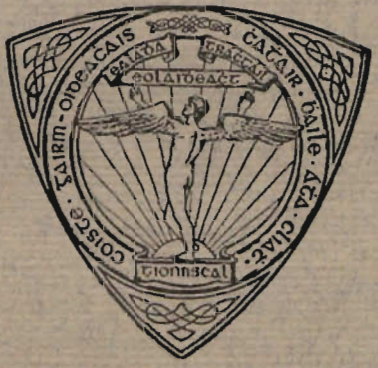
1937

Technical Institute, Kevin Street : Prospectus, 1937-38

City of Dublin Vocational Education Committee

City of Dublin
Vocational Education Committee

Scoileanna Ceárd-Oideachais
City of Dublin Technical Schools



Seisiún 1937-38

Session 1937-38

Electrical Engineering
Radiotelegraphy :: Physics :: Mathematics
Applied Chemistry and Pharmacy

PROSPECTUS OF COURSES

KEVIN STREET

CALENDAR—SESSION 1937-38

1937—SEPT. 6, MONDAY	Whole-time Day Schools open for enrolment. Day Apprentice School resumes work.
SEPT. 13, MONDAY	Whole-time Day Schools commence work and Part-time Day Classes open for enrolment.
SEPT. 20, MONDAY	Evening Classes open for enrolment and Part-time Day Classes commence work.
SEPT. 27, MONDAY	Evening Classes commence work.
NOV. 1, MONDAY	*All Saints' Day.* Whole-time Day Schools —excepting Day Apprentice School and Special Classes—closed.
DEC. 8, WEDNESDAY	*Feast of Immaculate Conception.* Whole-time Day Schools—excepting Day Apprentice School and Special Classes—closed.
DEC. 11, SATURDAY	Teaching work in Whole-time Day Schools ceases (excepting Day Apprentice School and Special Classes).
DEC. 13, MONDAY	Term Examinations in Whole-time Day Schools commence.
DEC. 18, SATURDAY	Schools close for Christmas Vacation.
1938—JAN. 3, MONDAY	All Classes resume work after Christmas Vacation.
JAN. 6, THURSDAY	*Feast of Epiphany.* Whole-time Day Schools —excepting Day Apprentice School and Special Classes—closed.
MAR. 4, FRIDAY	Land Surveying and Levelling Course begins.
MAR. 17, THURSDAY	*St. Patrick's Day.* Schools closed.
MAR. 19, SATURDAY	Land Surveying Field Work begins. Motor Car Driving Lessons begin.
APR. 12, TUESDAY	Last meeting of classes before Easter Vacation.
APR. 20, WEDNESDAY	All classes resume work after Easter Vacation.
APR. 29, FRIDAY	Evening Classes close — excepting Special Classes.
MAY 2, MONDAY	Evening Examinations commence.
MAY 26, THURSDAY	*Ascension Day.* Whole-time Day Schools— excepting Day Apprentice School and Special Classes—closed.
JUNE 6, MONDAY	*Whit-Monday.* Schools closed.
JUNE 16, THURSDAY	*Feast of Corpus Christi.* Whole-time Day Schools—excepting Day Apprentice School and Special Classes—closed.
JUNE 25, SATURDAY	Teaching work ceases in Whole-time Day Schools—excepting Day Apprentice School and Special Classes.
JUNE 27, MONDAY	Sessional Examinations commence in Whole-time Day Schools—excepting Day Apprentice School and Special Classes.
JUNE 29, WEDNESDAY	*Feast of Saints Peter and Paul.* Whole-time Day Schools—excepting Day Apprentice School and Special Classes—closed.
JULY 2, SATURDAY	Whole-time Day Schools and Part-time Domestic Economy Classes close—excepting Day Apprentice School and Special Classes.
JULY 16, SATURDAY	Day Apprentice School and Special Classes close.

Schools closed on all Bank Holidays not specified in above Calendar

CITY OF DUBLIN
VOCATIONAL EDUCATION COMMITTEE

COMMITTEE

Alderman C. Breathnach, ll.d., t.d., 384 Clontarf Road.
Councillor Mrs. T. Clarke, Baymount, 95 Clontarf Road.
„ D. D. Healy, p.c., 40 Usher's Quay.
„ Mrs. M. Walsh, 16 Elgin Road.
„ Mrs. M. Cosgrave, l.l.a., 17 Park Drive, Cowper Gardens.
„ P. Belton, Belfield Park, Drumcondra.
„ M. O'Sullivan, p.c., 74 Ballymun Road, Glasnevin.
„ J. J. Byrne, b.a., b.l., 51/53 Talbot Street.
Miss Helena Molony, 51 Larkfield Grove, Kimmage.
Micheal O'Foghludha, 5 Cabra Road.
Mr. M. P. Rowan, 52 Capel Street.
Mr. Michael Somerville, 1 O'Curry Road, South Circular Road.
Dr. Lorcan G. Sherlock, 21 Parliament Street.
Mr. W. J. Whelan, 35 Lower Gardiner Street.

Offices:—
Technical Institute,
Bolton Street,
Dublin.

L. E. O'Carroll, b.a., b.l.,
Chief Executive Officer.

LOCAL SUB-COMMITTEES

For triennial period 1934-37.

RATHMINES.

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Dr. Conn Murphy, 10 Charleston Avenue, Rathmines.
Councillor Mrs. M. Cosgrave, l.l.a., 17 Park Drive, Cowper Gardens.
Mr. G. F. Klingner, a.c.a., 7 St. Helen's Road, Booterstown.
Mr. M. P. Rowan, 52 Capel Street.
Mr. W. Woods Hill, 5 Parliament Street.
Mr. M. J. O'Reilly, 31 Kenilworth Square.

PARNELL SQUARE.

Alderman C. Breathnach, ll.d., t.d., 384 Clontarf Road (ex-officio).
M. O'Foghludha, 5 Cabra Road.
Liam O'Cearbhaill, 88 Manor Street.
Miss H. Chenevix, 48 Fleet Street.
Mr. J. W. Kelly, 16 St. Joseph's Parade, Nelson Street
Sean O'h-Uadhaigh, 12 Dawson Street.

Local Sub-Committees—(Continued)

BOLTON STREET.

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MR. R. MURPHY, Messrs. Hopkins and Hopkins, O'Connell Street.
MR. M. P. ROWAN, 52 Capel Street.
MR. M. SOMERVILLE, 1 O'Curry Road, S.C.R.
MR. W. J. WHELAN, 35 Lower Gardiner Street.
MR. SEAN CAMPBELL, 35 Lower Gardiner Street.
MR. GERALD DOYLE, 32 East Essex Street.
MR. THOS. DARCY, 91 Ceannt Fort, Mount Brown.
MR. J. G. WILSON, 13 Sackville Place.
MR. T. A. CRAMPTON, Hammersmith Works, Ballsbridge.

PEMBROKE (Ballsbridge and Ringsend).

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COUNCILLOR MRS. M. WALSH, 16 Elgin Road.
L. G. SHERLOCK, LL.D., 21 Parliament Street.
REV. J. HOOKE, C.C., St. Mary's, Haddington Road.
MR. J. J. BEGGAN, c/o. McEntagart Bros., Percy Place.
PROFESSOR B. F. SHIELDS, 87 Pembroke Road.
MR. WILLIAM HANLON, 29 Home Villas, Donnybrook.

KEVIN STREET.

ALDERMAN C. BREATHNACH, LL.D., T.D., 384 Clontarf Road (ex-officio).
MR. O. HYNES, 6 St. Kevin's Road, S.C.R.
MR. M. SOMERVILLE, 1 O'Curry Road, S.C.R.
REV. M. GERAGHTY, C.C., The Presbytery, High Street.
COUNCILLOR D. D. HEALY, P.C., 40 Usher's Quay.
MR. M. P. ROWAN, 52 Capel Street.
MR. J. W. KELLY, 16 St. Joseph's Parade, Nelson Street.
MR. J. ANDREWS, B.SC., Messrs. A. Guinness, Son and Co., James's Street.

CHATHAM ROW (School of Music).

ALDERMAN C. BREATHNACH, LL.D., T.D., 384 Clontarf Road (ex-officio).
COUNCILLOR MRS. M. WALSH, 16 Elgin Road.
COUNCILLOR M. O'SULLIVAN, P.C., 74 Ballymun Road, Glasnevin.
COUNCILLOR MRS. T. CLARKE, Baymount, 95 Clontarf Road.
MADAME KATHLEEN RODDY, Broadcasting Station, Henry Street.
MR. W. J. WHELAN, 35 Lower Gardiner Street.
MR. M. P. ROWAN, 52 Capel Street.
MR. J. T. DOYLE, Osborne Lodge, Mount Prospect Road, Dollymount.
MR. THOS. MURPHY, 16 Cowper Road.
MR. JOS. O'REILLY, 9 Lower Leeson Street.
L. G. SHERLOCK, LL.D., 21 Parliament Street.
MRS. MAUD AIKEN, Dungaoithe, Sandyford

ADVISORY COMMITTEES

MASTER JEWELLERS.

MR. G. THORNLEY.
MR. R. MURPHY.
MR. L. BEIRLEY.
MR. J. SHEERIN.
MR. SLEATOR.

MASTER TAILORS.

MR. W. O'CONNOR.
MR. W. SCOTT.
MR. R. BOYD.

CONTENTS

GENERAL NOTICES

Entrance Examinations — Fees — Regulations

Entrance Examinations will be held at the Technical Institute, Kevin Street, every evening during the week commencing 20th September, and on such subsequent evenings as may be arranged. Students who produce satisfactory evidence of education may be exempted from examination. Introductory Courses are provided for those who fail to obtain sufficiently high marks in the examination.

FEES PER SESSION.

Introductory Courses	£0 2 6
Pharmaceutical Chemistry (Lectures)	1 10 0
Do. do. (Practical)	0 10 0
Applied Chemistry	0 15 0
Medical Chemistry	1 10 0
Specialised Technical Analysis	0 15 0
Practical Pharmacy (per term)	0 15 0
Day and Evening Wireless Courses.	(See page 37).
All other Courses ..... 7/6 for each year of Course.	

For additional and single subjects the fee is the same as for a Course. Students of Technical Classes may take a Class in Irish at a fee of 2/6.

Applicants for admission to Courses or Classes must be at least fourteen years of age.

Students who through obtaining employment are unable to continue in attendance at the Whole-time Day School Courses of the City of Dublin Vocational Education Committee will be admitted to approved evening school courses, without fees, up to the value of the Day School Fees paid.

The same concession may be extended to other students who have left the Day School Courses, if the reasons for their non-attendance at the Day School Classes are considered by the Principal to be adequate.

The Trade Classes are primarily intended for those engaged in the several trades. Others will not be admitted before November 1st, and then only if there be room, and on payment of a quadruple fee.

A Laboratory or Workshop Class can only be taken in conjunction with an approved Lecture or Drawing Class. No student will be allowed to continue in a Laboratory or Workshop Class if his attendance at the Lecture or Drawing Class is unsatisfactory.

A Class may be discontinued if an insufficient number of students join or attend; the number of evenings allotted weekly to a Class may be reduced if there be a falling off in the attendance. The right is reserved to close Classes for any other reason whatever

Students must make good any damage done by them.

Strict order must be observed at all times within the precincts of the Schools.

A complete course of study in any section generally occupies about three years.

Where possible, separate classes for journeymen will be arranged in trade subjects.

The Courses as set out are not to be considered as arbitrary; the subjects may, with the sanction of the Head of the Department be varied.

SCHOOL CHOIRS AND DRAMATIC CLASSES.

The Committee is prepared to facilitate the organisation of Choral and Dramatic Societies and similar activities. Students interested are invited to communicate with the Principal of the Institute in which they are enrolled.

Schools of Electrical Engineering, Wireless Telegraphy, Physics and Applied Chemistry

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PROGRAMME AND TIME TABLE

OF THE COURSES IN

Electrical Engineering Practice and Technology
Electrical Trades and Crafts
Instrument Making and Allied Crafts
Radiotelegraphy
Physics and Mathematics
Pure and Applied Chemistry
Industrial Chemistry—Specialised Courses
Bacteriology and Botany
Pharmacy and Allied Subjects
Languages for Students of Technology

TECHNICAL INSTITUTE, KEVIN STREET

Session 1937-1938

Teaching Staff

E. MORTON, B.SC., A.R.C.SC.I. *Principal and Head of the School of Physics, Electrical Engineering and Chemistry.*

F. NOLAN, M.SC.

K. HANWAY, M.SC.

HENRY C. CLIFTON, B.A.

W. O'BRIEN.

HAROLD A. HODGENS.

P. WHELAN, B.SC., A.R.C.SC.I.

WILLIAM FEGAN, A.M.I.E.E.

G. A. WATSON, B.SC., A.R.C.SC.I.

MICHAEL LAMBERT.

JOHN SHEIL, M.D., B.L., PH.C.

R. G. ALLEN, B.SC., A.R.C.SC.I.

W. J. LOOBY, B.SC., A.R.C.SC.I., H. DIP. IN ED.

GEO. RING, B.SC., A.R.C.SC.I., B.E.

F. J. BARRAGRY, M.P.S.I.

P. BRICKELL, A.M.I.E.E.

P. SULLIVAN.

M. O'KEEFE.

P. J. O'CALLAGHAN, B.SC., A.R.C.SC.I.

J. O'TOOLE.

H. J. BARRISCALE, B.E.

E. MOYNIHAN, B.SC., A.R.C.SC.I.

J. HONAN.

H. FLOOD, B.SC., A.R.C.SC.I.

P. J. HURLEY, M.SC.

M. HENDERSON, B.E.

H. D. THORNTON, B.SC., A.R.C.SC.I

B. G. FAGAN, B.A., B.SC., F.I.C., A.R.C.SC.I.

B. DIXON, B.SC., A.R.C.SC.I.

M. J. GORMAN, B.SC., A.R.C.SC.I.

P. CONLON.

S. E. MACCORMAIC.

J. H. FERGUSON.

TECHNICAL INSTITUTE, KEVIN STREET.

Courses and Time Tables

No. of Course	Subject	Day	Hour	Room	Teacher
	SPECIAL CLASSES IN IRISH.				
	Irish—I.C.	Wed. ..	7.30–9.30	13	
	Irish—I.D.	Fri. ..	7.30–9.30		
	INTRODUCTORY COURSES				
4K	English—F	Mon. ..	7.30–8.30	27	S. E. MacCormaic.
	Elementary Mathematics—F ..	Mon. ..	8.30–9.30	27	S. E. MacCormaic.
	Elementary Science—A	Fri. ..	7.30–9.30	8	E. Moynihan.
5K	English—G	Thurs. ..	7.30–8.30	27	S. E. MacCormaic.
	Elementary Mathematics—G ..	Thurs. ..	8.30–9.30	27	S. E. MacCormaic.
	Drawing—F	Wed. ..	7.30–9.30	14	Miss M. Whelan.
	ELECTRICAL TRADES				
	ELECTRICAL INSTALLATION WORK.				
	FIRST YEAR.				
6K	Electrical Wiring—Pract. I. ..	Mon. or Fri.	7.30–10.0	1	
	Electrical Engineering—Lect. I...	Wed. ..	7.30–8.30	5	E. Moynihan
	Electrical Laboratory—I.	Wed. ..	8.35–10.0	8	E. Moynihan, H. Flood.
	Physics for Electricians	Tues. ..	7.30–10.0	8	H. Flood, M. Henderson
	SECOND YEAR.				
7K	Electrical Wiring—Pract. II. ..	Thurs. ..	7.30–10.0	1	
	Electrical Installation—Lect. II. ..	Tues. ..	7.30–8.30	5	W. Fegan.
	Electrical Engineering—II. ..	Mon. ..	7.30–10.0	6	G. Ring.
	ELECTRICAL FITTING.				
	THIRD YEAR.				
8K	Electrical Fitting—Pract.	Wed. ..	7.30–10.0	1	
	Electrical Engineering—(D.C. and A.C.)	Thurs. ..	7.30–10.0	6	W. Fegan.
	Practical Drawing	Fri. ..	7.30–10.0	14	H. J. Barriscale.
	CABLE JOINTING.				
9K	Cable Jointing	Mon. & Wed.	8. 0–10.0	18	P. O'Keeffe
	ELECTRIC WELDING.				
10K	Electric Welding	Mon. & Thur.	8.0-10.0	5	J. O'Toole.

