 10s. 6d.

A Course comprises four of the following subjects as grouped beneath, with the exception that a higher stage of a subject may be taken by students who have passed this Stage in the L. & C., or equivalent Examination.

SUBJECTS.

(1) Arithmetic.
(2) Book-keeping.
(3) Commerce.
(4) English & Commercial Correspondence.
(5) French.
(6) Geography.
(7) Shorthand.
(8) Typewriting.

To qualify for the old Lancashire and Cheshire Union Junior Course Certificates, Students must be successful in FOUR *subjects (Arithmetic or English, etc., being one)—at least two of the successes being of the first class (i.e., minimum marks, 75 per cent), and the other successes of the second class (i.e., minimum marks, 50 per cent). For the year* 1916, *qualifying successes obtained in* 1915 *will be accepted. A success in 3rd year French does not count towards these Course Certificates; the success must be in the 4th Year Stage, These Grouped Course Certificates will not be awarded after* 1916.

To qualify for the new Lancashire and Cheshire Union 3rd Year Grouped Course Certificate Students must be successful in Arithmetic, Commerce, and any two of the other subjects, excepting Typewriting, *additional* success in which will be endorsed on the Certificate. Third Year French counts.

All the successes have to be gained in 1916. Students taking a higher grade of any subject should note that success in such grade will be accepted for this Certificate in lieu of the 3rd Year Course success.

Students are strongly recommended to qualify for either of these Grouped Course Certificates (particularly the new one), although for the Session 1915-16, Certificates for the separate subjects will be awarded. Those who are seeking to qualify should give full particulars to the Principal early, so that claims may be sent not later than March 31st, 1916.

I.—Third Year Grouped Courses in preparation for the new Lancashire and Cheshire Union Course Certificates.

Course No. 1.	Sub. No.
Arithmetic	(1)
Book-keeping	(2)
Commerce	(3)
Shorthand	(7)

Course No. 2.	Sub. No.
Arithmetic	(1)
Commerce	(3)
French	(5)
Shorthand	(7)

Course No. 3.	Sub. No.
Arithmetic	(1)
Book-keeping	(2)
Commerce	(3)
Geography	(6)

Course No. 4.	Sub. No.
Arithmetic	(1)
Commerce	(3)
French	(5)
Geography	(6)

Course No. 5.	Sub. No.
Arithmetic	(1)
Commerce	(3)
English, etc.	(4)
Shorthand	(7)

II.—Grouped Courses for Typists.

Course No. 6.	Sub. No.
Arithmetic	(1)
English, etc.	(4)
Shorthand	(7)
Typewriting	(8)

Course No. 7.	Sub. No.
Arithmetic	(1)
Bookkeeping	(2)
Shorthand	(7)
Typewriting	(8)

Third Year Grouped Courses—Time Table.

Day.	Time.	Subject.
Monday	7-15 to 8-15	(1) Arithmetic
,,	7-15 to 8-15	(6) Geography.
,,	7-15 to 8-15	(7) Shorthand (From—Tion Hook—"Manual.")
,,	8-15 to 9-15	(1) Arithmetic.
,,	8-15 to 9-15	(7) Shorthand (Beginners class—"Manual").
Tuesday	6-15 to 7-15 or 8-15 to 9-15	(8) Typewriting. (Or Friday—one hour only).
,,	7-15 to 8-15	(3) Commerce.
,,	8-15 to 9-15	(5) French.
Wednesday	7-15 to 8-15	(2) Book-keeping.
Friday	6-15 to 7-15 or 8-15 to 9-15	(8) Typewriting. (Or Tuesday—one hour only).
,,	7-15 to 8-15	(4) English, etc.

CLASS AND EXAMINATION SYLLABUSES.

(1) *Arithmetic*—

1. Rapid decimalisation of money and conversion from a decimal of £1 into shillings, pence and farthings. Calculation for cost, given price per unit and *vice versa*. Calculation of net price from gross price and *vice versa*. (English and metric systems.)

2. Multiplication and division by contracted methods.

3. Gross profit and net profit. Variation of net profit with turnover and working expenses. Interest. Total interest on sums of money for different periods. Interest tables. Accounts current.

4. (*a*) Graphical demonstration of simple problems occurring under Sections 1 and 3.

