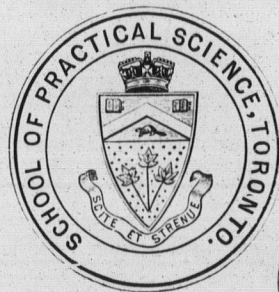


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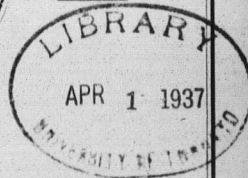
Toronto, University of Faculty of
Applied Science and Engineering

PROSPECTUS
OF THE
SCHOOL OF PRACTICAL SCIENCE,
PROVINCE OF ONTARIO,
WITH A
SYLLABUS
OF THE
COURSES OF INSTRUCTION AND OF THE REGULATIONS
FOR
DIPLOMAS.

Eighth Session,



1885-6.



TORONTO:
PRINTED BY "GRIP" PRINTING AND PUBLISHING COMPANY.
1886.

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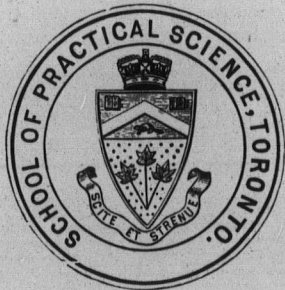
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To whom :

Faculty of the School.

D. WILSON, LL.D., F.R.S.E., CHAIRMAN OF THE BOARD.

MEMBERS OF THE BOARD.

E. J. CHAPMAN, Ph.D., LL.D.....	<i>Professor of Mineralogy and Geology.</i>
JAMES LOUDON, M.A.....	<i>Professor of Mathematics and Physics.</i>
R. RAMSAY WRIGHT, M.A., B.Sc.....	<i>Professor of Biology.</i>
J. GALBRAITH, M.A., ASSOC. M. INST. C.E.....	<i>Professor of Engineering.</i>
W. H. PIKE, M.A., Ph.D.....	<i>Professor of Chemistry.</i>
D. WILSON, LL.D., F.R.S.E.....	<i>Professor of Ethnology.</i>
W. H. ELLIS, M.A., M.B.....	<i>Professor of Applied Chemistry.</i>

Assistant Instructors :

A. BAKER, M.A.....	<i>Mathematical Tutor.</i>
W. J. LOUDON, B.A.....	<i>Demonstrator in Physics.</i>
W. J. REID, B.A.....	<i>Fellow in Mathematics.</i>
T. MULVEY, B.A.....	" <i>Physics.</i>
A. B. McCALLUM, B.A.....	" <i>Biology.</i>
N. McEACHREN, B.A.....	" <i>Chemistry.</i>
H. R. WOOD, B.A.....	" <i>Mineralogy and Geology.</i>
*	" <i>Engineering.</i>

Secretary of the Board :

W. DALE, M.A.,

To whom application may be made for information further than that contained in the present Prospectus.

* To be appointed this year.

Engineering Department.

SESSION 1884-5.

REGULAR STUDENTS.

1st Year.

J. NAIRN	E. F. BALL	J. H. MOORE
A. E. LOTT	C. J. MARANI	C. M. CANNIFF
W. E. COLQUHOUN	A. R. WATSON	D. L. CAMPBELL
F. G. MILLAR	J. L. BOYD	F. A. MARTIN
H. J. CHEWETT	J. C. BURNS	L. M. BOWMAN
G. RICHARDSON	J. ROGER	J. FLEMING
D. CAMERON	C. E. JOHNSON	C. H. PINHEY.
P. GIBSON	W. J. WITHROW	

2nd Year.

A. L. McCULLOCH	R. LAIRD	E. B. HERMON
H. G. TYRRELL	T. K. THOMPSON	W. C. BEACH.

3rd Year.

B. A. LUDGATE	E. E. HENDERSON	J. C. WILLIAMS
F. BLEAKLEY	H. J. BOWMAN	O. McKAY.

SPECIAL STUDENTS.

F. McMASTER	A. HALFORD	J. R. GORDON
J. N. SMITH	*A. W. KIPPEN	R. H. LABATT.
	W. O. JOHNSTON.	

GRADUATES.

1881.—J. L. Morris, Assistant Engineer C. P. R., Biskotasing, Eastern Division
C. P. R.

1882.—J. McAree, P. L. S., Toronto, Ont.