No. of Course	Subject	Day	Hour	Room	Teacher
	ELECTROTECHNOLOGY				
	ELECTRICAL ENGINEERING PRACTICE.				
	FIRST YEAR.				
11K	Electrical Engineering—I.A. ..	Thurs. ..	7.30-10.0	12-10-8	H. Flood, E. Moynihan
	Physics for Electricians—I.A. ..	Mon. ..	7.30-10.0	8	H. Flood, E. Moynihan
12K	Electrical Engineering—I.B. ..	Wed. ..	7.30-10.0	12-10-8	E. Moynihan, H. Flood.
	Physics for Electricians—I.B. ..	Tues. ..	7.30-10.0	8	H. Flood, E. Moynihan
	SECOND YEAR.				
13K	Electrical Engineering—II. ..	Mon. ..	7.30-10.0	4-6	G. Ring, M Henderson
	Mathematics—II. C.	Fri. ..	7.30-9.30	4	H. C. Clifton.
	Practical Drawing—II.	Wed. ..	7.30-10.0	9	H. J. Barriscale.
	THIRD YEAR.				
14K	Electrical Engineering—III. ..	Wed. ..	7.30-10.0	4-6	G. Ring, W. Fegan.
	Applied Mechanics—I.	Fri.	7.30-10.0	9	F. Nolan
	Mathematics	Thurs. ..	7.30-10.0	9	K. Hanway.
	FOURTH YEAR.				
15K	Electrical Engineering—A.C. ..	Tues. ..	7.30-10.0	4-6	G. Ring.
	Practical Mathematics	Thurs. ..	7.30-9.30	9	K. Hanway.
	FIFTH YEAR.				
16K	Electrical Engineering—IV. ..	Tue., Thur.	7.30-10.0	4-6	G. Ring, W. Fegan.
	Power Plants and Producers ..	Wed. ..	7.30-10.0	A8*	P. Cormack.
	SIXTH YEAR.				
17K	Electrical Engineering—V.	Tue., Thur.	7.30-9.30	9-6	R. G. Allen.
	*Mathematics	Mon. ..	7.30-9.30	B2*	H. C. Clifton.
	POST OFFICE ENGINEERING COURSES				
	TECHNICAL TELEGRAPHY.				
	FIRST YEAR.				
18K	Technical Telegraphy—I.	Thurs. ..	8. 0-10.0	27	P. Sullivan.
	Magnetism and Electricity	Fri. ..	7.30-10.0		E. Morton.
	SECOND YEAR.				
19K	Technical Telegraphy—II.	Fri. ..	8. 0-10.0	9	P. Conlon
	TECHNICAL TELEPHONY				
	FIRST YEAR.				
20K	Technical Telephony—I.	Wed. ..	8. 0-10.0	11	P. Sullivan.
	Magnetism and Electricity	Fri. ..	7.30-10.0		E. Morton.
	SECOND YEAR.				
21K	Technical Telephony—II.	Tues. ..	8. 0-10.0	9	P. Sullivan.
	POST OFFICE ENGINEERING.				
22K	Post Office Engineering—I. ..	Mon. ..	8.45-10.15	8	H. J. Barriscale.
	Instrument and Wiring (Pr.) ..	Fri. ..	8.0-10.0	11 & 6	H. J. Barriscale.

No. of Course	Subject	Day	Hour	Room	Teacher
	RADIO TECHNOLOGY				
	RADIO COMMUNICATION.				
	FIRST YEAR.				
23K	Radio Communication—I.	Tues. ..	8.0 10.0	8	P. J. O'Callaghan.
	Magnetism and Electricity—I. ..	Fri. ..	7.30-10.0	12 & 10	do.
	SECOND YEAR.				
24K	Radio Communication—II. ..	Fri. ..	8.0-10.0	13	
	Electrical Engineering (A.C.) ..	Thurs. ..	7.30-10.0	4 & 6	W. Fegan.
	RADIO - SERVICE.				
	FIRST YEAR.				
25K	Radio Service—I.	Mon. ..	7.30 9.30	11	H. Hodgens.
	Magnetism and Electricity—I. ..	Fri. ..	7.30-10.0	12 & 10	P. J. O'Callaghan.
	SECOND YEAR				
26K	Radio Service—II.	Thurs. ..	8.0 10.0	11	H. Hodgens.
	Radio Communication—I.	Tues. ..	8.0-10.0	8	P. J. O'Callaghan.
	MORSE PRACTICE.				
27K	Telegraphy Practice	Mon., Wed., Th.	7.30 9.30	13	J. V. Honan.
	TRAINING COURSES FOR WIRELESS OPERATORS (See Page 15).				
	INSTRUMENT MAKING AND GLASS BLOWING				
	FIRST YEAR. **INSTRUMENT MAKING.**				
28K	Instrument Making—I.	Tues. ..	7.30-10.0	2	M. Lambert.
	Elementary Science	Fri. ..	7.30-9.30	8	E. Moynihan.
	SECOND YEAR.				
29K	Instrument Making—II.	Fri. ..	7.30-10.0	2	M. Lambert.
	Electrical Engineering—I. *or* ..	Tues. ..	7.30-10.0	12-10-8	E. Moynihan.
	Physics—1.	Mon. ..	7.30-10.0	12 & 10	P. J. O'Callaghan.
	GLASS BLOWING OF SCIENTIFIC APPARATUS				
30K	Glass Blowing	Mon.,Wed, Fri.	7.30-10.0	27	
	PHYSICS AND MATHEMATICS				
	GENERAL PHYSICS.				
	FIRST YEAR.				
31K	Physics—I.	Mon. ..	7.30-10.0	12 & 10	P. J. O'Callaghan, P. Whelan.
	(A Class in Mathematics may be taken in addition).				
	SECOND YEAR.				
32K	Physics—II.	Wed. ..	7.30-10.0	9 & 10	P. J. O'Callaghan.
	(A Class in Mathematics may be taken in addition).				
	MECHANICS				
33K	Mechanics	Fri. ..	7.30-9.30	9	F. Nolan
	MAGNETISM AND ELECTRICITY.				
34K	Magnetism and Electricity.. ..	Fri. ..	7.30-10.0	12 & 10	P. J. O'Callaghan, B. Dixon.
	(A Class in Mathematics may be taken in addition).				

No. of Course	Subject	Day	Hour	Room	Teacher

SPECIAL COURSES

35K | • SANITATION SCIENCE.

36K | • ELECTRICITY FOR RADIOLOGISTS.

37K | • PHYSICAL OPTICS.

38K | • OPTICAL INSTRUMENTS.

* The Special Courses listed above will be organised in the Session 1937-38. Intending students should consult the Principal.

MATHEMATICS.

39K	Practical Mathematics—I.	Fri. ..	7.30–9.30	4	
40K	Practical Mathematics—II. ..	Thurs. ..	7.30–9.30	8	K. Hanway.
41K	Practical Mathematics—III. ..	Mon. ..	7.30–9.30	B 2	H. C. Clifton.
42K	Pure Mathematics .. .. (Tutorial Class).	Fri. ..	7.30–9.30	11	H. C. Clifton.

PURE AND APPLIED CHEMISTRY

APPLIED CHEMISTRY (GENERAL).

	FIRST YEAR.				
43K	Inorganic Chemistry, Lecture ..	Tues. ..	7.30–8.30	25	G. A. Watson; H. Thornton.
	Laboratory—I.	Tues. ..	8.35–10.5	21	G. A. Watson; H. Thornton.
	Do.	Wed. ..	7.30–10.0	21	G. A. Watson; H. Thornton.
	Physics—I.	Mon. ..	7.30–10.0	10	P. O'Callaghan.
	SECOND YEAR.				
44K	Inorganic Chemistry, Lecture ..	Mon. ..	9.5–10.5	25	G. A. Watson.
	Chemical Analysis—II.	Tues. ..	7.30–10.0	22	G. A. Watson.
		Mon. ..	7.30–9.0	22	G. A. Watson.
	Physics—II.	Wed. ..	7.30–10.0	9 & 10	P. J. O'Callaghan.
	THIRD YEAR.				
45K	Inorganic Chemistry, Lecture ..	Thurs. ..	7.30–8.30	25	H. Thornton; B. G. Fagan.
	Chemical Analysis—III.	Fri. ..	7.30–10.0	22	H. Thornton; B. G. Fagan.
		Thurs. ..	8.35–10.5	22	H. Thornton; B. G. Fagan.
	FOURTH YEAR.				
46K	Organic Chemistry *and* ..	Thurs. ..	7.30–10.0	22	B. G. Fagan; H. Thornton.
	Technical Analysis—IV.	Fri. ..	7.30–10.0	22	B. G. Fagan; H. Thornton.
	FIFTH YEAR.				
47K	Analysis—V.	Thur., Fri. ..	7.30–10.0	22	B. G. Fagan; H. Thornton.

PHYSICAL CHEMISTRY.

48K	Physical Chemistry—Lecture ..	Wed. ..	7.30–10.0	23	F. Nolan
	Physical Chemistry—Laboratory ..	Wed. ..	7.30–10.0	23	F. Nolan

No. of Course	Subject	Day	Hour	Room	Teacher

INDUSTRIAL CHEMISTRY

SPECIALISED COURSES IN TECHNICAL ANALYSIS.

FOOD AND DRUGS.

49K	Technical Analysis	Thurs. & Fri.	7.30–10.0	22	B. G. Fagan; H. Thornton.

OILS AND FATS

50K	Technical Analysis	Thurs. & Fri.	7.30–10.0	22	B. G. Fagan; H. Thornton

GAS MANUFACTURE.

51K	Technical Analysis	Thurs. & Fri.	7.30–10.0	22	B. G. Fagan; H. Thornton

COURSE FOR DIPLOMA OF VETERINARY STATE MEDICINE EXAMINATION.

52K	Technical Analysis	Thurs. & Fri.	7.30–10.0	22	B. G. Fagan; H. Thornton

TECHNOLOGY OF MANUFACTURES

BREWING SCIENCE AND CHEMISTRY OF FERMENTATION.

53K	Lecture and Laboratory	Mon. ..	6.0–8.0	23	W. J. Looby.

INDUSTRIAL BACTERIOLOGY AND ENZYME CHEMISTRY.

54K	Lecture and Laboratory	Tues. ..	7.30–10.0	23	W. J. Looby.

MILK PROCESSING AND MILK PRODUCTS MANUFACTURE.

55K	Lecture and Laboratory	Mon., Fri. ..	7.30–10.0	23	M. J. Gorman.

CEREAL CHEMISTRY AND FLOUR MILLING TECHNOLOGY.

56K	Lecture and Laboratory	Mon. ..	7.30–10.0	23	W. J. Looby;
		Wed. ..	7.30–10.0	28	J. H. Ferguson.

TECHNOLOGY OF PAINT AND VARNISH MANUFACTURE.

57K	Lecture and Laboratory	Wed. ..	7.30–10.0	21	G. A. Watson.

CHEMISTRY FOR PHOTOGRAPHY. PHOTO-MECHANICAL PROCESS WORK, LITHOGRAPHY, ETC.

58K	Lecture and Laboratory	Thurs. ..	7.30–9.30	22	F. Nolan

CHEMISTRY AND BOTANY FOR SEEDSMEN.

59K	Lecture and Laboratory	Fri. ..	7.30–9.30	23	W. J. Looby.

MEDICAL CHEMISTRY

60K	Medical Chemistry—Lect.	Wed., Fri. ..	7.30–8.30	25	P. J. Hurley.
	Do. Lab.	Mon. ..	7.30–10.0	21	P. J. Hurley.
	Do. Lab.	Fri. ..	8.30–10.0	21	P. J. Hurley.

No. of Course	Subject	Day	Hour	Room	Teacher

COURSES FOR PHARMACEUTICAL CHEMISTS

* LECTURE COURSE IN PHARMACEUTICAL CHEMISTRY.

(September to May).

61K	Chemistry and Physics, Lecture ..	Mon. & Fri.	7.30–8.30	25	P. J. Hurley.
	.. .. Lab. (Optional)	Mon. & Fri.	8.30–10.0	21	P. J. Hurley.

* POST-LECTURE COURSES IN PRACTICAL CHEMISTRY.

(September to January; January to May; May to August).

62K	Chemical Laboratory .. .. (120 hours).	Mon., Wed. Thurs., Fri.	7.0–10.0	21	P. J. Hurley. H Thornton.

* BOTANY

(September to May).

63K	Botany	Thurs.	7.0–8.30	23	W. J Looby

* MATERIA MEDICA.

(September to May).

64K	Materia Medica	Thurs. ..	8.30–9.30	23	Dr. J. Shiel

* Courses recognised by the Pharmaceutical Society of Ireland)

PRACTICAL PHARMACY.

(September to January ; January to May ; May to August)

65K	Lecture and Practical .. —	Mon., Tues. Thurs., Fri.	7.30–10.0	24	F. J. Barragry

LANGUAGE COURSES

IRISH FOR STUDENTS OF SCIENCE AND TECHNOLOGY.

66K	Irish	Wed.	8.0–10.0	24	W. J. Looby.

GERMAN FOR STUDENTS OF SCIENCE AND TECHNOLOGY.

67K	German—I	Wed. ..	8,0–10.0	23	W. O'Brien
	German—II	Thurs. ..	8.0–10.0	28	W. O'Brien.

Scholarships

THE FOY SCHOLARSHIPS IN APPLIED CHEMISTRY.

A former student of the City of Dublin Municipal Technical Schools, Mr. W. P. Armstrong, has established a Scholarship in Chemistry to be called the "Foy Scholarship." The annual value of the Scholarship is about £20, being the proceeds of an investment of £500 in Dublin Corporation Stock.

The Scholarship is awarded each Session on the result of an Examination in Chemistry, usually held in May. All students who have attended regularly during two Sessions in the Chemistry Department are eligible to compete, and the student to whom the Scholarship is awarded must pursue his studies in the Chemistry Department during the following Session.

THE DUBLIN MECHANICS' INSTITUTE SCHOLARSHIPS.

The Residuary Fund of the Dublin Mechanics' Institute has been made available for Industrial Scholarships under the management of the Technical Education Committee.

Three Scholarships will be awarded annually—one in the Mechanical Engineering Group, one in the Electrical Engineering and Physics Group, and one in the Building Trades Group. The Scholarships are tenable for three years, and are value about £3 each per year.

Candidates must be engaged in an Operative Trade as Apprentices or Learners. They must be between the ages of 16 and 19, and must have attended a Technical Course during the preceding)School Session and made 80 per cent. of the possible attendances in two of the subjects of the Course in which they are entered.

MULLIGAN SCHOLARSHIPS.

As a result of a bequest by the late John Mulligan, Managing Director of the Hibernian Bank, and for many years Chairman of the City of Dublin Technical Education Committee, approximately 25 Scholarships of £1 each will be awarded annually.

The awards will be made on the results of the Second Year Course Examination of the Department of Education to successful students having the best record of attendance.

School of Wireless Telegraphy

DAY AND EVENING COURSES FOR THE TRAINING AND CERTIFICATION OF SEA-GOING WIRELESS OPERATORS.

DAY COURSE

Subject	Day	Hour	Room	Teacher
Technical Radio Lecture—Section A.	Tues., Wed., Fri.	11.30–12.30	11	H. Hodgens
Technical Radio Lecture—Section B.	Mon., Wed., Fri. ..	3.0–4.0	11	H. Hodgens.
Direction Finding Theory—Section A. ..	Mon, Thurs. ..	11.30–12.30	11	H. Hodgens.
Practical Radio* Instruction and Exercises— Section A.	Tues., Thurs. ..	3.0–4.0	11	H. Hodgens.
Section B.	Tues., Thurs. ..	2.0–3.0	11	H. Hodgens.
Electricity and Magnetism—Section B.	Mon., Thurs. ..	11.30–12.30	12	E. Morton.
	Tues., Wed., Fri.	11.30–12.30	12	W. Fegan.
Rules and Regulations	Tues., Thurs. ..	2.0–4.0	13	J. V. Honan.
Telegraphy and Traffic Practice ..	Daily	10.0–11.30 and 2.0–4.0	13	H. Hodgens and J. V. Honan.

Fortnightly examination tests will be held in all subjects.
*Practice in taking and working out bearings daily.

EVENING COURSE

Subject	Day	Hour	Room	Teacher
Telegraphy Practice (including handling of radio-telegrams)	Mon.	7.30–9.30	13	J. V. Honan.
	Wed.	7.30–9.30	13	J. V. Honan.
	Thurs.	7.30–9.30	13	J. V. Honan.
*Technical and Practical Radio ..	Tues.	7.30–9.30	11	H. Hodgens.
Electricity and Magnetism	Fri.	7.30–9.30	8	P. O'Callaghan.