(*b*) Introduction to logarithms. Multiplication, division, involution, evolution, solved by four-figure logarithms.

5. Discount in the sense of the difference between the amount of a claim in the future and its present value by (*a*) the method of true discount, (*b*) the method of commercial discount. Comparison of the values of futures claims. The substitution of one claim for a number of future claims, (*a*) by the method of true discount, (*b*) by the method of commercial discount. Mean due date. Compound interest. Simple commercial problems involving compound interest Compound interest tables.

6. Partnership. Division of profits at the end of trading period when withdrawals by partners are regarded as (*a*) salaries, (*b*) anticipated profits, (*c*) withdrawals of capital.

Companies. Calculations of dividends on various kinds of shares.

7. General use of contracted methods and logarithms to facilitate solutions. [Seven-figure logarithms will be provided where necessary].

(2) *Bookkeeping*—

1. Book-keeping by double entry, including the opening and keeping of the following books :—

Cash book (with bank reconciliation statements).
Petty cash book.
Bought day book. Sold day book.

Returns books (inwards and outwards).
Bills books (simple bill transactions only).
Journal.
Ledger.

2. The balancing of the accounts and the testing of the correctness of the postings by a trial balance, the preparation of an account of profit and loss and a balance sheet in such form as to show the exact position of the business at date of stocktaking.

(3) *Commerce (Theory and Practice of)*—

1. COMMERCE.—Meaning of the term. The advantages of exchange. Commerce as one main branch of production. The meaning of the term production as shown by the classification of occupations into—

(*a*) Extractive industry. (Agriculture, Mining, Fishing.)
(*b*) Manufacture and constructive industry.
(*c*) Commerce.
(*d*) Direct services (*e.g.*, Medicine, Law, Teaching, the Fine Arts).

The requisites for production: (*a*) Land (*i.e.*, nature); (*b*) Labour (*i.e.*, Mankind); (*c*) Capital—the forms of capital—the capital of a business and the forms taken by it.

2. THE CLASSIFICATION OF COMMERCE—(*a*) Trade; (*b*) Transport; (*c*) Banking and Finance; (*d*) Insurance.

Division of trade—Wholesale, retail, home, foreign.

3. THE RETAIL TRADE.

(*a*) Historical development of the retailer from the mediæval craftsman (outline only).
(*b*) Machinery of retail trade; purchase of goods by retailer from manufacturer or warehouseman; price lists.
(*c*) Terms of purchase.—Quantity, quality, time of delivery, terms of payment; a simple treatment of the essentials of contract.
(*d*) Methods of payment.—Bills, cheques; elementary notions of the modern English banking system, starting from the consideration of a cheque; the Post Office as an agency for remittance—money orders, postal orders.
(*e*) Profits, gross and net; their relation to turnover and working expenses.

4. The WHOLESALE TRADE.—The functions of the dealer and warehouseman; the organisation of a wholesale warehouse (illustrated as for as possible from typical local trades); methods and machinery of the purchase and sale :—(*a*) of raw materials and foodstuffs, (*b*) of manufactured goods; estimates, tenders; procuring orders, execution and delivery.

Practical office work to be done in connection with 3 and 4 and the nature and uses of essential documents to be understood.

(4) *English and Commercial Correspondence.*

1. An essay. Subjects of both general and commercial interest will be set. The essay should be of at least 150 words.

2. A business letter to be written from data supplied.

3. A precis of a short series of letters or of a speech or statement.

4. General reading.—Peacock's "English Essays" (Essays of Bacon, Addison, Steele); Lyde, "Man and His Markets."

(5) *French—Examination Syllabus—*

Questions in Grammar, and simple sentences for translation into English and *vice versa.*

(6) *Geography—*

PART I.

1. Climate and the great climatic regions of the earth.

2. The distribution of forest lands. The production of timber.

3. The fishing industry, particularly in its application to the supply of the British market.

4. The ranching industry and cattle raising generally considered in relation to the British meat supply. Rapid transit and cold storage.

PART II.

The economic geography of India, Japan, and China considered in respect of the following matters :— (*a*) Climate; (*b*) Relief; (*c*) Vegetation, rivers, lines of communication, and ports; (*d*) Peoples; (*e*) Agriculture, mining, manufactures, and commerce. Imports, exports, and the directions of trade.