D. Jeffrey, Contractor, Winnipeg.

J. H. Kennedy, Civil Engineer and Architect, St. Thomas, Ont.

* Killed at Batoche.

1883.—G. H. Duggan, Assistant Engineer C. P. R., end of track, Western Division
C. P. R.

J. W. Tyrrell, P. L. S., Geological Survey, Ottawa, Ont.
D. Burns, Toronto.

1884.—E. W. Stern, Assistant Engineer, Northern & Pacific Junction Railway,
Cyprus, Ont.

A. R. Raymer, Assistant Engineer, Northern & Pacific Junction Railway,
Huntsville, Ont.

J. Robertson, County Engineer's office, Glencoe, Ont.

W. C. Kirkland, Northern & Pacific Junction Railway.

J. McDougall, County Engineer's office, Toronto.

PRIZEMEN.

1879.— I. Year..... J. McAree..... 1st prize.

1880.— II. Year..... J. L. Morris..... 1st prize.

881.— I. Year..... G. H. Duggan..... 1st prize.

II. Year..... D. Jeffrey..... 1st prize.

1882.— I. Year..... A. R. Raymer..... 1st prize.

“ “..... E. W. Stern..... 2nd do.

II. Year..... G. H. Duggan..... 1st prize.

III. Year..... D. Jeffrey..... 1st prize.

83.— I. Year..... B. A. Ludgate..... 1st prize.

“ “..... A. M. Bowman..... 2nd do.

II. Year..... A. R. Raymer..... 1st prize.

“ “..... E. W. Stern..... 2nd do.

III. Year..... G. H. Duggan..... 1st prize.

4.— II. Year..... B. A. Ludgate..... 1st prize.

III. Year..... E. W. Stern..... 1st prize.

“ “..... A. R. Raymer..... 2nd do.

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Eastern Division

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School of Practical Science,

PROVINCE OF ONTARIO.

PROSPECTUS FOR THE SESSION 1885-6.

IN the Session of 1877 the Legislative Assembly gave its sanction to the establishment of a School of Practical Science on the basis proposed in a memorandum of the Minister of Education, confirmed by the Lieutenant-Governor in Council, on the 3rd day of February, 1877,

By the scheme thus approved of, the Government effected an arrangement with the Council of University College, whereby the students of the School of Practical Science enjoy full advantage of the instruction given by its Professors and Lecturers in all departments of Science embraced in the work of the School. In addition to this, the faculty of the School of Science includes Professors of Engineering and Applied Chemistry, along with the requisite assistants in the several departments.

The building originally purchased for the College of Technology having proved altogether unsuitable, a new one has been erected in proximity to University College, with lecture rooms, laboratories and other essential requisites. A School of Science has thus been secured for Ontario at very moderate expense to the Province, fitted to supply practical education in Physical Science, thoroughly efficient in character, and directly bearing on the professional aims of its students.

The new building contains commodious Chemical, Assaying, Physical and Biological Laboratories, Chemical and Engineering Lecture Rooms, a Room for Designing and Drawing, and Apparatus and Model Rooms. Private laboratories, balance rooms and experimental rooms, are also provided, along with the requisite fittings, apparatus and store rooms.

The position which it is intended that the School of Practical Science shall occupy in the Educational system of Ontario may be indicated as follows:—

I.—Students, who have passed through the regular courses of the School, will be enabled to prosecute professionally: (1) Engineering; (2) Assaying and Mining Geology; or (3) Analytical and Applied Chemistry. With this view, Diplomas will be granted in each of those branches after due examination.

The instruction in Engineering is designed to give the student a thorough knowledge of the scientific principles of the profession, and also to afford such practical training in drawing and surveying as will make him immediately useful in the office and field.

The establishment of a Diploma for special qualifications in Assaying and Mining Geology, apart from the knowledge of these subjects incidental to the course of Mining Engineering, is called for by the necessity which exists for the development of the mineral wealth of the Province. Students who pass through the course necessary to obtain this Diploma will have acquired the knowledge requisite for inspecting and surveying mineral lands, as well as the ability to report accurately on the composition and value of economic minerals generally.

The importance of the study of Chemistry is now fully recognized, and in Canada, through the Public Analysts and otherwise, protection is being secured to consumers, while the producers are necessarily brought to recognize its importance. The course in Chemistry is such as to fit the student for the position of Public Analyst or of Consulting or Resident Chemist.

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II.—It is designed to furnish preliminary scientific training for students entering the professions of Surveying and Medicine.