*Direction Finding Theory and Practice included in Course for 1st Class Certificate.

Courses and Syllabuses

ELECTRICAL ENGINEERING, WIRELESS TELEGRAPHY, APPLIED PHYSICS AND CHEMISTRY.

INTRODUCTORY COURSE (ELECTRICAL).

Subjects:

ENGLISH.
WORKSHOP ARITHMETIC.
ELEMENTARY SCIENCE, *or*
PRACTICAL DRAWING.

ENGLISH.

Grammar—parts of speech—punctuation—letter and essay writing—notetaking—dictation and reading from technical journals—lectures on simple electrical apparatus and machinery.

WORKSHOP ARITHMETIC.

Signs and symbols—factors and powers—G.C.M. and L.C.M. fractions, simplification and conversion to decimals—decimals and metric system—percentages—ratio and proportion—units of length—mensuration of rectangles, parallelograms, triangles, circles, cylinders and cones—practical methods of calculating areas and volumes—units of weight and specific gravity—evaluation of simple formulae used in electrical engineering.

ELEMENTARY SCIENCE.

Units—length, area, volume and mass. Force and moment of a force—lever—balance. Density. States of matter and change of state. Pressure. Heat and temperature. Centigrade and Fahrenheit scales. Demonstration of effect of heating solids, liquids and gases—expansion, conduction, convection and radiation. Evaporation and boiling. The Calorie-specific heat. Distinction between chemical

and physical changes. Study of nature and action of air. Heating of metals in air—change of appearance and weight—rusting of iron—meaning or burning or combustion. Inactive and active constituents of air. Preparation of oxygen and examination of its properties—meaning of burning or combustion. Inactive and active constituents paration of hydrogen and examination of properties. Oxidation of hydrogen. Action of metals on acids—sulphuric, nitric and hydrochloric acids. Elementary ideas on formation of salts with mention of copper sulphate, ammonium chloride, silver nitrate, and zinc chlorade. Decomposition of water by the electric current and identification of the products of decomposition—relative amounts of oxygen and hydrogen evolved. Production of an electric current—using any two dissimilar metals and a mineral acid. Necessary elements of a primary cell. Magnetism—properties of a magnet—lines of force—magnetic field. Magnetisation of iron. Comparison of magnetic properties of soft iron and hard steel. Magnetic field around a straight current-carrying conductor—circular conductor—solenoid. Polarity of solenoid. Electromagnet and electric bell. Leclanche and Daniell cells—examination of—determination of positive and negative poles—conventional direction of current—polarisation. Potential—analogy of "head of water" and "current strength" of water flow with electrical potential and current. Continuous fall of potential in the direction of current. Chemical effect of current—revision—passage of current through acidulated water—anode and kathode. Copper voltameter (expt.). General effect of electrolysis—electrolytes. Definition of ampere in terms of electrodeposition of copper (silver). Conductors and insulators. Resistance—ohm defined. Potential—volt defined (assuming Ohm's law). Electric Circuit—use of ammeter and voltmeter—general statement of Ohm's law. Application of Ohm's law to whole or part of circuit. The "Polarisation Effect" in cells. Secondary cells—lead—lead-acid accumulator—no E.M.F. between two plates of lead immersed in dilute sulphuric acid, or between any two similar metals in contact with an electrolyte. Charging process—conversion of lead plates into two dissimilar plates by oxidation of one of them. "Forming"—examination of "formed" plates. The "discharge"—examination of plates in "discharged" condition. Elementary ideas of "capacity" of an accumulator. Construction of the commercial storage cell. Battery E.M.F.—cells in series. Battery E.M.F.—cells in parallel.

Resistances in series and in parallel. Resistance of a cell. Calibration of an ammeter (copper voltameter). Calibration of a voltmeter (using standard resistance and ammeter). Measurement of resistance by the ammeter—voltmeter method. Heating effect of a current. Electrical heating appartus. Variation of resistance with change of temperature of pure metals, alloys, carbon and electrolytes. Use of Nichrome, Manganese, etc., in making resistance coils. Joule's Law —Joule defined—relation between the Calories and the Joule. Glow lamps and arc lamps. Electromagnetism and electromagnetic induction—Lenz's law.

PRACTICAL DRAWING.

Use and care of instruments—scales—lettering and simple geometrical exercises on lines and circles—projections of solids—free-hand sketching and measurement of models—methods of making drawings of simple parts of machines and apparatus.

FIRST YEAR COURSE IN ELECTRICAL ENGINEERING PRACTICE.

Subjects:

ELECTRICAL ENGINEERING.

MATHEMATICS, MECHANICS AND DRAWING.

(PHYSICS FOR ELECTRICIANS).

ELECTRICAL ENGINEERING.

FIRST YEAR.

Phenomena of electric charges and currents—lines of force—types of magnetic fields—electro-magnets, permanent magnets, and their applications—conductors and insulators—difference of potential—primary cells—volts, amperes, and ohms—Ohm's law—galvanometers —ammeters, and voltmeters—resistance and methods of measurement —specific resistance—temperature co-efficient—thermal effects of currents—incandescent lamps; attainment of steady temperature—

simple photometry—fuses—heaters and radiators—Joule's, Watt's, and B.O.T. units—Coulombs—potential and other factors governing size of cables—description and grading of cables—electric arc-switches—chemical effects of a current—electro-deposition—secondary cells and batteries—internal resistance—divided circuits and currents—grouping of cells—electro-magnetic induction—spark coil—simple action of the dynamo.

SCIENCE, MATHEMATICS, AND DRAWING.

(*Physics for Electricians*).

Units—length, area, volume and mass. Force and moment of a force—lever—balance—weighing density. States of matter and change of state. Properties of materials. Strength, hardness, tenacity, divisibility, ductility, elasticity, porosity. Liquids—capillarity, absorption of water by various materials. Exclusion of water by impregnation and protective coverings. Solvents and solutions. Pressure. Heat and temperature. Centigrade and Fahrenheit scales. Demonstration of effect of heating solids, liquids and gases. Expansion. Transfer of heat by conduction, connection and radiation. Evaporation and boiling. Calorie-specific heat. Distinction between chemical and physical changes. Study of nature and action of air. Heating of metals in air—rusting of iron—meaning of burning and combustion. Inactive and active constituents of air. Preparation of oxygen and examination of its properties—oxidation—oxides. Preparation of hydrogen and examination of its properties. Oxidation of hydrogen. Action of metals on acids—sulphuric, nitric, and hydrochloric-acids—salt formation. Decomposition of water by the electric current—identification of products of decomposition. Production of electric current using any two dissimilar metals and a mineral acid. Revision. Force. Work done by a force. Transformation of Work into Heat energy. Various forms of energy. Conservation of energy. Transformation of chemical into electrical energy. Transformation of electrical energy into various forms. *Mechanics*: Concrete illustrations of electrical and mechanical forces—parallelogram of forces—resolving forces—triangle and polygon of forces. Moments, parallel forces, centres of gravity, loaded beam. Couples. Electrical and mechanical examples. *Mathematics*: Fractions and decimals—curtailment of unnecessary figures. Measurement and calculation of

perimeters, cross-sectional areas, surfaces, volumes, and weights of simple details of apparatus in metric and British systems. The triangle, rectangle, circle, cylinder, cone and frustrum. Square root. Percentage. Sine, cosine, and values for 0, 30, 45, 60 and 90 degrees. Use of tables. *Drawing*: Simple geometrical figures and hexagons, ellipses and polygons to scale from specified dimensions to illustrate distributing networks.

SECOND YEAR COURSE IN ELECTRICAL ENGINEERING PRACTICE.

Subjects:

ELECTRICAL ENGINEERING.

MATHEMATICS.

MACHINE DRAWING.

ELECTRICAL ENGINEERING.

SECOND YEAR.

Practical units for current, voltage, resistance power and energy—Ohm's law—resistances in series and parallel—measurement of resistances—Wheatstone bridge—use of megger—ohm-meter and generator, and voltmeter for measuring insulation resistance—principles of commercial measuring instruments—electrical and mechanical properties of conductors and insulators—magnetic induction—simple theory of the dynamo—construction and functions of different parts of direct current dynamo—shunt series and compound windings—deduction of the formulae for generated volts—motors, general principles of action—starters and regulators—reversal rotation in series—shunt and compound wound motors—commonly occurring faults and wrong connections—secondary cells, installation and maintenance, direct current transmission and distribution circuits—simple calculations thereon—types of electric lamps—illumination tests and calculations—alternating currents—single phase—elementary theory of construction of alternator—frequency—effect of self-induction and capacity—lag and lead—choking coil—resistance and impedence—power in single-phase circuits, inductive and non-inductive—principle

of action of the transformer—A.C. motors—elementary treatment of the production of a rotating magnetic field by two and three-phase currents in order to explain the action of induction motors.

MATHEMATICS.

SECOND YEAR.

Logarithms and log-tables—cube root by logarithms—use of logarithms in calculations of amount of electrical energy supplied to motors and circuits, and weights and costs of machine parts—values of Ax and Ebx—areas by squared paper and Simpson's rule—ratio of area to perimeter and bearing on economy of copper wire—area of a sine current half-wave and ratio of its average to its maximum value—equations—examples involving simple equations—finding D and L knowing D2L and D/L—determining X and Y knowing 1/X+1/Y, Y and XY, as required in testing the insulation resistance of two-wire circuits—trigonometry—radian measure—relation between degrees and radians—angular velocity of current or voltage vectors and their instantaneous values—meaning of the form I sine (at—g)—geometrical proofs for expanded forms of sin (A+B) and cos (A+B) in terms of sines and cosines of A and B, and verification from trigonometrical tables—graphs of trigonometrical and exponential functions, and of such algebraical functions as value of AX+BX with respect to value of X. *Mechanics*: The lever, pulley-block, screw-jack, hydraulic press—mechanical advantage—resultant pull of field-magnet poles upon armature core—velocity and acceleration; linear and angular—law connecting force, mass and acceleration—work, energy, and power—calculation of brake-horse-power—efficiency—friction—calculation of brush friction loss—energy of rotating masses, as parts of a flywheel—centrifugal force—simple balancing of rotating masses—general principles of fluid pressure.

MACHINE DRAWING.

SECOND YEAR.

Freehand diagrammatic sketches of electrical apparatus, and the conventional drawing of circuits and connections, such as those associated with measuring instruments, storage batteries, and direct current machines. Freehand and scale drawings of bearings, shaft, armature core, field-magnets, brush holders, switches, and other simple parts of direct current machines.

THIRD YEAR COURSE IN ELECTRICAL ENGINEERING PRACTICE.

Subjects:

ELECTRICAL ENGINEERING.

APPLIED MECHANICS.

POWER PLANTS AND PRODUCERS.

ELECTRICAL ENGINEERING.

THIRD YEAR.

Materials: Conductors; electrical and mechanical properties, resistivity, conductivity, temperature effects—insulators, properties, temperature and moisture effects. Electrical Circuits: Units—Ohm's law—parallel and series circuits—energy—drop in P.D. in feeders—Kirchoff's laws. *Magnetic Materials*: Properties of iron and steel—hysteresis and permeability—laws of and calculations on magnetic circuits. *Instruments*: Principles of types of ammeters, voltmeters, wattmeters and watt-hour-meters—calibration and tests—measurement of resistances—test sets. *Generators*: Principles of armature windings—armature reaction and commutation—shunt and series and compound dynamos; losses, operation, tests and characteristics. *Motors*: Principles, force, torque, B.H.P.—series shunt and compound motors; losses, characteristic curves, efficiencies and tests—motor starters, controllers, speed control—parallel running of machines—batteries: types, maintenance and uses—transmission of power; systems and efficiencies—distributing systems and auxiliary plant, boosters, balancers, etc. *Electrical Lighting*: Lamps; types used, construction and efficiencies—principles of photometry and of illumination. *Traction*: Motors used; control, speed-time curves, etc.

II. MECHANICS.

SECOND YEAR.

Displacement, Velocity, and Acceleration.

Motion of a body with constant Acceleration.

Resolution and Composition of Velocities, Accelerations, etc.

Mass and Momentum.

Force as measured by the rate of change of momentum.

Newton's Laws of Motion.

Kinetic Energy and Work.

Units of Force, and Measurement.
Balancing of Forces.
Torques and Moments.
Condition for the equilibrium of three Parallel Forces.
Resolution and Composition of co-planar Parallel Forces. Centre of Gravity. Stable, Unstable, and neutral Equilibrium.
Equilibrium of Three Forces not parallel. Triangle and Parallelogram of Forces. Moments. Polygon of Forces.
Work; energy; power; friction.
Simple machines; velocity ratio; mechanical advantage; efficiency; principle of work.
Pressure in Liquids; variations with depth.
Transmission of Liquid Pressure; Hydraulic Press.
Pressure on immersed and floating bodies.
Density; methods of determining Relative Densities.
Relation between volume and pressure in Gases.
Atmospheric Pressure.

MATHEMATICS III.

THIRD YEAR.

Indices—logarithms and slide rule—Napierian logs—simple equations, simultaneous equations, quadratic equations—use of formulae—miscellaneous problems in solution of triangles—plotting of functions. Curves $Y=A \sin (Cx+d)$, and $Y=-Ae^{Bx}$—study of Curve $Y=Ae^{Bx} \sin (Cx+d)$, simple harmonic motion—graphic solution of equation—determination of mean values and areas. *Vector Algebra*: Scalar and vector quantities—addition of vectors—use of + and − signs—relative velocity—multiplication of vectors—scalar quantity—resultant of two parallel forces—multiplication of vectors—scalar product of two vectors—commutative law—perpendicular and parallel vectors—rule of signs—orthogonal projection—resolution of forces—projection of the sides of a closed polygon—distributive law for scalar products—use of brackets—field of a vector—flux of a vector across a surface—vector products—rule of signs—application to magnetic field. *Rotating Vectors*: Representation of alternating quantities by rotating vectors—vector diagrams. Application of vector algebra to solution of D.C. and A.C. problems.

FOURTH AND HIGHER YEARS' COURSES IN ELECTRICAL ENGINEERING PRACTICE.

Subjects:

ELECTRICAL ENGINEERING.
MATHEMATICS.
POWER PLANTS AND PRODUCERS.

ELECTRICAL ENGINEERING.

FOURTH AND HIGHER YEARS.

General consideration of alternating E.M.F. and current—maximum R.M.S. and average values—inductance, reactance, and impedance—capacity and condensers—vectors and their application to A.C. circuits—power and power factor—iron, properties and measurement of losses in iron—wave forms and harmonies—production of polyphase currents, three-phase circuits—power in polyphase circuits, methods of measurement of power—rotating fields—transformer; construction, types principles, performance, tests—auto-transformer; principle and uses—transformer connections, phase-transformations—alternators; construction, principles, performance and tests—armature windings, common types—synchronous motors, principles, performance and tests—methods of starting and synchronising—induction motor; construction, types, principles and performance—vector and circle diagrams, tests—rotary converter; principle, voltage, ratios, performance and uses—commutator motors; general principles of operation—repulsion motors; principles of operation—motor converters; principles of operation—transmission; voltage drop due to resistance capacity and inductance—comparison of efficiency of methods of transmission.

MATHEMATICS.

FOURTH YEAR.

Simultaneous equations of three unknowns—simple cases of the binomial theorem—values of sin 2A and cos 2A in terms of sin A and cos A—value of tan $(A \pm B)$ in terms of tan A and tan B—values of sin $A \pm$ sin B and cos $A \pm$ cos B in terms of the sines and cosines of half the sum or difference of A and B—solution of triangles—sum of

the series sine a+sin $(a+d)$+sin $(a+2d)$ . . . to n terms—calculation of hysteretic co-efficient from hysteresis curve of sample of iron—graph of $I=Ae^{at}+\sin mt$; t being time and I current—measurement of slope at a point on sine and other curves such as those representing $y=e^x$ and $y=e^{ax}$—simple differentiation with respect to x, of forms such as ax^n and ax^n; n being 1, 2, 3, or 4: a sin x, a cos x, a tan x; a sin bx, a cos bx, a tan bx; log x—simple integration of forms such as ax^n and ax^n in which $n=1$, 2, 3, or 4; a sin bx, a cos bx, a sin ^2x, a cos ^2x—integration between limits such as is involved in determining area of a half sine wave, strength of the magnetic field outside a straight conductor carrying a current, insulation resistance of a cable, temperature rise in machine parts.

POWER PLANTS AND PRODUCERS.

Fourth Year.