(7) *Shorthand (Advanced Theory).*—

Instruction will be given in the principles of Phonography set forth in the "Manual of Phonography" (Instructor, pt. 1). Advanced principles will be introduced early, and application made especially to commercial phraseology. The examination will consist of the neat and correct transcription into Shorthand of about 200 words, partly in single words and partly in simple sentences, a short passage of which will be slowly dictated. Candidates must be familiar with the main principles and resources of Pitman's Shorthamd as applied to commercial and general work, but will *not* be required to shew any knowledge of principles or resources applicable especially to reporting.

(8) *Typewriting*—

The syllabus is shown by the examination test, which will comprise the following items:—

(1) The typing of a carelessly written letter, not to exceed 120 words in length.
(2) The composition and typing of a reply to the letter given in paragraph 1.
(3) Questions on the care, oiling, &c., of a typewriter, including the use of the variable spacer, the adjustment of margins for different kinds of work, line spacing, &c.
(4) The indication of correct fingering and correct division of words.
(5) The copying of an arranged tabulation or specification.
(6) The typing of an invoice, or other commercial statement, from unarranged details given.

Candidates will be required to attempt the whole of the questions.

Fourth Year Grouped Courses.

FEE FOR COURSE, 7s. 6d.; IF IT INCLUDES TYPEWRITING, 10s. 6d.

A Course comprises three of the following subjects, but only as set out beneath.

SUBJECTS.

(1) Arithmetic.
(2) Book-keeping.
(3) English and Commercial Correspondence.
(4) French.
(5) Shorthand (Speed at least 60 words per minute for examination).
(6) Typewriting.

To qualify for the Lancashire and Cheshire Union Senior Course Certificates, Students who hold Junior Commercial Certificates must be successful in three subjects, and other Students in four subjects, and two of the successes must be of first-class standard (i.e., minimum marks, 75 per cent.). French of this stage does not count as a subject for these Course Certificates; the next higher Stage does count.

For the year 1916, qualifying successes obtained in 1914 and 1915 will be accepted. These Grouped Course Certificates will not be awarded after 1916.

Students seeking to qualify for the Course Certificate should give full particulars to the Principal early, so that claims may be sent not later than March 31st, 1916.

Fourth Year Grouped Courses in preparation for the Senior Lancashire and Cheshire Union Course Certificates.

COURSE No. 8.	Sub. No.
Arithmetic	(1)
Book-keeping	(2)
English, etc.	(3)

COURSE No. 9.	Sub. No.
English, etc.	(3)
French	(4)
Shorthand	(5)

COURSE No. 10.	Sub. No.
English, etc.	(3)
Shorthand	(5)
Typewriting	(6)

COURSE No. 11.	Sub. No.
Book-keeping	(2)
Shorthand	(5)
Typewriting	(6)

Fourth Year Grouped Courses—Time Table.

DAY.	TIME.	SUBJECT.
Tuesday	7-15 to 8-15	(5) Typewriting. (Or Friday—one hour only.)
[redacted] ,,	7-15 to 8-15	(6) French.
,,	8-15 to 9-15	(3) English and Commercial Correspondence.
Wednesday	7-15 to 9-15	(2) Book-keeping.
Thursday	7-15 to 9-15	(4) Shorthand (Speed, 50-150 words per minute).
Friday	7-15 to 8-15	(1) Arithmetic (Senior Grade).
,,	7-15 to 8-15	(5) Typewriting. (Or Tuesday—one hour only.)

CLASS AND EXAMINATION SYLLABUSES.

(1) *Arithmetic (Commercial)*—

1. Revision of partnership. Companies. Discount. Compound interest and logarithms. Present value of a future claim on the basis of compound interest.

2. MONEY AND EXCHANGE.—Given that 40lbs. Troy of standard gold are coined into 1869 sovereigns, to calculate weight of a sovereign and the number of sovereigns that are made out of 1oz. Troy of standard gold. Comparison of mint price gold thus obtained (taking into account period of waiting for the coins) with the Bank of England price of silver. The cost of silver in a shilling at the current price of silver. The cost of bronze in a penny. Some foreign systems of metallic currency. The so-called Mint par of exchange. The practical parity of exchange, *e.g.*., between £1 and 1 franc involving (*a*) prices of gold in London and Paris, *or* conditions of mintage in London and Paris ; and (*b*) cost plus transport and insurance. Rates of exchange—the sight rate and long rate, the relation of sight, rate, long rate and rate of discount. Calculation of the cost of a bill of exchange. Arbitrage in respect of rates of exchange.