Steam: Fuels, solid and oil—calorific power—heat transmission in steam boilers; effects of deposits and incrustation—types of land boilers—choice of boiler to suit character of fuel, restrictions of space and required output—boiler mountings—superheaters, economisers, feed water-heaters, boiler feed pumps of different makes, injectors—hand stoking, mechanical stokers—natural and forced draught—testing, examination and upkeep of boilers—lay-out of a boiler house. *Reciprocating Steam Engines*: Description of present-day types—peculiarities of high-speed engines used in electrical plants—forced lubrication—valve gears and valve setting—governors; governing for special and fluctuating loads—fly-wheels—jet and surface condensers—air and circulating pumps—maintenance of vacuum—cooling towers—pipe lines, lagging, provision for expansion and drainage—water hammer—steam traps and separators—connection of boiler and engine house—lay-out of an electrical generating station—indicators, calculations, I.H.P. and B.H.P.—measurement of feed and condensing water—steam consumption per I.H.P., B.H.P., and kilowatt hour. *Locomotive Engine*: Conditions affecting the design of locomotives—train resistance on the level, on curves and on inclines—tractive power and draw-bar power—adhesion on dry and wet rails—distribution of weight, centre of gravity and wheel arrangements—balancing for revolving and reciprocating masses—valves and valve gears—locomotive boilers—superheaters and feed water-heaters—special valves, fittings,

lubricators, etc.—vacuum and air brakes. *Steam Turbines*: Types, operation and care of steam turbines—lubrication, governing, etc. *Internal Combustion Engines*: Description, starting, operation and care of gas oil engines—indicator diagrams, calculations of power, gas and oil consumption per brake horse-power hour—calorific powers of oils and gases—Diesel engines—the Still and other special engine types. *Water Turbines*: Choice of a particular type—lay-out of hydro-electric plant.

Arrangements will be made at suitable times for visits to power-houses and important engineering works in the city and vicinity.

FIRST YEAR COURSE IN ELECTRICAL INSTALLATION WORK.

Subjects:

ELECTRICAL WIRING (LECTURES).
ELECTRICAL WIRING (PRACTICAL WORK).
ELECTRICAL ENGINEERING.
PHYSICS FOR ELECTRICIANS.

ELECTRICAL WIRING (LECTURES).

FIRST YEAR.

Electricity: Elementary principles of electricity and magnetism as applicable to installation work. *Conductors*: The standard wire gauge—simple problems relating to current-carrying capacity and voltage drop in copper wires and cables. *Resistance Wires*: Properties of resistance materials in common use—methods of winding and connecting resistance spirals and installation of resistances. *Fuse Wires*: Properties of materials in common use—precautions in installing. *Insulators*: Porcelain, pure and vulcanised rubber, paper, slate, marble, fibre, etc.—insulation of single and twin wires on rubber and paper cables up to ½ square inch size, or its equivalent. *Wiring Systems*: Cleats, insulators, wood casing, surface wiring, metal piping, and conduits—details of handling material, fixing in position, running of wires—return systems. *Connections* to distribution boards, cut-outs, ceiling roses, lamp holders, switches (in-

cluding two-way and two-way intermediate switches), fuses—wiring of fittings and other consuming devices. *Testing*: Use of the test lamp and detector for sorting out circuits—pole finding. *Bells*: Installation of electric bells and simple indicators. *Lamps*: Carbon and metal filament lamps; currents and voltages required. *Electrical Machinery*: Principles of the action of C.C. dynamos and motors. *Buildings*: Precautions when cutting away for installation work in buildings. *Plans*: Plotting out runs of wires and cables on plans provided.

ELECTRICAL WIRING (PRACTICAL WORK).

First Year.

Methods of handling wire and cable—soldering iron and blow lamp —methods of tinning and heating fluxes—sweating and preparing thimbles and lugs—making the following joints:—Running, end to end, T and Y in 1/18, 3/22, 7/16, 19/16—connecting to ceiling roses, switches, sockets, and other accessories—methods of connecting flexibles—insulating joints—preparation of ends—looping in—cutting, screwing, and bending metal pipes and conduits—bending and connecting up metal-sheathed wires.

ELECTRICAL ENGINEERING AND PHYSICS FOR ELECTRICIANS.

First Year.

See Syllabuses under First Year Course in Electrical Engineering.

SECOND AND THIRD YEAR COURSES IN ELECTRICAL INSTALLATION WORK.

Subjects:

Electrical Wiring (Lectures).
Electrical Wiring (Practical Work).
Electrical Engineering.
Machine Drawing.

ELECTRICAL WIRING (LECTURES).

Second and Third Years.

In addition to the subjects of First Year the following will be dealt with: Wiring Rules of the Institution of Electrical Engineers and

Regulations of the Home Office—insulation testing with ohm-meter and generator, or other testing instruments—location and repair of faults—details of cables, switches and cut-outs in general use and carrying capacities—rating of fuses—connecting-up motors and dynamos and methods of altering speed and rotation—three-wire system and lamp and power connections thereon—care and maintenance of secondary batteries—more extended knowledge of principles governing earthing of metal portions of installations—precautions to be taken against; unsuitable switches, fittings, etc.; insufficient earthing of iron piping, motors, etc.; dampness in exposed cables or outside wiring—vulcanising concentric and other special systems—drawing up wiring schedule for small installation—erection and running of small isolated plants, including oil or gas engine, dynamo, and secondary battery—principles and connections of electrical cooking and heating apparatus, signs and flashers, time switches, and small motor-driven appliances—energy consumed by electric cooking and heating apparatus and advantages or disadvantages compared with other means of heating and cooking—wiring up and connecting simple telephones and intercommunication systems. *Drawing*: Plans, elevations, sections and dimensioned sketches roughly to scale.

ELECTRICAL WIRING (PRACTICAL WORK).

SECOND AND THIRD YEARS.

More advanced work on the matters included in the Syllabus for the First Year, and in addition: Joints on cables up to ½ square inch sectional area—jointing and connecting lead-covered cables, including V.R., or paper insulated concentrics—making and installing fuses of various capacities—wiring of more complex circuits—working and connecting up of metal-sheathed wires, and cables—making of working sketches from diagrams.

ELECTRICAL ENGINEERING.

SECOND YEAR.

See Syllabus under Second Year Course in Electrical Engineering.

CABLE JOINTING.

FIRST AND HIGHER YEARS.

Low tension, high tension and extra high tension cables. Concentric cables. Preparation of ends for jointing. Straight through

joints on L.T. single core, twin core, 3-core and 4-core cables. Tee-joints on above. Making of sleeves for joints. Correct method of filling sleeves with insulating compound. Joints on single core, twin core, 3-core, and 4-core concentric cables. Joints on H.T. and E.H.T. cables.

ELECTRIC WELDING.

First and Higher Years.

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

FIRST YEAR COURSE IN TECHNICAL TELEGRAPHY.

Subjects:

Technical Telegraphy.
Magnetism and Electricity.

TECHNICAL TELEGRAPHY.

First Year.

Preliminary. Fundamental principles of Magnetism and Electricity in their application to Telegraphy.

Batteries. Primary Batteries, wet and dry; their composition and chemistry. Simple calculations relating to special combinations of cells; potential drop in a battery, and the effect on circuits connected thereto; testing and maintenance of Leclanché primary batteries. Secondary batteries; construction and application to telegraph working.

Telegraph Instruments. The construction of permanent and electro-magnets; simple calculations relating to electro-magnets. The principles and construction of the following apparatus:—Sounders (ordinary and polarised), keys, relays and simple switches; galvano-

meters—single current and differential; resistance coils—gauge and kind of wire used, methods of winding and insulating, and effect of temperature variation; shunts and their uses; condensers and their uses in the simpler telegraph systems. Inspection, testing and adjustment of telegraph instruments.

Telegraph Lines—Overhead. Preservative treatment of poles and timber; pole fittings, brackets, insulators, various types and their uses, erection of poles. Types of wire employed, properties and use of hard drawn copper, bronze and iron. Method of erecting wires; jointing wires. Aerial cables—types, their uses and methods of erecting. Insulated wires used in overhead construction. Methods of leading in.

Telegraph Lines—Underground. Iron and earthenware single and multiple way conduits; pipe bends and couplings. Manhole and joint box construction. Types of cable used for main and local circuits; jointing wires, twisted and soldered joints; numbering wires and joints; drying joints; plumbing; pressure testing and desiccating.

Internal Wiring. Termination of interal cables on main frames. Classes of wire used and general wiring scheme of large telegraph offices.

Telegraph Systems. The simpler systems of manual telegraphy, including single and double current duplex, universal battery system and central battery working. Simple methods of cable telegraphy.

Testing Instruments. Detectors, galvanometers for testing purposes. Wheatstone bridge. Simple line tests for conductor resistance, insulation resistance, disconnections, earths and contacts. Localisation of faults on lines and apparatus.

Protective Devices. Methods of protecting lines, submarine cables and apparatus from (*a*) lightning, (*b*) power circuits.

MAGNETISM AND ELECTRICITY.

Magnets and magnetic substances. Action of magnets on one another. North and south poles, consequent poles and magnetic axis of a magnet. Laws of magnetic force.

Magnetic field. Lines of force; their delineation by iron filings or a small compass.

Magnetic induction. Magnetic qualities of hard steel and soft iron; permeability, retentivity, coercive force. Effects of the introduction of soft iron into a magnetic field.

Methods of magnetisation by permanent magnets. Distribution of magnetism in magnets. Effect of breaking or subdividing a magnet. Effect of the keeper of a magnet on the distribution of the lines of force.

Terrestial magnetism; declination; dip. Earth's magnetic force; horizontal and vertical components of the force. Magnetic poles and equator; magnetic meridian. General explanation of the behaviour of the compass and dip needle on the assumption that the earth is a magnet.

Electrification by friction; positive and negative electrification; simultaneous developments of positive and negative charges in equal quantities. Attraction and repulsion. Electric charge or electric quantity. The gold leaf electroscope. Laws of electric attraction and repulsion.

Conductors. Non-conductors.

Distribution of electricity on conductors; electric density; action of points. Hollow conductors.

Difference of potential. Analogies with temperature, level and pressure. Work done by, or against, electric forces. Electric field. Electrostatic capacity.

Electrostatic induction.

Leyden jar and plate condenser. Electrophorus.

Frictional electric machine. Influence machines. Electric discharge.

Practical unit of capacity. Condensers in series and in parallel.

Electromotive force. Potential difference. Electric current. Simple voltaic cells. Local action and polarisation. Constant cells. General description of the chemical action taking place in the more common forms of cells.

The electric circuit, resistance; simple analogies with hydraulics. Relation between the resistance of a wire and its physical dimensions. Ohm's law and its application to simple circuits. Units; ampere, coulomb, volt, ohm. Ammeter; voltmeter. Resistances in series and in parallel. Cells in series and in parallel.

Electrolysis. Copper and water voltameters.

Electric power; watt, joule.

The heating effect of a current in a conductor; calorie.

Magnetic field due to a current in a straight wire, circular coil and solenoid. Oersted's experiment. Ampere's and Maxwell's rules. Galvanometer. Forces acting on needle of galvanometer. Astatic needles. Moving coil instruments.

Electro-magnets. Ampere turns and permeability of core. Use of soft iron and hard steel. Elementary conception of magnetic circuit.

Electro-magnetic induction; induction of electro-motive forces by moving conductors in magnetic fields; induction of E.M.F. in secondary circuit by starting and stopping the current in a neighbouring primary circuit; induction coil; self-induction.

SECOND YEAR COURSE IN TECHNICAL TELEGRAPHY.

Subject:

TECHNICAL TELEGRAPHY.

SECOND YEAR.

Construction: Testing of materials employed—aerial lines; factor of safety; stresses on poles; static and kinetic stresses on wires; law connecting sag and stress—regulation of wires—underground lines; modern practice—submarine lines; manufacture, laying, and repairing internal wiring of large telegraph offices. *Telegraph Instruments*: Wheatstone apparatus, Creed, Hughes, Baudot, the siphon recorder, the undulator and cable relays; general principles of construction. *Telegraph Systems*: Wheatstone, quadruplex, type-printing telegraphs—concentration—inter-communication and common battery systems—methods of working long submarine cables—superimposed circuits—simultaneous telegraphy and telephony. *Repeaters*: Principles of, simplex and duplex; forked and divided quadruplex. *Telegraphic Transmission*: Effects of capacity and inductance in circuits—method of reducing, compensating for, and eliminating same—laws governing the speed of working on long aerial, underground, and submarine lines. *Testing*: Wheatstone bridge—tangent, ballistic and reflecting galvanometers—ammeters—voltmeters—bridge megger—theory, construction, and methods of use

—localisation of earths, contacts, and disconnections on line wires—capacity, resistance, inductance, and insulation measurement—measurement of resistance and E.M.F. of batteries. *Wireless (or Radio) Telegraphy* : Theory—principal systems in use—construction of aerial gear—transmitting and receiving apparatus—wave measuring devices. *Miscellaneous* : Variable period of a current—Helmholtz's equations—Kirchoff's and Maxwell's laws—electro-magnet coils, simple formulae for—Suitable illustrative diagrams will be systematically introduced.

FIRST YEAR COURSE IN TECHNICAL TELEPHONY.

Subject:

MAGNETISM AND ELECTRICITY.

TECHNICAL TELEPHONY.

FIRST YEAR.

Preliminary. Fundamental principles of Magnetism and Electricity in their application to Telephony.

Batteries. Primary batteries, wet and dry; their composition and chemistry. Simple calculations relating to special combinations of cells; potential drop in a battery, and the effect on circuits connected thereto; testing and maintenance of Leclanché primary batteries. Secondary batteries; construction and application to telephone working.

Telephone Instruments. The construction of permanent and electro-magnets; simple calculations relating to electro-magnets. The elementary theory of the electric transmission of sound. The various transmitters and receivers in common use; induction coils, repeating coils, transformers, impedance coils, keys, lamps, jacks, cords, plugs, indicators, condensers and other minor apparatus; magneto and trembler bells; magneto-generator and vibrator; magneto and C.B.S. subscribers' instruments; construction, principles, and application of the foregoing apparatus.

Telephone Lines—Overhead. Preservative treatment of poles and timber; pole fittings, brackets, insulators, various types and their uses; erection of poles. Types of wire employed, properties and use of hard drawn copper and bronze. Method of erecting wires, jointing wires.

Aerial cables—types, their uses and method of erecting. Insulated wires used in overhead construction, bridle wire, bronze parallel wire; distribution poles; fittings for house attachments. Tools and safety appliances.

Telephone Lines—Underground. Iron and earthenware single and multiple way conduits; pipe bends and couplings; manhole and joint box construction; types of cable for trunk and local working; jointing wires, twisted and soldered joints; numbering wires and joints; drying joints, plumbing; pressure testing and desiccating.

Telephone Systems. The simpler systems of telephony, including magneto and central battery signalling; house telephones; multiple jacks, branching and series arrangement; operator's telephone circuits, cord circuits, junction circuits; magneto and C.B.S. exchanges. The principles of central battery working; the principles of trunk working. The use of main and intermediate distributing frames. Various types of small switchboards.

Testing Instruments. Detectors, galvanometers for testing purposes, Wheatstone bridge. Simple line tests for conductor resistance, insulation resistance, disconnections, earths and contacts. Localisation of faults on lines and apparatus.

Protective Devices. Methods of protecting lines, submarine cables and apparatus from (*a*) lightning, (*b*) power circuits.

MAGNETISM AND ELECTRICITY.

(*See Syllabus for First Year Technical Telegraphy*).

SECOND YEAR COURSE IN TECHNICAL TELEPHONY.

Subject:

TECHNICAL TELEPHONY.

SECOND YEAR.

Construction: Testing of materials employed—aerial lines—modern practice—stresses on poles—static and kinetic stresses on wires, law connecting sag and stress, regulation of wires—factors of safety—underground and submarine lines, modern practice. *Telephone Apparatus*: Construction and theory of telephonic apparatus

generally, methods of use and maintenance, various forms of transmitters and receivers, tests for efficiency, subscribers' sets. *Telephone Systems*: Manual Exchanges; magneto and common battery, complete multiple, partial multiple, divided multiple, transfer, method of ringing, engaged tests—lay-out of exchanges, equipment, including frames, racks, sections, desks, apparatus and power plant—automatic exchanges, general principles of—party line systems; circuits exchange equipment, subscribers' station equipment—private branch exchanges, "house" systems, pay stations, coin-collecting boxes—junction circuits; methods of working between local exchanges in same area and between trunk and local exchanges—trunk circuits; exchange equipment, circuits, methods of working, signalling, recording calls—super-imposed or multiplex circuits—simultaneous telegraphy and telephony on the same wires, practical systems and theory of. *Telephonic Transmission*: Limiting factors—attenuation and distortion—loading—Pupin's and other formulae—effects of leakage—conductance—comparative efficiencies of wires of various materials and gauges, open, underground, and submarine. *Testing*: Wheatstone bridge—tangent, ballistic and reflecting galvanometers—ammeters—voltmeters—theory, construction, and methods of use—localisation of earths, contacts, and disconnections on line wires—capacity, resistance, inductance, and insulation measurements—measurement of resistance and E.M.F. of batteries—Post Office Morning Test system (for long-distance lines). *Miscellaneous*: Kirchoff's and Maxwell's laws—electro-magnet coils, simple formulae for telephone repeaters. Suitable illustrative diagrams will be systematically introduced.

TELEGRAPHY—MORSE SOUNDER PRACTICE.

In this class instruction will be given in the manipulation of the Morse Sounder and the reception and transmission of messages, up to the speed required by the Post Office. Instruction will also be given in Post Office telegraphic regulations, signalling procedure, etc.

INSTRUMENT MAKING AND LABORATORY ARTS.

INSTRUMENT MAKING.

FIRST AND HIGHER YEARS.

Materials: Metals—alloys—woods—insulating materials—mechanical properties of each and suitability for different purposes.

Tools: Varieties and uses—making and setting—defects and treatment. *Processes*: Filing—bending—soldering—welding—polishing—lacquering—surface finishing—drilling—tapping—silvering. *Lathe Work*: Turning, tapering—bevelling—mill-heading—screw-cutting. *Fine Work*: Use of phosphor-bronze and quartz filaments—mounting of spider threads—silvering of glass. *Design and Construction of Instruments*: General mehcanical principles—levers—springs—screws—periodic and aperiodic, ballistic and dead-beat system—dimensions and proportions—workmanship and finish. *Weighing Scales*: Considerations of range of reading—factors determining sensitivity—precision and accuracy—systems of control—gravity—tension—torsion—spring. *Special Work*: Construction of fixed and variable inductances, condensers and other parts for wireless receiving sets—design and construction of panels and switchboards for such sets using two, three or more valves—general assembling of all component parts of wireless systems.

GLASS BLOWING OF TECHNICAL APPARATUS.

Preliminary Considerations: Tools, Blowpipe, Files and Knives, Flame, Cleaning of Glass.

General Operations: Cutting Soft Glass, Cutting Hard Glass, Concentric Capillaries, Constricting a Tube, Rotation of the Tube, Flanging, Bending Glass.

Elementary Services: Joining Tubing End to End (Equal bore), Joining Two Tubes (Unequal bore), T-pieces and Angle joints, Bulb at End of Tube, Bulb in middle of Tube.

More Advanced Exercises: Spinning Glass, Thistle Funnel Let-through Joint, Gash-washing Tube, Suction Pump, Capillary Tubes, Thermometers, Joints in Position, Cross Joints, Joints on Thin Glass or Glasses of Different Hardness, U-Tube.

Special Operations: Condensers, Spirals, Cone-and-socket Joint, Cylindrical Dewar-vessels, Silvering of Glass, Simple manipulations with hard glass in the oxygen flame, Glass-to-metal Seals and Joints, Electrodes, Copper to Glass Joints.

NOTICE.

Students of the Electrical Engineering Classes are advised to read the regulations relating to the examination for the Associateship of the Institution of Electrical Engineers.

It may be pointed out here that Part II., *i.e.,* the professional section of the examination, is exempt to holders of the following Certificates :—

City and Guilds of London Institute—A Pass in the final grade in (*a*) Electrical Engineering, or (*b*) Telegraphy, or (*c*) Telephony.

Holders of the above Certificates desiring to sit for the examination have only to pass a qualifying examination in the following subjects : English or another language, Applied Mechanics, General Physics or Inorganic Chemistry, Electricity and Magnetism.

Copy of the Regulations may be seen on request to the Teacher.

SCHOOL OF WIRELESS TELEGRAPHY

EQUIPMENT.

The School is fully equipped with up-to-date Wireless Apparatus, including a standard 1½ K.W. Quenched Spark Transmitter, a 1½ K. W. I.C.W. and C.W. Transmitter, a ¼ K.W. Emergency Transmitter (lifeboat set), latest type valve receiver, and complete direction finding apparatus. Students have spacious rooms for Morse Practice and the use of fully-equipped Electrical and Physical Laboratories.

INSTRUCTION.

The Course of Training is arranged to prepare students in the shortest possible time for the Examination of Proficiency in Radiotelegraphy. The instruction consists of Lectures and Practical Work in Technical Electricity, Technical Wireless Telegraphy, and Telephony and Direction Finding, with practice on the 1½ K.W. Sets and other apparatus specified above, Morse training (traffic practice), instruction in the Handbook for Wireless Operators (Rules and Regulations) and Typewriting.

COURSES.

Day and Evening Courses are provided. Students of the Day Course attend each day from 10—12.30 and 2—4. Students of the Evening Course attend each evening from 7.30—9.30, except Saturday evening.

FEES.

The Fees, which cover tuition in all subjects up to obtaining the P.M.G. Certificate of Proficiency, are payable in advance, and are as follows :—

Day Course for 1st Class Certificate	£12 0 0
Day Course for 2nd Class Certificate	10 0 0
Evening Course	4 0 0

Students may arrange to take, with the approval of the Principal, any special course in the Day or Evening programme.

ADMISSION.

Students are expected to have a good general education, with special attention to handwriting, spelling, geography, arithmetic up to square root, algebra up to quadratic equations.

SCHOOL SESSION.

The School of Wireless Telegraphy is conducted independently of the other classes in the Technical Schools, and is open all the year, with the usual holidays at Christmas, Easter and Summer. Students are admitted at all periods. The usual time taken to train for Examination is about 10—12 months in the Day School, and proportionately longer in the Evening Course

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SYLLABUS OF EXAMINATION FOR CERTIFICATES OF PROFICIENCY IN RADIOTELEGRAPHY.

INTERNATIONAL TELECOMMUNICATION CONVENTION.

(1) It is necessary for persons operating wireless telegraph apparatus on board ships registered in An Saorstát which are subject to the provisions of the Merchant Shipping (Wireless Telegraphy) Act, 1919, and the Merchant Shipping (Safety and Load Line Conventions) Act, 1933, to hold either a 1st or 2nd Class Certificate of proficiency

issued by the Minister for Posts and Telegraphs in accordance with Article 10 of the General Radiocommunication Regulations annexed to the International Telecommunication Convention, 1932.

The First Class Certificates states that the holder possesses the following qualifications :—

(*a*) Knowledge of the general principles of electricity, of the theory of radiotelegraphy and radiotelephony, and of the practical adjustment and operation of all apparatus (spark C.W., I.C.W., and D.F.) and accessory apparatus used in the ship service.

(*b*) Transmitting and receiving by ear, messages in plain language at a speed of 25 words a minute, and in code groups at a speed of 20 groups a minute.

(*c*) Sending and Receiving spoken messages clearly by telephone apparatus.

(*d*) A detailed knowledge of the Regulations applying to the exchange of radiotelegraph traffic, of the documents relative to the charges for radiotelegrams, and of the radiotelegraph part of the Regulations for the Safety of Life at Sea.

(*e*) A knowledge of the principal maritime navigation routes and of the most important wire and wireless routes of the world.

(2) In order to qualify, candidates will be required :—

(*a*) To send for each test on an ordinary Morse key for three consecutive minutes at not less than the prescribed speed five letters or characters counting as one word or group. The accuracy of signalling, the correct formation of the characters, and the correctness of spacing will be taken into account.

(*b*) To receive Morse signals for three consecutive minutes at the prescribed speeds from a double headgear telephone receiver ordinarily used for radio-telegraph reception, and to transcribe them legibly.

(*c*) To send and receive traffic by means of telephone apparatus.

(*d*) To have a theoretical and practical knowledge of the operation, adjustment and maintenance of spark C.W., I.C.W., and D.F. apparatus.

(*e*) To have a theoretical and practical knowledge of the operation, adjustment and maintenance of the accessory apparatus, such as motor-generator sets, storage batteries, etc.

(*f*) To have the necessary knowledge to make, with the means that would be available on board a ship, the repairs of damaged apparatus.

(*g*) To know the principal wire and wireless routes of the world, as indicated in the relative publications issued by the International Office of the Telegraph Union, Berne, and the principal maritime navigation routes of the world.

(3) The practical examination on the apparatus specified in Section 2 (*d*) above will include :—

(*a*) Connecting-up apparatus.

(*b*) Regulating and adjusting apparatus.

(*c*) Tracing and clearing faults.

(*d*) Repairing defective apparatus.

(*e*) Using D.F. apparatus to obtain bearings.

(*f*) Operating (sending and receiving).

(*g*) A test on commercial working, exchanging traffic as between a ship and other ship stations, and between a ship and a shore station.

(4) The theoretical examination will consist of two papers. Two hours will be allowed for the first, and three hours for the second paper. These papers will consist of comprehensive questions under the following headings :—

Magnetism general electrical principles. Atmospheric electricity. Condensers. Primary and secondary cells. Direct alternating and oscillatory currents. Electro-magnets. Electro-magnetic induction. Meters. Motors, dynamos, alternators and converters. Spark, C.W. and I.C.W. transmitting installations : principles, apparatus, circuits, adjustments, maintenance. Receiving apparatus : principles, circuits, adjustments, maintenance. Emergency installations. Ether waves. Aerials. Radiotelephony, transmitting and receiving apparatus : principles, circuits, adjustments, maintenance. Direction finding apparatus : principles, circuits, adjustments, maintenance. Auto-alarm devices : principles, adjustments, maintenance.

The standard of theoretical knowledge required from a candidate for a First Class Certificate calls for a sound grasp of the theoretical principles and of the practical methods of application thereof. The candidate's mathematical knowledge should include algebra up to

simple equations, elementary graphs and the elements of trigonometry. Questions in the written tests dealing with the practical application of general principles will have reference to one or other of the commercial sets fitted in merchant ships.

(5) The examination in the Radiocommunication Regulations will be based upon the rules contained in the "Handbook for Wireless Telegraph Operators," which can be obtained through any bookseller or direct from the Stationery Office, London. These rules, subject to suitable verbal alteration where necessary, *e.g.*, Minister for Posts and Telegraphs for Postmaster-General; The Secretary, Department of Posts and Telegraphs, Dublin, for The Secretary, General Post Office, London; Accountant, Department of Posts and Telegraphs, Dublin, for Comptroller and Accountant General, London; Irish Free State for Great Britain and Northern Ireland or United Kingdom; Irish for British, etc., will apply for the time being, in the case of ships' radiotelegraph installations licensed by the Minister for Posts and Telegraphs of the Irish Free State.

The commercial working test will include the preparation of messages for transmission; insertion of preambles, charges, routes; order of transmission; transmission and reception of messages at the prescribed speeds; log keeping; procedure signals.

(6) The Second Class Certificate states that the holder possesses the following qualifications :—

(*a*) An elementary theoretical and practical knowledge of electricity and radiotelegraphy, as well as knowledge of the practical adjustment and operation of spark, C.W., and I.C.W. apparatus and accessory apparatus used in the ship service.

(*b*) Transmitting, and receiving by ear, messages in plain language at a speed of 20 words a minute, and code groups at a speed of 16 groups a minute.

(*c*) A knowledge of the Regulations applying to the exchange of radiotelegraph traffic, of the documents relative to the charges for radiotelegrams, and of the radiotelegraph part of the Regulations for the Safety of Life at Sea.

(*d*) A knowledge of the principal maritime navigation routes and of the most important wire and wireless routes of the world.

(7) In order to qualify, candidates will be required :—

(*a*) To send for each test on an ordinary Morse key for three consecutive minutes at not less than the prescribed speeds, five letters or characters counting as one word or group. The accuracy of signalling, the correct formation of the characters, and the correctness of spacing will be taken into account.

(*b*) To receive Morse signals for three consecutive minutes at the prescribed speeds from a double head-gear telephone receiver ordinarily used for radiotelegraph reception, and to transcribe them legibly.

(*c*) To have an elementary theoretical and practical knowledge of the operation adjustment, and maintenance of spark C.W., and I.C.W. installations, and their accessory apparatus, such as motor-generator sets, storage batteries, etc.

(*d*) To have practical knowledge sufficient for making small repairs in case of damage to the apparatus.

(*e*) To know the principal wire and wireless routes of the world, as indicated in the relative publications issued by the International Office of the Telegraph Union, Berne, and the principal maritime navigation routes of the world.

(8) The practical examination will include :—

(*a*) Operating (sending and receiving).

(*b*) A test in commercial working, exchanging traffic as between two stations in the mobile service.

(*c*) Connecting-up apparatus.

(*d*) Regulating and adjusting apparatus.

(*e*) Tracing and clearing faults.

(9) The theoretical examination will consist of one paper, for which three hours will be allowed. This paper will consist of comprehensive questions under the following headings :—

Primary and secondary cells. Direct, alternating and oscillatory currents. Meters. Motors, dynamos, alternators, and converters. Spark, C.W. and I.C.W. transmitting installations : principles, apparatus circuits adjustments, maintenance. Receiving apparatus :

principles, circuits, adjustments, maintenance. Emergency installations. Aerials. Auto-alarm devices: principles, adjustments, maintenance.

The standard of theoretical knowledge required from a candidate for a Second Class Certificate calls for a sound grasp of the theoretical principles and of the practical methods of application thereof. The candidate's mathematical knowledge should include algebra up to simple equations, elementary graphs and the elements of trigonometry. Questions in the written tests dealing with the practical application of general principles will have reference to one or other of the commercial sets fitted in merchant ships.

PHYSICS AND MATHEMATICS

FIRST YEAR COURSE IN GENERAL PHYSICS.

Subjects:
GENERAL PHYSICS.
MATHEMATICS.

GENERAL PHYSICS.

FIRST YEAR.

Measurement of length, area, volume—motion—mass—force—Newton's laws—measurement of force—gravitation principles of statics—moments—principles of dynamics—rotation, elementary ideas on moments of inertia—elasticity and strength of materials—stretching, bending, twisting—simple periodic motion—vibration—principles of fluid pressure and applications—principles of Archimedes and applications—density determinations—flotation—atmospheric pressure—Boyle's law—thermometry—measurement of high and low temperatures—expansion of solids, liquids, gases—measurement of heat quantities—specific heats—fusion—latent heat—vaporisation—vapour pressure—study of steam, hygrometry—mechanical theory of heat—convection, conduction, radiation—propagation of light—elementary theory, photometry—formation of images by reflection from plane and spherical mirrors—refraction—prisms, lenses, dispersion—optical systems—lenses and combinations, telescope and microscope—spectrum analysis and theory of colours—wave motion—interference, diffraction, polarisation—velocity of sound—vibration of strings—resonance—vibration of air columns and rods.

PURE MATHEMATICS.

FIRST YEAR.

Arithmetic: Fractions and decimals—square root—percentages—interest, simple and compound—estimates—weights and measures—metric system. *Geometry*: Properties of lines, triangles, rectilinear figures, circles and polygons as treated in first four books of Euclid. *Algebra*: Definitions and signs—indices—factors—simple and quadratic equations—involution and evolution—sounds—ratio, proportion and variation. *Trigonometry*: Definition—measurement of angles by degrees and radians—relations of functions and conversion of one into another—ratios of sum and difference of angles and multiples and submultiples of angles—curve of sines. *Logarithms*: Definitions—multiplication and division—use of tables and slide rule.

SECOND AND HIGHER YEARS' COURSES IN GENERAL PHYSICS.

Subjects:

GENERAL PHYSICS.

MATHEMATICS.

GENERAL PHYSICS.

SECOND AND HIGHER YEARS.

The courses will consist for the main part of laboratory work, with frequent occasional lectures on special subjects. Each student will do a special course of experiments assigned to him in accordance with his capabilities and his own special requirements.

PURE MATHEMATICS.

SECOND YEAR.

Geometry: Ratio and proportion with applications to geometry, so far as the subject is treated in the definitions of Euclid's 5th Book, and in his 6th Book. *Algebra*: Permutations and combinations—progressions—complete theory of indices—the Binomial theorem. *Plane Trigonometry*: Formulae for finding the sine, cosine, etc., of the sum and difference of two angles, and of the multiples and submultiples of an angle—diameters of circles inscribed in and circumscribed about a given circle—area of a circle—description and use of the vernier, theodolite, and sextant. *Graphics*: Plotting of observations on squared paper—interpolation—errors of observation—

average value, etc.—the plotting of functions—maximum and minimum values—calculations and determinations by graphical methods.