3. Calculation of prices, involving freight, insurance, terms of payment and rates of exchange. The construction of tables and graphs of equivalents. Arbitrage in respect of prices.

(2) *Book-keeping*—

1. SINGLE AND DOUBLE ENTRY.

(*a*) Theory of single entry ; theory of double entry ; advantages of double over single.

(*b*) Conversion of a set of books from single entry to double entry.

(*c*) Various kinds of ledger accounts—(i.) personal, (ii.) impersonal, (iii.) real, and (iv.) nominal.

(*d*) Various kinds of assets—(i.) fixed, (ii.) floating, (iii.) wasting, (iv.) fictitious.

(*e*) Distinction between capital and revenue.

(*f*) Distinction between accounts of income and expenditure and accounts of receipts and payments.

2. THE APPLICATION OF DOUBLE ENTRY BOOK-KEEPING TO VARIOUS BUSINESSES.

(*a*) Merchants. (*b*) Manufacturers. (*c*) Trading companies.

3 Sectional Balancing Systems.

(*a*) Total accounts. (*b*) Self-balancing ledgers.

4. Consignment Accounts, Joint Ventures, Goods on Sale or Return.

(*a*) Consignments, inward and outward.
(*b*) Joint ventures.
(*c*) Treatment of goods on sale or return.
(*d*) Account current.
(*e*) Average date.

5. Negotiable Instruments.

(*a*) Promissory notes. (*b*) Bills of exchange.

6. Partnership Accounts.

(*a*) Provisions of Partnership Acts.
(*b*) Kinds of partners—(i.) Sleeping, (ii.) active, (iii.) quasi, (iv.) limited.
(*c*) Adjustments, interest accounts, drawings, salaries.
(*d*) Admission of new partners.
(*e*) Alternative to cash premium.
(*f*) Goodwill.
(*g*) Limited partners.
(*h*) Dissolution.
(*i*) Bankruptcy of partners.
(*j*) Partnerships compared with Limited Companies.
(*k*) Conversion of private firm into a Limited Company.

7. Company Accounts.

(*a*) Distinction between Partnerships and Limited Liability Companies.
(*b*) Private Companies.
(*c*) Statutory books.
(*d*) Different classes of share capital.
(*e*) Mortgages and debentures.
(*f*) Application and allotment of shares.

(*g*) Preliminary and formation expenses.

(*h*) Forfeited shares.

(*i*) Bonus shares.

(*j*) Trading and profit and loss accounts and balance sheet.

(3) *English and Commercial Correspondence*—

1. An essay—on a topic of general or commercial importance. (About 200 words should be written.)

2. A business letter—to be written from data supplied. The compilation of a brief circular.

3. Précis of a series of letters or other documents.

4. General reading. Peacock's Essays (Essays of Lamb, Hazlitt, Hunt, Macaulay, Carlyle); D. H. Macgregor, "The Evolution of Industry."

(4) *French*—(formerly Intermediate Grade).

(*a*) Questions in grammar; (*b*) translation either of a passage from Daudet "Lettres de mon Moulin" [Blackie & Son, 4d.], or an easy unprepared passage from a modern French writer; (*c*) a short piece of unprepared translation for all candidates; (*d*) a simple piece of English prose to be translated into French.

(5) *Shorthand* (*Speed*)—

Instruction will be given in the special principles of abbreviation, phrasing, intersection, &c., set forth in the "Reporter" (Instructor, pt. 2), and dictation of a great variety of matter relating to commerce, politics, science, religion, &c., will be given at rates varying from 50 to 150 words per minute. For examination the Student may take one of four tests:—4 minutes at 60, 80, 100, or 120 words per minute, and the following points will be specially noticed:—(1) Shorthand note. (2) Accuracy of transcription. (3) Spelling and punctuation. (4) Reasonable neatness. The main consideration, however, will be accuracy in the transcript.

(6) *Typewriting*—

The syllabus is shown by the examination test, which will comprise the following items in addition to those specified in the Junior Grade syllabus:—

(1) Typing appropriate replies to given letters.

(2) Questions on correct forms of address.