PURE MATHEMATICS.

THIRD AND HIGHER YEARS.

Algebra: Theory of indices—summation of series—tests of the convergence and divergence of series—binomial, exponential, and logarithmic series—partial fractions—elementary determinants—imaginary and complex quantities—De Moivre's theorem. *Solid Geometry*: Properties of straight lines and planes; their intersections, inclinations, parallelism, perpendicularity—properties of the sphere, and of cylinders and cones. *Spherical Trigonometry*: Definitions of great and small circles, angles and sides of supplemental triangles—fundamental relations between trigonometrical ratios of the sides and angles of spherical triangles. *Geometrical Conics*: Properties of the parabola, ellipse, and hyperbola deduced by pure geometry from definition in *plano*. *Co-ordinate Geometry*: Co-ordinates of a point; rectangular, oblique, and polar—transformation of co-ordinates—equations of straight lines, and treatment of questions relative to intersection, concurrence, inclination, parallelism, perpendicularity, etc.—equations of circles, their tangents and normals: properties of their diameters, axes, foci, conjugate diameters, asymptotes, poles and polars and determination of circles satisfying given conditions of their tangents and normals—discussion of the general equation of the second degree. *Differential Calculus*: Definitions, limits, differential co-efficients—differentiation of simple and 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 intermediate in form—differentiation 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 the preceding to the geometry of the plane curves referred to rectangular or to polar co-ordinates—tangents, normals, sub-tangents, sub-normals, asymptotes—singular points—contact and curvature—tracing of curves—differential co-efficients of arcs and areas of plane curves, and of the surfaces and volumes of solids of revolution. *Integral Calculus*: Meaning of definite and of indefinite integrals—integration of the more frequently occurring functions—integration

by parts—rational functions—formulae of reduction—applications to areas and lengths of curves, to volumes and areas of surfaces of revolution, to centres of gravity, and moments of inertia. *Elementary Differential Equations*: Integration of differential equations of the second and higher orders with constant co-efficients.

FIRST YEAR COURSE IN RADIO COMMUNICATION.

Subjects:

RADIO COMMUNICATION.—I.

ELECTRICAL ENGINEERING.—I.

RADIO COMMUNICATION.

FIRST YEAR.

1. Magnetic flux—induced E.M.F.—self-induction—construction of inductances for transmitting and receiving units—reactance. 2. Capacity, charge as proportional to voltage, units—construction of fixed and variable condensers for low voltage—fixed condensers for high voltage. 3. Working ideas of alternating currents—calculation of current in circuits containing resistance, capacity, and inductance—resonance—simple aspect of coupled circuits—damped waves and continuous waves. 4. The nature of eddy current losses in conductors carrying high-frequency currents, of skin effects and of dielectric losses in condensers, treated qualitatively—working ideas of damping of circuit and effect on resonance. 5. Construction of thermionic valves, two electrode and three electrode—working ideas of action, characteristic curves. 6. The fundamental principles of action of alternators and transformers. 7. Essential components of spark transmitter, including description of some actual instruments. 8. The production of oscillations in a valve circuit—essential components of the valve transmitter, and of the Poulsen arc generator—principle of smoothing devices for rectified alternating-current high-tension supply. 9. Detecting devices for small currents—crystals, valves—construction and action of telephone receivers. 10. Component parts of receiving circuits—use of "stand by" and "selective" adjustments. 11. Heterodyne reception, general principles and how used. 12. Thermionic valve amplifiers

and note magnifiers, construction and essential principles of action. 13. Methods of "keying" spark and continuous-wave transmitters for Morse signalling. 14. Methods of modulating continuous waves for transmission of speech—action of receiver in reproduction of speech. 15. Use of a frame aerial for reception—application to direct finding.

ELECTRICAL ENGINEERING.—I.

(*See Syllabus for First Year Electrical Engineering*).

SECOND YEAR COURSE IN RADIO COMMUNICATION.

Subjects:

RADIO COMMUNICATION.—II.

ELECTRICAL ENGINEERING.—(A.C.)

RADIO COMMUNICATION.

SECOND YEAR. (*Subjects above*).

1. High-frequency measurements—current wave-length capacity and inductance, resistance and decrement—field strength. 2. More complete theory of coupled circuits. 3. The subject of clause 4 of the Grade I. syllabus treated quantitatively. 4. The construction and action of high-frequency alternators and transformers. 5. Frequency changers. 6. Construction and action of smoothing devices for rectified alternating-current high-tension supply. 7. Anti-atmospheric and anti-interference devices. 8. High-speed keying devices—high-speed reception—methods of duplex working—Wheatstone transmitter and receiver—recording device—call signals device. 9. Method of connecting radio telephone to land line telephone. 10. Theory and construction of aerials—construction of masts and towers. 11. General properties of electro-magnetic waves radiated from an aerial. propagation round the earth—electro-magnetic waves from natural

sources, "X's." 12. Directional properties of loops for transmitting and receiving—Bellini-Tosi system, rotating loop and Robinson crossed loop system—uses of direction finding. 13. The Turner valve relay—the Armstrong super-regenerative circuit.

ELECTRICAL ENGINEERING.—(A.C.)

(*See Syllabus for Fourth Year Course in Electrical Engineering*).

RADIO SERVICE.

FIRST AND SECOND YEARS.

Service Equipment: Avometer, set analyser, modulated oscillator, output meter, etc. *Valves*: Types, characteristics, installation, applications, faults and tests. *Component Parts and Tests*: Condensers, transformers, resistances. *Amplifiers*: Troubles, indications, tests and remedies. *Detector and Oscillator*: Troubles and tests. *Radio Sets*: Construction, assembly and wiring, installation—aerial and earth, mains apparatus. Analysis of circuits from diagrams. Manual and automatic volume control. Noise suppression control. Interference. Location of faults—preliminary tests; process of elimination; continuity, resistance and voltage checks; alignment of circuits. Short wave reception. New developments.

APPLIED CHEMISTRY

FIRST YEAR COURSE IN APPLIED CHEMISTRY.

Subjects:
INORGANIC CHEMISTRY.
PHYSICS FOR CHEMISTRY.

INORGANIC CHEMISTRY.

FIRST YEAR.

Chemical and physical changes; elements, compounds and mixtures. General properties of solids, liquids and gases. Application of Boyle's Law and Charles's Law.

Hydrogen. Oxygen; basic and acid forming oxides. Water; gravimetric and volumetric composition; solvent properties, crystillization.

Chemical equivalents. Laws of chemical combination, Dalton's Atomic Theory. Gay Lussac's Law of Volumes. Avogadro's Hypothesis, molecular weights of gaseous compounds, atomic weights. Valency, formulae, equations. Calculations by means of equations.
Chlorine, hydrochloric acid.

Nitrogen, ammonia, nitric acid, nitrates, nitric oxide, nitrous oxide, nitrogen peroxide. Nitrous acid, nitrates.

Sulphur; allotrophy; sulphuretted hydrogen; sulphur dioxide and trioxide; sulphurous acid and sulphites. Simple consideration of the contact and chamber processes for the production of sulphuric acid.

Carbon; allotropes. Carbon monoxide and dioxide. General properties of the carbonates.

Combustion; flame; Bunsen burners; oxidation and reduction. Acids, bases, salts.

Practical Work: Glass-working, cork boring and fitting up apparatus—action of heat, water, on substances and mixtures —solubility—preparation and properties of hydrogen, oxygen, chlorine, hydrochloric acid, nitric acid, ammonia, nitric oxide, sulphurdioxide, sulphuretted hydrogen and carbon dioxide—action of acids on metals—measurement of volumes and density of gases and reduction of N.T.P.—alkalies, properties and reactions

with acids—indicators—preparation and crystallisation of simple salts —simple determinations of equivalents—recognition of chlorides, sulphates, sulphites, sulphides, carbonates, nitrates and nitrites.

PHYSICS FOR CHEMISTRY.

PHYSICS—FIRST YEAR.

Units of length, area and volume. Units of mass. Use of metre stick, vernier calipers and micrometer screw gauge. Use and limitations of graduated cylinder, pipette and burette.

Centre of gravity. The lever. Common balance. The Laboratory Balance. Sensibility of balance. Density of regular solids—estimation of possible error. Use of specific gravity bottle. Specific gravity of liquids and of powders insoluble and soluble in water.

Hydrostatic pressure. Principle of Archimedes. Specific Gravity of irregular solids heavier and lighter than water, insoluble and soluble in water. Specific Gravity of liquids. Hydrometer. Atmospheric pressure. Simple barometer. Fortin barometer. Open manometer—simple pressure gauge. Siphon.

Boyle's Law. Exhaust pump.

Expansion of solids, liquids and gases. Thermometers. Determination of fixed points. Coefficients of expansion of a solid. Variation of density of a liquid with temperature. Real and apparent coefficients of expansion of liquid. Charles's Law. Absolute temperature. The Gas Equation. Simple gas thermometer.
Transmission of heat—conduction, convection and radiation.

Quantity of heat. Calorie. British Thermal Unit. Specific heat. Law of Dulong and Petit. Approximate determination of heat of solution, neutralization, reaction and combustion. Change of state. Cooling curve for pure substance. Melting point of pure substance. Latent heats of fusion and vaporization.

Vapour pressure. Properties of saturated and unsaturated vapours. Critical temperature. Dalton's Law of Partial Pressures. Influence of pressure on boiling point of pure liquid. Vacuum and steam distillation. Evaporation. Elementary Hygrometry.

The Lever as a machine. Work. Work equation for simple machines. Galileo's pendulum. Conservation of mechanical energy. Mechanical equivalent of heat.

Elementary treatment of electrostatics to develop the conception of quantity of electric charge. Joule, ampere coulomb, volt, ohm. Chemical effect of eletric current. Faraday's Laws of Electrolysis. Ionic Theory.

SECOND YEAR COURSE IN APPLIED CHEMISTRY.

Subjects:

INORGANIC CHEMISTRY.
CHEMICAL ANALYSIS.
PHYSICS.

INORGANIC CHEMISTRY.

SECOND YEAR.

A detailed study of water. Impurities met with in natural waters. Hard and soft waters. Chemical processes involved in the treatment of water to render it fit for industrial use.

Technical methods of softening water for industrial use, such as the lime and sodium carbonate process and the permutit process.

Technical methods of filtration.

Methods of determination and equivalents. Law of Dulong and Petit. Atomic weights. Simple methods of determining vapour density and the determination of the molecular weight from vapour density.

Law of mass action. Fadaray's Laws of Electrolysis. Elements of the ionic theory and its application to analysis.

Hydrogen peroxide; preparation and uses. Ozone.

Diffusion of gases.

The halogens. Commercial preparation and uses of these elements and their hydracids. Bleaching powder, sodium hypochlorite, potassium chlorate. General comparison of properties of halogen group.

Catalysts and their influence on the velocity of chemical change. Contact and chamber processes for the manufacture of sulphuric acid. Fuming sulphuric acid. Thiosulphuric acid and sodium thiosulphate. Sodium hydrosulphite. Potassium persulphate. Sulphur chloride.

Carbon; partial and total gasification of carbon and carbonaceous material. Manufacture of coal gas, producer gas, water gas, carburetted water gas, Mond gas. Thermo-chemistry. Exothermis and endothermic reactions. Carbon disulphide. The electric furnace and its application in the manufacture of metallic carbides.

Detailed study of the atmosphere.

Liquefaction of gases. Higher oxides of nitrogen. Gaseous dissociation.

Manufacturing processes for the fixation of nitrogen. Oxidation of ammonia to nitric acid. Preparation and manufacture of common ammonium salts. Nitrification and denitrification.

Phosphorus. Its oxides, chlorides, hydrides and acids. Calcium phosphate and fertilisers. Use of grinding machines in chemical industry. Manufacture of matches.

Arsenic, antimony and bismuth. Their occurrence, preparation, properties and uses. The compounds they form with hydrogen, oxygen and chlorine, studied comparatively with those of nitrogen and phosphorus.

Boric acid, borax. Chemistry of the borax bead tests. Boron. Boron trioxide and boron fluoride.

Silica—its occurrence, properties and uses. Common natural silicates. Stoneware, glass, pottery and fused silica ware. Silicon, its chloride and fluoride. Etching on glass. Silicic and hydrofluosilicic acids.

Dialysis. Colloids.

CHEMICAL ANALYSIS.

SECOND YEAR.

Detection of the following metals in the pure state, in salts, simple mixtures of salt or alloys: Silver, lead, mercury, bismuth, copper, cadmium, arsenic, antimony, tin, iron, aluminium, chromium, manganese, zinc, nickel, cobalt, calcium, strontium, barium, magnesium, potassium, sodium and ammonium—qualitative recognition of chlorides, bromides, iodides, hypochlorites, chlorates, fluorides, intrites, nitrates, phosphates, sulphates, sulphites, sulphides, thiosulphates, carbonates, bicarbonates, borates, silicates, arsenites and arsenates—use and care of instruments employed in volumetric analysis, including the

standardisation of pipette and burette—use of standard alkali, alkali carbonate and acids, together with exercises arising from their use—preparation and use of standard silver-nitrate solution—use of standard thiocyanate solution—standard iodine, sodium thiosulphate and sodium arsenite solutions and exercises on their use—preparation of salts and common substances in a state of purity.

PHYSICS FOR CHEMISTRY.

PHYSICS—SECOND YEAR.

Elementary surface tension and viscosity. Osmosis. Elementary Kinetic Theory of Gases.

Reflection and refraction at plane surfaces. Dispersion. Elementary theory of mirrors and lenses necessary for the understanding of optical instruments. Camera. The simple microscope. Telescope. Compound microscope. Refractometer.

The spectrum. Spectroscope and spectrometer. Elementary wave theory. Interference. Diffraction. Measurement of wavelength. Elementary treatment of polarization. The polarimeter.

Properties of a magnet. Magnetic fields. Molecular theory of magnetism.

Electrostatics. Quantity. Potential. Capacity. Electroscopes.

Magnetic effect of current. Electro dynamics—moving coil instruments. Electric motor.

Heating effect of current. Potential Difference. Electrical energy and power. Ohm's Law.

Decomposition potential. Conversion of electrical energy into chemical energy. Reversible cells. Storage battery. Electromotive Force.

Wheatstone Bridge. Potentiometer. Elementary thermo electricity. Electrical thermometers.

Electro-magnetic induction. Dynamo. Induction Coil. Transformer.

Elementary treatment of conduction through gases.

THIRD YEAR COURSE IN APPLIED CHEMISTRY.

Subjects:

INORGANIC CHEMISTRY.
CHEMICAL ANALYSIS.

INORGANIC CHEMISTRY.

THIRD YEAR.

Metals and the chief sources from which they are obtained. General methods used in the extraction of metals from their more important ores.

Preparation of alloys and their general properties. Freezing point curves and cooling curves.

Classification of the elements of the Periodic system. Law of Isomorphism. X-ray spectra and atomic numbers.

The more important compounds of the following metals :—

(a) Sodium and potassium.
(b) Copper and silver.
(c) Calcium, strontium and barium.
(d) Magnesium, zinc, cadmium and mercury.
(e) Aluminium.
(f) Tin and lead.
(g) Chromium and manganese.
(h) Iron, cobalt and nickel.

Manufacture of solium, zinc, aluminium, tin, lead, copper, cast-iron, wrought iron and steel. Hardening of steel. Influence of added elements on the properties of steel.

Technical production and uses of solium peroxide, hydroxide, carbonate and bicarbonate; potassium chloride and nitrate; potash fertilisers; lime, mortar; plaster of Paris; Portland cement; magnesium sulphate; zinc oxide and sulphide; Lithophone alums; thermit; red lead; white lead, potassium chromate, dichromate and permanganate; ferrous sulphate.

Solutions—lowering of vapour pressure, osmotic pressure, determination of molecular weight by cryoscopic and ebullioscopic methods. Limitations of the methods. Equivalent conductivity. Degree of dissociation as found by conductivity compared with Van't Hoff's coefficient.

Relative strengths of acids. Hydrogen ion concentration. Hydrolysis of salts. Use of the spectroscope.

Colloidal solutions—preparation of typical solutions of a suspensoid and an emulsoid. Characteristic behaviour and influence of degree of dispersion.

CHEMICAL ANALYSIS.

THIRD YEAR.

Ordinary methods of gravimetric analysis, including the estimation of silver, lead, copper, tin, arsenic, antimony, iron, aluminium, zinc, nickel, calcium, barium, magnesium, sodium, potassium, and ammonium, hydrochloric, sulphuric, phosphoric and carbonic acids—application of above, and also of volumetric methods to determination of the composition of simple alloys, and of simple mixtures—preparation of typical metals, oxides and salts, in a state of purity—analytical control of purity—revision of the volumetric work of the second year course—more extended use of standard iodine and thiosulphate—use of standard permanganate and dichromate solutions.

FOURTH AND FIFTH YEAR COURSES IN APPLIED CHEMISTRY.

Subjects:

ORGANIC CHEMISTRY.

TECHNICAL ANALYSIS.

ORGANIC CHEMISTRY.

FOURTH YEAR.

The province of organic chemistry. Reasons for separate study of carbon compounds. Detection and estimation of carbon, nitrogen, sulphur and halogens in organic substances.

Calculation of percentage composition from the results of analysis and deduction of empircal formulae. Molecular and constitutional formulae.

Methane and ethane considered as typical saturated hydrocarbons. Homologous series. Higher members of paraffin series. Isomerism. Petroleum and its products. Halogen derivatives. Chloroform, iodoform.

Ethylene and acetylene considered as typical unsaturated substances. Ethylene dibromide.

Methyl alcohol. Ethyl alcohol. Alcoholic fermentation. Higher alcohols considered briefly. Alkyl halides—methyl and ethyl iodides, ethyl chloride. Acetonitrile.

The oxidation products of alcohols. Formaldehyde, acetaldehyde and acetone. Formic and acetic acids. The chlorocetic acids as examples of substitution. Acetic anhydride and acetyl chloride and their use as reagents.

Ethyl acetate—its preparation, properties and saponification.

Nature of common oils, fats and waxes; their saponification.

Soap and Candles. Palmitic, stearic and oleic acids.

Acetamide.

Amines—primary, secondary and tertiary amines.

Glycollic and lactic acids. Optical isomerism. Oxalic, malonic, succinic, malic and tartaric acids. Ethyl malonate and ethyl aceto-acetate and their use as synthetic reagents.

Keto-enolic desmotropy.

Maleic and fumaric acids and geometrical isomerism.

Glycol.

Glycerol. Its manufacture and conversion into nitro-glycerine.

Mannitol and the carbohydrates. Sucrose and its technical production, dextrose, laevulose, maltose and lactose—their occurrence, preparation, properties, and distinctive tests. Use of polarimeter.

Starch and the dextrines. Cellulose, nitrocelluloses, cellulose acetate and gun-cotton.

Cyanogen compounds. Cyanic and cyanuric acids. Thiocyanates. Potassium ferrocyanide and ferricyanide. Prussian blue. Preparation of hydrocyanic acid, potassium, sodium, silver and mercuric cyanides. Cyanogen. Urea.

Organo-metallic compounds of zinc and magnesium.

FIFTH YEAR.

Benzene, toluene and their halogen derivatives.

Nitrobenzenes; aniline; mono and di-methyanilines; toluidines, Diazobenzene. Phenol. Dihydroxybenzenes.

Tannic acid, mordants, tanning. Benzoic and salicylic acids.

Higher homologues of benzene with their halogen, nitro, amino, hydroxy and sulphonic acid derivatives. Diazo, diazoamino and aminoazo compounds. Phenylhydrazine. Aromatic aldehydes and ketones. Toluic and phthalic acids. Naphthalene, anthracene, and their technically important derivatives. Thiophene, pyridine and quinoline.

Brief consideration of the dyes of the di-phenylmethane and tri-phenylmethane series.

Technically important organic compounds of arsenic.

ANALYSIS.

FOURTH AND FIFTH YEARS.

Students will be allowed to follow a course of chemical analysis of an advanced character, *or* to select for investigation certain industrial products, such as soaps, oils fats and waxes, painters' oils, colours and varnishes, fertilisers.

PHYSICAL CHEMISTRY, SPECIAL COURSE.

The Lectures will deal with the fundamental principles of Physical Chemistry and their bearing on, and application to, Systematic Chemical Analysis and Applied Chemistry generally.

The course of experimental work, arranged as far as possible to illustrate the Lectures, will include the determination of molecular weights by various methods: Victor Meyer, Hofmann, Beckman, Silver Salts, etc. Inversion Points, Rate of Inversion and Polarimetry, Pulfrich Refractometer, Spectroscope, Calorimetry, Heats of Solution and Neutralization, Flash Point, Bomb Calorimeter, Freezing and Boiling Points of Pure and Mixed Substances, Electrolysis, Rate of Migration, Conductivity of Solutions, Ph. Values.

INDUSTRIAL CHEMISTRY

ANALYSIS OF FOOD, DRUGS, AND WATER.

SALE OF FOOD AND DRUGS ACT.

Short history of adulteration and early legislation in regard to pure food. The present laws relative to food and drugs adulteration. Sections of the Acts that intimately concern the Public Analyst.

Form of Analyst's certificate. Certificates as *prima facie* evidence, and conditions governing the institution of proceedings. Regulations regarding standards of purity.

FOOD.

Milk: Composition of milk and variation in composition—milk of mammals other than the cow—milk standards—methods of calculating added water and fat deficiency—fat of milk, its composition and methods of estimation—methods of Gerber, Werner, Schmidt, and Rose-Bottleib—composition of non-fatty solids—estimation of proteins, milk-sugar and ash—changes in milk on souring—analysis of sour milk—preservatives in milk and methods of detection—artificial colouring matter in milk—composition and analysis of skimmed, separated, condensed and dried milk. *Butter and Margarine:* Composition of butter fat, and its analysis—Reichart—Wollny number—Polenske number—Kirschner number—iodine and saponification values—refractive index and Valenta test—standards for butter—general consideration of fats used in manufacture of margarine—laws relating to sale of margarine. *Cheese:* Various kinds of cheese and their comparison—adulteration of cheese—standards for cheese—analysis. *Starch Food:* Microscopical characters of the starches—use of the microscope in their detection—rice, sago, pearl barley, oatmeal, wheat, potato and maize. *Wheat Flour:* Wholemeal—wheatmeal—household flour—analysis of flour—bleaching of, and addition of "improvers" to, flour—self-raising flour—bread and its analysis—baking powder. *Condiments and Spices*: General consideration and analysis of vinegar, pepper, mustard, ginger, etc. *Tea, Coffee, and Cocoa*: Composition and analysis—microscopical characteristics—addition of chicory to coffee—coffee extracts. *Sugar, Jams and Honey*: Composition and analysis—artificial colours in jam—glucose in honey. *Beer, Wine and Spirits: Analysis*—original gravity of beer—standard for spirits. Preservatives and poisonous metals in food.

DRUGS.

Standards of the British Pharmacopoeia and the Department of Local Government—methods of analysis of extracts, liquors, liniments, mixtures, powders, syrups, tinctures and ointments.

WATER AND WATER ANALYSIS.

Natural waters and source of impurities—rain water—surface water —river water—wells and springs—waters used in brewing, distilling, and mineral water industries—boiler-feed waters—sources storage and distribution of waters used for drinking supply—water treatment—chemical analysis of water and interpretation of results.

THE CHEMISTRY OF OILS, FATS AND WAXES.

INTRODUCTION.

General method of producing and refining oils, fats and waxes. Occurrence of fatty oils, fats and waxes. Saponification products. Soap. Glycerine. Mono, di- and tri-glycerines. Naphthenes. Benzenes. Isomerism. Meaning of Hydrolysis. The fatty acids. The carbonyl group. Saturated and unsaturated compounds. Valency of carbon and structure of carbon compounds. The stearic, oleic, linoleic, linolenic and clupanodoric acid series.

TESTING AND ANALYSIS.

Physical methods. Specific gravity; viscosity; flash point; refractive power; melting point; titer test.

Chemical methods. Bromine thermal value; saponification value; Reichert-Wollny value; Polenske value; Acetyl value; Avic value; Unsaponifiable value.

CLASSIFICATION.

Marine oils, including Menhaden; cod-liver; whale.

Vegetable drying oils, including Linseed.

Vegetable semi-drying oils, including maize; cottonseed; and sesame.

Vegetable non-drying oils, including rape; olive and castor.

Animal oils, including Neatsfoot.

Vegetable fats, including cocoa-butter; palm and cocoanut.

Animal fats, including tallow; butter-fat and lard.

THE WAXES.

Occurrence and properties of sperm oil; carnauba wax; bees-wax; wool wax.

MINERAL OILS.

Occurrence and properties of petroleum; shale oil; coal-tar oil and lignite oil; paraffin; vaseline and ozokerite.

HARDENED FATS.—PRACTICAL COURSE.

INTRODUCTION.

Sampling and preliminary tests. Practical method for determining specific gravity; melting point; solidifying point of mixed fatty acids; refractive index; viscosity; solubility; iodine value; saponification value; Reichert-Wollny value; acetyl value, etc.

Specific tests for certain oils and fats.

Testing and analysis of mineral oils and waxes.

Interpretation of results.

Scheme for identification of an oil fat or wax.

TECHNICAL ANALYSIS—GAS MANUFACTURE.

(1) Coal (Approximate Analysis).
- (a) Moisture.
- (b) Organic Volatile Matter.
- (c) Ash.
- (d) Fixed Carbon, by difference.
- (e) Sulphur.
- (f) Calorific Value.
- (g) Evaporative Power from f.

(2) Gas (Partial and Complete).

Partial (a) Carbon-dioxide.
- (b) Oxygen.
- (c) Olefines.
- (d) Carbon-monoxide.

Complete. As above, and
- (e) Methane and Hydrogen by explosion.
- (f) Nitrogen, by difference.

Sulphuretted Hydrogen tested for by lead acetate paper, also estimated as grains per 100 cubic feet by Iodine solution. Total Sulphur in Gas. Test for cyanogen compounds and for Benzole vapour.

(3) Sulphate of Ammonia.

(a) Moisture.
(b) Free acid or ammonia.
(c) Total ammonia.
(d) Sulphuric acid from fixed ammonia by calculation.
(e) Insoluble Matter.
(f) Residue.
(g) Nitrogen calculated from (c).

Colormetric test for copper, and test for lead. Examination of B.Ov. for nitrates by Lunge Nitrometer.

(4) Bog-Iron Oxide.

(a) Moisture.
(b) Fe2 O3.
(c) Fe2 (OH)6.

(5) Spent Oxide.

(a) Moisture.
(b) Pure Sulphur.
(c) Tar.

Test for Cyanogen Compounds.

(6) Liquor.

Ammonia content, free and fixed.

Tests for Sulphur compounds, cyanogen and amount of gas given off on acidification.

(7) Tar.

(a) Water content.
(b) Specific gravity.
(c) Distillation test.
(d) Estimate of Tar Acids.
(e) Estimation of basic compound.

(8) Oils.

Specific Gravities, viscosity, flash point and distillation test.

SPECIAL COURSE FOR DIPLOMA OF VETERINARY STATE MEDICINE.

Water Analysis: Solids in solution, Ammonias, Nitrates, Chlorine, Oxygen absorbed and dissolved, hardness, interpretation of results.

Air: Estimation of CO.

Milk: Specific gravity; total solids; fat; solids not fat; ash; preservatives.

Feeding Stuffs: Moisture; oil; albuminoids, fibres; starch; ash; sand in ash; food unit value; albuminoids ratio.

Disinfectants: Chemical valuation of bleaching powder; permanganate of potash, formaldehyde; sulphurous acid; carbolic acid.
Tests for Common poisons; mineral acids and alkalis; arsenic; antimony; mercury; lead; barium; cyanides; phosphorus; alkaloids, including strychnine, morphia.

BREWING SCIENCE AND CHEMISTRY OF FERMENTATION.

First and Higher Years.

Preparation and properties of cellulose, starch from various sources, soluble starch, dextrose, cane and invert-sugar, and the products of the hydrolysis of starch.

The examination and valuation of barleys. Kiln-drying barleys, storing and screening.

Malting. The process of malting, including the so-called atmospheric systems. Conditions necessary for healthy germination.

The examination and comparative valuation of malts. Estimation of extract, proteins, ash constituents, etc.

Water. Analytical examination and test of fitness for brewing ales and stouts. Artificial softening and purification.

Mashing. Various methods of making the mash. Use of raw grain and other starch-containing material. Chemical changes effected during the mashing process, especially those attending the hydrolysis of starch. Influence of time and temperature on the result.

Use of sugar as a brewing material.

Boiling. Influence of boiling on the raw wort. Objects attained by the use of hops. Sulphured hops and their detection. The cold storage of hops.

Cooling. Influence of aeration on the cooling worts.

The various forms of the saccharometer, and the relation of their readings to each other and to specific gravity as ordinarily indicated.

Fermentation. The various systems of fermentation employed in the United Kingdom. The yeast organisms. Microscopical examinations of ferments, their modes of growth and reproduction. The chemical function of the ferments. Theories of fermentation.

Analysis of beer and worts. Determination of "original gravity." The "forcing tray" process as a test of the stability of a beer.

Preservative agents, and how applied to beer. The preparation and use of finings and caramel.

BACTERIOLOGY AND ENZYME CHEMISTRY.

Examination of plant cells as an introduction to the use of the microscope.

Preparation of culture media.

Study of the life histories of typical yeasts, bacteria and moulds, including their special cultural treatment in the laboratory.
Experiments on enzyme chemistry.

Bacterial analysis of water, milks, etc.

Preservation of foods by sterilization, drying, salting, cold storage, etc.

MILK PROCESSING AND MILK PRODUCTS MANUFACTURE.

SCIENCE.

Chemistry.—Elements, compounds, mixtures, acids, bases, salts, quantitative estimation of acidity, alkalinity. The Atmosphere; water; hydrogen; oxygen; carbon; nitrogen; phosphorus; sulphur; common metals; elementary chemistry of the sugars; alcohols; formaldehyde; acetic acid; butyric acid; lactic acid; fats; proteins.

Chemical composition and physical properties of milk. Analysis of milk (fat, total solids, protein, lactose, chlorides and acidity). Elementary chemistry of milk constituents. Causes of variations in composition of milk. Effects of heat. Causes and prevention of deterioration and taints. Adulteration of milk. Comparative nutritive value of milk. Water supply. Water softening. Detergents.

Physics.—Specific gravity. Viscosity. Surface tension. Hygrometry. Heat. Expansion. Thermometry. Latent heat. Specific heat. Conduction. Convection. Radiation. Evaporation. Principles of refrigeration. Fluid pressure. Barometers. Syphons. Pumps. Elementary machines.

Microbiology.—Microscope. Form, growth and classification of micro-organisms. Isolation. Culture media, staining and examinatin. Flora of milk and milk products. Effect of physical factors, including temperature, light, sterilization, pasteurization. Disinfectants, detergents, preservatives. Changes produced by micro-organisms, including acidity, alkalinity, oxidations, reductions, pigment formation and aroma. Enzymes.

MILK PROCESSING AND MILK PRODUCTS MANUFACTURE :

(Pasteurization, Sterilization, Ice Cream, Condensed and Dried Milk Products.)

Pasteurization and Sterilization.—Raw material. Bacterial flora and pre-pasteurization bacteriological standards. Pre-pasteurization treatment; bulking, pre-heating, straining, homogenizing. Principles of pasteurization and sterilization. Types and construction of pasteurizing and sterilizing apparatus. Precision control; thermometers and thermographs. Refrigeration. Faults, their detection and remedy. Cleansing of apparatus by hot water. Steam sterilization and use of detergents. Bottling and bottling equipment. Legal bacteriological and chemical standards. Water supplies. Methods of steam raising.

Ice Cream Manufacture.—Materials. Standards. Public Health requirements. Functions and quantities of components. Calculation of quantities and preparation of mixes. Mixing and refrigeration. Hardening. Types of refrigerating plants. Ageing vats and other equipment. Packing. Filling machines. Physical properties of ice cream. Faults, their detection and remedy.

Manufacture of Condensed and Dried Milk Products.—Raw materials. Legal standards.

Condensed milk; types of equipment; sugar addition; viscosities; cooling; canning, storage. Dried milk and dried whey; types of equipment, including spray, roller, vacuum band methods; grinding, packing, types of package, vacuum packing.

Keeping qualities of the above products; faults, their detection and remedy.

CEREAL CHEMISTRY AND FLOUR MILLING TECHNOLOGY.