(3) Punctuating, paragraphing, and capitalising a passage.

(4) Typing of meanings of abbreviations.

(5) Typing from mis-unpunctuated, abbreviated, and confused manuscripts.

(6) Questions on duplicating processes.

(7) The display of titles and headings.

(8) Typing an invoice or statement from printed or manuscript copy.

Candidates will be required to attempt the whole of the questions.

NOTE.—Accuracy and neatness being of the greatest importance, *the quality of the work will be noticed, rather than speed.*

It is not desirable that candidates should take this examination unless they have a fair knowledge of English.

Fifth Year.

For Senior Students who desire to prepare for Accountants', Bankers', and Secretaries' professional examinations, or the examinations of the Royal Society of Arts, Lancashire and Cheshire Union, etc., Lectures will be given in the following subjects, provided that a sufficient number of Students seek enrolment.

I. Accountancy—Friday, 8-15 to 9-15.

II. Commercial Law—Friday, 7-15 to 8-15.

Fee for one Subject 5s.; *both Subjects*, 7s. 6d.

SYLLABUSES.

(1) *Accountancy—*

1. SYSTEMS OF ACCOUNTING.—Single and double entry and the conversion of single to double entry; the single account and double account methods, and their application to undertakings.

2. METHODS OF BALANCING.—Self-balancing ledgers, Trading or Working Accounts, Receipts and Payments, Income and Expenditure, Profit and Loss and Revenue Accounts, and Balance Sheets.

3. PARTNERSHIP ACCOUNTS.—Constitution of a partnership and the principles governing the distribution of profits; goodwill; dissolution accounts; sale of a firm to a company; limited partnerships; joint venture accounts.

4. COMPANY ACCOUNTS.—Private and public limited companies; statutory books for a limited company; record of share capital transactions; purchase of a business; absorptions and amalgamations of companies.

5. BANKRUPTCY AND LIQUIDATION ACCOUNTS.—Principles and forms of bankruptcy and liquidation accounts; compulsory and voluntary windings-up.

6. INCOME TAX.—Business accounts for assessment and appeal; partnership and private assessments; collection of tax, and rates for time being in force.

7. DEPRECIATION AND RESERVES.—Reserve funds; sinking funds, secret reserves.

8. COST ACCOUNTS; STORES AND STOCK ACCOUNTS.

9. MISCELLANEOUS ACCOUNTS.—Consignment Accounts; Royalty Accounts; Hire Purchase Accounts; Departmental and Branch Accounts. Adjustments as between Capital and Revenue; preparation of a Company's Annual Return; forms of Annual Accounts of Limited Companies, Gas and Water Companies, Banking and Insurance Companies, Railway Companies, etc.

(2) *Commercial Law*—

1. General elements of the law of contract.

2. Sale of goods.

3. Negotiable instruments.

4. The law of master and servant (with special reference to the Workmen's Compensation Act).

ENROLMENT.

Students who have not previously attended classes at the Harris Institute or Technical School must see the Principal prior to filling up the enrolment Form. He can be seen for this purpose at the Technical School, Corporation Street, on Wednesday and Thursday evenings, the 15th and 16th September, and at the Harris Institute Avenham, on Friday evening, the 17th.

The Staff will also be present on the above nights to advise Students as to Courses of Instruction, Text Books, etc.

An Entrance Examination will be held on Friday evening, the 17th September.

FEES AND REGISTRATION.

All Fees must be paid in advance, and Students must obtain the official receipt and show it to the Teacher before their names can be entered on the Register.

An Adult Student who does not desire to take a full Course and can prove to the satisfaction of the Principal and Head of Department that he can benefit by instruction in a certain subject or subjects of a group course, may be allowed to attend at a fee of 7s. 6d. per subject—Typewriting, 10s. 6d.

Students who enter for Courses must clearly understand that they will be required to attend all the subjects regularly, otherwise they will be compelled to pay a fee of 7s. 6d. for each subject taken. *This rule will be strictly enforced.*

REPORTS.

The Teachers are authorised to report periodically through the Principal as to the attendance and homework of each Student. In dealing with Students who are unsatisfactory in either of these respects the Council shall have power to remove their names from the Register without return of fee.

PRIZES.—Local Prizes for high Examination successes will be awarded to Students who have attended a complete Course, provided that their reports are satisfactory.