Cereal Science :

Elementary chemistry; constituents of air; combustion in air; oxides; combustion of coal and producer gas; constituents of water; hard and soft water; formation of rust; chalk and lime; carbon dioxide and monoxide; simple ideas of elements and compounds, of acids, bases and salts, and of metals and non-metals.

Sources of power; measurement of heat in B.Th.U.; specific and latent heat; hygrometry; properties of saturated and superheated steam; special applications to milling—*e.g.*, moisture tests of wheat, wheat-feed and flour; effect on milling of moisture in wheat, in stocks and in the air.

Knowledge of pests in wheat and its products; reasons for heating, sweating and degeneration of wheat.

Elementary principles of breadmaking; effects of yeast, salt, temperature and time on breadmaking; gluten and the effect of quality and quantity on breadmaking; tests for nitrogen, gluten, ash and fibre; influence on bread-making of natural properties of flours and of bleachers and improvers; starch, sugar and enzymes.

Action of improvers; methods of improving flour quality.

Bleaching, natural and artificial.

Milling Processes and Operation :

Quality of flour from various wheats; merits and demerits.

Art of wheat blending.

Design of flow sheets.

Advanced knowledge of overhead control of milling machinery such as is expected from mill foremen.

Manipulation of :—

(*a*) Washers and conditioners.

(*b*) Screenroom machinery.

(*c*) Breaks and reductions.

(*d*) Graders, purifiers and dressers.

(*e*) Grinders for screenings and wheat-feed.

Flour grading.

Flour bleaching.

Flour improving.

Production of weatings and bran.

Manufacture of specialities; wheatmeal, self-raising flour, biscuit flour, soft and strong flours, flour for export.

Management. Finished Products :

1. Choice of site and of prime mover. Lay-out of mill premises.

2. Insurance against fire.

Wheat valuation; calculations of the values of wheats, taking into account the impurities, moisture content and flour content.

Planning of economic grists.

Periodical calculation of gain or loss of weight in screen-room and mill; the effect on costs.

Calculation of flour extraction; its effect on costs.

Divides; how obtained and calculated, and their effect on costs.

Costs of manufacture and of selling, distribution and administration.

Effect of output on costs; fixed and variable charges.

Common faults in flour and wheat-feed.

TECHNOLOGY OF THE MANUFACTURE OF PIGMENTS, PAINTS, AND VARNISHES.

This Course is designed to provide those engaged in these industries with a knowledge of the chemical nature of the materials used, and of the scientific basis underlying works operations.

Physics : Measurement. Specific gravity. Hydrometers. Heat. Methods of transference. Expansion. Thermometers. Specific heat. Latent heat. Boiling and melting points. Hydrometry.

Chemistry : A simple study of facts and theories.

Atmosphere, oxygen, hydrogen, carbon, carbon dioxide, carbonates. Hardness in water. Sulphur, oxides of sulphur. Sulphurous acid, sulphuric acid, hydrogen sulphide and sulphides. Chlorine and hydrochloric acid. Nitric acid, ammonia. Acids, alkalis and salts. Compounds of metals used in the industry.

Technology : Oils and varnishes including methods of testing. Solvents, resins and gums.

Pigments including mixing and grinding. Drying and properties of films.

CHEMISTRY FOR PHOTOGRAPHY, PHOTO-MECHANICAL WORK, LITHOGRAPHY, Etc.

This class forms part of the Courses in Photography, Photo-Mechanical Work and Lithography (see Book Production and Printing Trades Booklet).

To understand the processes used in Photography, Photo-Mechanical Work, Lithography, etc., it is necessary to have some knowledge of chemistry and its general principles. Throughout the part of the syllabus devoted to General Chemistry, frequent reference is made to applications to these chemical processes.

General Chemistry : Physical and chemical changes—mixtures and compounds—elements—chemical laws—elementary treatment of the atomic theory. *The Atmosphere* : Constitution of the atmosphere—oxygen—nitrogen. *Acids* : General study of the common acids, sulphuric, nitric, hydrochloric. *Alkalies* : Lime, caustic soda, sodium carbonate, ammonia. *Salts* : Methods of formation—water crystallisation. *Water* : Hydrogen—carbon dioxide—natural waters *Sulphur* : Oxides, sulphites, sulphates, thiosulphates. *Halogens* : Detailed study of chlorine, bromine and iodine. *Oxidation and Reduction* : Study of typical examples with particular reference to photographic operations. *Metallic Salts* : Silver, gold, copper, iron, uranium.

Applied Chemistry: Photo-chemistry of certain metallic salts—photo-chemistry of silver salts—theories concerning latent image—sensitizers—history of photographic processes—collodion and gelatine emulsions—ripening—dry plates—theory of developers, and restrainers—acid and alkaline development—fixing agents—intensification and weakening of silver image—printing processes—toning processes—platinotype—chemistry of photo-mechanical processes.

BOTANY FOR SEEDSMEN.

FIRST YEAR.

Examination of a simple flowering plant; its chief organs.

Various forms of root, stems and leaf; modifications of these organs for special purposes; food storage; vegtative propagation.

The cell and cell contents in embryonic and adult structures, variations in type of cells of different organs.

Tissues.

Brief survey of the chemical nature of the principal components of plant bodies; food, food storage and translocation.

Such of the minute structure of root, stem and leaf of herbaceous and of woody types as is necessary to explain the physiological processes connected with absorption, respiration, transpiration, assimilation, movement, growth in length and in thickness.

Buds and branching. Winter condition of some trees of different types.

Forms of inflorescence. The flower; variety of structure of floral organs.

Detailed structure of stamen and of pistil.

Pollination and fertilization.

Fruit.

Seed Dispersal.

Germination.

Various forms of vegetative and of floral organs of plants as illustrated by reference to some members of the commoner families of flowering plants.

SECOND YEAR.

Characters of common forage plants.

Identification of seeds of farm and garden crops.

Seed testing.

Introduction to the study of lower plants by reference to the general structure, physiology and mode of life of Fern, Moss, Alga, Fungus and Bacillus.

Outline of principles of classification of Fungi.

Survey of the commoner fungoid pests, and insect pests of farm and garden.

FIRST YEAR COURSE IN MEDICAL CHEMISTRY.

Subjects:

MEDICAL CHEMISTRY.
PHYSICS FOR CHEMISTRY.

MEDICAL CHEMISTRY.

FIRST YEAR.

See Syllabus for Pharmaceutical Chemistry.

PHYSICS FOR CHEMISTRY.

FIRST YEAR.

See Syllabus under First Year Course in Applied Chemistry.

SECOND AND THIRD YEAR COURSES IN MEDICAL CHEMISTRY.

Subjects:

INORGANIC CHEMISTRY.
CHEMICAL ANALYSIS.

INORGANIC CHEMISTRY.
CHEMICAL ANALYSIS.

SECOND AND THIRD YEARS.

See Syllabuses under Second and Third Year Courses in Applied Chemistry.

PHARMACEUTICAL COURSES.

The Pharmaceutical Society of Ireland recognise and accept certificates of attendance at courses of instruction in

THEORETICAL CHEMISTRY AND PHYSICS.
PRACTICAL CHEMISTRY.
BOTANY.
MATERIA MEDICA.

Applications for enrolment should be made as early as possible before the dates fixed for the commencement of the courses.

The Courses are intended for chemists' assistants who have passed their preliminary and are working for their final examinations.

Recognised certificates for lectures and practical work are given to all students whose attendance and progress are satisfactory. The lectures and practical work cover the subjects outlined in the subjoined syllabuses.

THEORETICAL CHEMISTRY AND PHYSICS.

(September to May.)

Inorganic Chemistry :

Elements and compounds. Laws of Chemical combination. Atomic Theory; symbols and formulae. Vapour density; molecular weight; atomic weight; equivalent weight; valency. Periodic table. Acids, bases, salts.

Non-Metals : H; O; N, S, C, P, Cl., Br., I, B., As, Si.

Metals : Sodium group; calcium group; Mg; Zn; Cd.; Pb; Cu; Ag; Hg; Al.; Fe; Mn; Co; Ni; Cr; Sb; Bi; Au; Pt.
Oxides, hydrates and salts.

Organic Chemistry :

Nature and scope of organic chemistry. Qualitative and quantitative analysis of organic compounds. Determination of empirical and molecular formulae.

Paraffin hydrocarbons; homologous series; isomerism; olefine and acetylene series; halogen derivatives; alcohols and mercaptons; aldehydes and ketones; polymerism. Fatty acids—formic, acetic,

palmitic, stearic, oleic acids. Fats; soaps. Oxalic, citric, tartaric and lactic acids. Ethers; esters; amines; amides; cyanogen derivatives; nitrites.

Benzene and its homologues; naphthalene; authracene; halogen derivatives of benzene; nitrobenzene; aniline; phenol, azo, diazo and hydrazine compounds. Aromatic alcohols, aldehydes and ketones. Aromatic acids—benzoic, salicylic.

Carbohydrates; proteins; glucosides; terpenes and camphors; the principal alkaloids.

Physics :

Units of measurement, lengths, areas, volumes—states of matter—physical and chemical changes—mass inertia, force, parallel forces—weight—Hooke's law—energy and work—densities of solids, liquids and gases—Archimedes' principles and applications—liquids and gases—principle of flotation—atmospheric pressure—barometers—Boyle's law—kinetic energy and gases—diffusion—heat and its general effects—thermometry—melting and boiling points—expansion of solids liquids and gases—specific heats—Dulong and Petit's law—change of state—latent heat—transference of heat; methods.

PRACTICAL CHEMISTRY.

Qualitative analysis for bases and acids in solutions of simple salts, including the salts of common organic acids.

Principles of organic analysis.

Detection of B.P. substances and the chief alkaloids.

Standard solutions. Volumetric estimations of B.P.

Water analysis—ammonia—nitrates—nitrites—chlorides; total and permanent hardness.

Urine analysis; estimation of sugar.

BOTANY.

(September to May.)

1.

The plant cell, tissues, and systems.

II.

The structure and principal modifications of root, stem, and leaf in Angiosperms; structure of typical flowers, fruits, and seeds.

III.

The elements of plant Physiology and plant Biology, including the Ecology of native plants.

IV.

The special study of the following :—Bacillus subtillus, Spirogyra, Fucus, Mucor, Psalliota, Funaria, Aspidium, Pinus, Cheiranthus.

V.

The outlines of classification of Spermaphyta.

The Natural Orders :—Liliaceae, Orchidaceae, Gramineae, Rosaceae, Ranunculaceae, Papaveraceae, Cruciferae, Leguminosae, Compositae, Solanaceae, Scrophulariaceae, Umbelliferae.

VI.

The following collection of slides :—Vicia Faba—L.S. root apex, Lilium—L.S. root tip, Helianthus—T.S. stem, Zea—T.S. stem, Helianthus—T.S. root, Ricinus—T.S. seed, Pinus—L.S. ovule, Ficus T.S. leaf, Horse-chestnut—L.S. stem node, Wheat—L.S. seed, Quercus—T.S. stem (2nd year), Circaea—raphides, Typical Leaf—T.S. Sieve tubes, Lenticel.

MATERIA MEDICA.

(September to May.)

I.

Identification; description; natural origin; family; geographical source; chief constituents and pharmacopoeial requirements of the following :—

Drugs of Vegetable and Animal Origin.

Acacia, aconitum, adeps, adeps lanae, agar, aloe, amylum, anethum asafoetida, aurantii cortex, balsamum peruvianum, balsamum tolutanum, belladonnae folium, belladonnae radix, benzionum, buchu, calumba, capsicum, carum, caryophyllum, cascara sagrada, cassia, catechu, cera alba, cera flava, cinchona, cinnamomum, coccus, chlchoci cormus, colchici semen, colocynthis, colophonium, copaiba, coriandrum,

digitalis folium, ergota, filix mas, ipecacuanha, foeniculum, gelatinum, gentiana, glycyrrhiza, hamamelis, hyoscyamus, ipomoea, jalapa, krameria, limonis cortex, linum, lobelia, mel depuratum, morrhuae oleum, myrrha, nux vomica, olivae oleum, ricini oleum, abietis oleum, amygdalae oleum, anethi oleum, anisi oleum, arachis oleum, cadinum oleum, lavandulae oleum, limonis oleum, lini oleum, menthae piperates oleum, myristicae oleum, rosmarini oleum, santali oleum, santali australiensis oleum, sesami oleum, terebinthinae oleum, theobromatis oleum, opium, pix carbonis praeparata, pix liquida, podophylli resina, podophyllum, prunus serotina, quassia, quillaia, rheum, scammoniae resina, scilla, senega, sennae folium, sennae fructus, serpentaria, stramonium, strophanthus, styrax, tamarindus, thyroideum, tragacantha, valeriana, zingiber.

II.

Bacteriology.

Definition of bacteria; size; reproduction; motility; structure; spores; effect of light; effect of heat; growth in gases; identification; classification; preparation of sera and vaccines.

III.

Definition and storage of the following bacteriological preparations: antitoxinum diphthericum, antitoxinum tetanicum, antitoxinum welchicum, serum antidysentericum (shiga), toxinum diphthericum calefactum, toxinum diphthericum detoxicatum, toxinum diphthericum diagnosticum, tuberculinum pristinum, vaccinum typho-parathyphosum (t.a.b.), vaccinum vacciniae.

IV.

Vitamines.

Presence of vitamin bodies in vegetables, fruits, oils, wheat, and rice.

PRACTICAL PHARMACY.

Translation of latin prescriptions; detection of dangerous doses; compounding and dispensing; explanation of process of making non-chemical preparations of the Pharmacopoeia. Resignition of preparations of the Pharmacopoeia which are not of a definite chemical nature, such as extracts, tinctures and powders.

Demonstrations, as far as possible, will be made of the Pharmacopoeia operations; dispensing of physicians' prescriptions, prescription reading, calculation of percentages, and other quantities occurring in prescriptions.

SPECIAL CLASSES

IRISH LANGUAGE.

IRISH.

First Year.

Oral: Conversation lessons on simple matters such as the following:—Name, home or residence, salutations, the clock, days of the week, months and seasons, the weather, money, easy counting, colours, etc. Location of objects in the classroom and neighbourhood, parts of the body and clothing, giving and carrying out simple orders. With the conversational lessons, the student will be familiarised with the use of *is* and *tá* and of verbal nouns.

Written Work: Each student will keep a note-book to record the salutations, phrases, etc., in correct Irish.

Cultural: Memorising of simple songs, rhymes, stories, etc., so as to be able to repeat them with correct *blas*. Stories and recitations by Gaelic authors.

TECHNICAL GERMAN.

Readings: Fiedler and Sandbach and Linguaphone Course.

Grammar: Pronunciation—the articles—declension of nouns—declension of adjectives—comparison of adjectives, adverbs, numerals, pronouns—conjugation of verbs—prepositions—cases with verbs—order of words—omission of words. German words not to be translated—subjunctive, infinitive—formal subject—comparative. Technical vocabulary. Abbreviations used in technical and scientific German. Commercial terms and correspondence. German technical journals. Sources. Bibliographies. Abstraction. German currency.

GENERAL CURRICULUM OF THE SCHOOLS

UNDER THE CONTROL OF

THE CITY OF DUBLIN VOCATIONAL EDUCATION COMMITTEE.

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PEMBROKE TECHNICAL INSTITUTE (Ringsend and Ballsbridge)

General Commercial Subjects.
Retail Distribution.
Languages.
Domestic Science and Housecraft.
Art and Art Crafts.
Mechanical Engineering.
Motor Car Engineering.
Oxy-Acetylene Welding.
Building Trades.

Day School of Commerce.
Day Junior Technical School.

RATHMINES TECHNICAL INSTITUTE

General Commercial Subjects.
Accountancy, Auditing and Allied Subjects.
Insurance.
Advertising and Publicity.
Banking, Finance and Foreign Exchange.
Company Secretaries.
Government Accountancy & Finance.
Languages.

Domestic Science and Housecraft.
Day School of Commerce.
Pre-Employment Day Courses for Girls.

MARINO TECHNICAL INSTITUTE

General Commercial Subjects.
Languages.
Domestic Science and Housecraft.
Metalwork.
Science.
Woodwork.

Day Junior Technical School.
Day School of Commerce.
Pre-Employment Day Courses for Girls.

CHATHAM ROW SCHOOL OF MUSIC (Day and Evening Classes)

Pianoforte.
Violoncello.
Uileann and Irish War Pipes.
Elocution.
Violin.
Singing and Choir.
Organ.
Wind Instruments (Wood & Brass).
Fifes.
Viola.
Orchestra.
Drums and Flute.
Traditional Music.
Irish Harp.