In addition, valuables Prizes are offered by the Union of Lancashire and Cheshire Institutes.

Scholarships and Prizes.

SCHOLARSHIPS AND PRIZES.

Conditions on which Scholarships and Prizes will be awarded.

Two Scholarships of £45 *a year each may be offered on the following conditions :*

One Scholarship, tenable for one year, at the Manchester or Liverpool Universities, or other place of higher education approved by the Council, to be competed for at an Examination to be held for that purpose, open to all Students who obtain a Higher Certificate in any subject of Science at the May Examinations, 1916, and who have attended the Classes at the Harris Institute for two years preceding that Examination, and reside within a radius of seven miles from the Preston Town Hall during that period.

One Scholarship, tenable for one year, at the National Art Training School, South Kensington, to be competed for at an Examination held during the fortnight preceding the Summer Vacation, 1916, open to all Art Students who have sat for the Government Examinations connected with the Art Class Teacher's Certificate, and have attended the Art School at the Harris Institute for two years preceding the Examination, and resided within a radius of seven miles from the Preston Town Hall during that period.

The Council reserve the right of witholding the Scholarships if the drawings or work submitted do not, in the opinion of the Examiners, possess sufficient merit.

SCIENCE, TECHNOLOGY, AND COMMERCIAL.

A Scholarship will be awarded to each Student who passes the Course Examinations, conditionally on attendance and home work being satisfactory, and with the distinct understanding that the Student takes a complete Course the following session.

Scholarships will also be awarded to Students who have obtained a First-Class Pass in cases where Courses are not arranged.

A limited number of Prizes will be awarded for successes at the Course Examinations conditionally on attendance and home work being satisfactory.

SCHOOL OF ART.

For particulars see School of Art Prospectus.

DAY PREPARATORY TRADE SCHOOL.

Scholarships for Boys Attending Elementary Schools.

A limited number of Scholarships are offered to boys residing within seven miles of the Preston Town Hall. They must be over 13 years of age. A Test Examination will be held in July, 1916. These Scholarships cannot be competed for by anyone who is, or has been, a Student of the Institute.

DAY COMMERCIAL SCHOOL.

A limited number of Scholarships are offered to boys and girls over 13 years of age, attending Elementary Schools in Preston and district. A Test Examination will be held in July, 1916.

EVENING CONTINUATION SCHOOL SCHOLARSHIPS,

Tenable at the Harris Institute.

Science, Technical, Commercial, and Domestic Scholarships are awarded to Students passing the 2nd Year Course (Males), and 3rd Year Course (Females), at the Evening Continuation Classes conducted by the Preston Education Committee.

Scholarships and Prizes will be awarded only to Students who have made at least 75 per cent, of possible attendances during the Session, and worked satisfactorily.

No Student who has been awarded a Prize or a Scholarship will be eligible for a Prize for a similar success a second time.

All Prizes will be in the form of books, instruments, or materials.

REGULATIONS.

Applicable to all Students attending Classes at the Harris Council.

The Lecturers are authorised to report periodically, through the Principal, as to the attendance, homework and conduct of each Student. The Council shall have power in dealing with the students who are unsatisfactory in these and other respects, to remove their names from the Register without return of fee.

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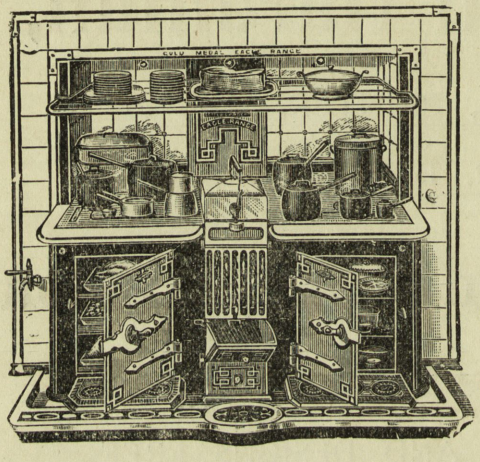

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Nature of Sample: Xtol.

Object of Examination: Testing Co-efficient against Carbolic. Rideal Walker Method.

Particulars on Label:

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REPORT: The Carbolic Acid co-efficient of the Xtol tested against B. typhosus according to Rideal Walker method was found to be 20.

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