Certificates in Surveying will be granted after due examination, which will have the effect of shortening the ordinary period of apprenticeship to a Land Surveyor, by the length of time covered by such certificates—one, two or three sessions, as the case may be.

The School of Practical Science, in relation to the Medical Schools of the Province, will supply recognized deficiencies by affording scientific training beyond what is merely necessary for a license to practise, but which should be required for a good University Degree in Medicine.

III.—Persons desirous of instruction in any of the subjects taught in the School, may be allowed to attend separate courses in these, as *special* students; and courses of evening lectures, adapted to skilled mechanics and others, to whom some practical knowledge of science is of value, will be organized each winter.

Students intending to become mechanical engineers will enter as special students, and receive instruction in the principles of mechanism, the theory of machines and drawing, together with such work in the civil engineering course as may be suitable for their purpose.

Students intending to become electrical engineers are admitted as special students, and will receive instruction in drawing, mechanical engineering, and electricity. The physical laboratory is now being furnished with electrical instruments which will afford unusual facilities for the prosecution of experimental work.

Extracts from Regulations.

*Approved by His Honour the Lieutenant-Governor in Council,
28th June, 1878.*

1. The Board to whom the internal management and discipline of the School is intrusted is composed of the Lecturers and Instructors therein, with Chairman and Secretary, as nominated by the Lieutenant-Governor in Council.
2. The academic year consists of two terms. The Michaelmas Term extends from 1st October to 23rd December; the Easter Term from 8th January to 18th April.
3. A diploma will be given to each student who shall have completed, to the satisfaction of the Faculty, any one of the regular courses of the School.
4. The Regular Course for the Diploma of the School in each Department is three years in duration.
5. Students who propose to obtain the Diploma of the School must pass an Entrance Examination in the subjects of the *Intermediate High School Examination. The Board will give credit for such of these subjects as have been passed by the students at any examination for Public School Teachers of any class, or at any Matriculation Examination in any University in Ontario, or at any Terminal Examination in University College, or at the Entrance Examinations of the Law Society, or the College of Physicians and Surgeons of Ontario.
6. Certificates of attendance and standing, when satisfactory, will be issued for any separate course or group of courses, provided that the student shall have passed an entrance examination equivalent to that for Third Class Public School Teachers' Certificates.

[This is applicable to those who take advantage of the courses for Surveyors or Medical Students.]

*The list of the subjects prescribed for the Intermediate High School Examination may be obtained by applying to the Education Department, Toronto.

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7. At the conclusion of each term, examinations will be held in all the subjects taught, and prizes will be awarded for excellence in each department at the end of the session. Candidates for Diplomas and Certificates are required to enter for these.
8. All regular students are required to be in attendance at the School during the whole of each term, unless exempted by special permission of the Board. The term will not be allowed to any student who has attended less than three-fourths of the required Lectures and practical Lessons, or who has been reported to the Board for bad conduct, and adjudged guilty thereof.
9. Students of the School of Practical Science shall attend such courses of Lectures as are delivered by the Professors of University College to the students thereof, so far as applicable to both classes of students, while instruction of a practical character in the Department of Engineering is specially appointed for students of the School.
10. Special students may be permitted to attend such lectures or courses of instruction, or of practical work, as the Board may think proper.

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Regular Courses for the Diploma.

See especially regulations 3, 4, 5, 6, 7 ; pp. 8 and 9.

The fees (payable through the Secretary to the Provincial Treasurer), for instruction in any of the Departments are as follows :

First Session : Thirty Dollars.

Second Session : Forty Dollars.

Third Session : Fifty Dollars.

These are payable in two instalments, one at the beginning of each term. There is no extra fee for the Diploma.

The following are the Departments in which the Diploma is granted :

- (1) Engineering (Civil and Mining).
- (2) Assaying and Mining Geology.
- (3) Analytical and Applied Chemistry.

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FORM OF DIPLOMA.

THE

School of Practical Science.

PROVINCE OF ONTARIO.

(ESTABLISHED 1878.)

THIS IS TO CERTIFY that

..... in the has completed the Regular Course of this School for the Diploma in the extending over a period of three years, and comprising theoretical and practical instruction in the following subjects, viz. :

WHEREFORE the said becomes duly entitled to receive this Diploma, having fulfilled to the satisfaction of the Faculty of the School all the requirements thereunto relating.

IN WITNESS whereof we have signed this Diploma at Toronto, in the Province of Ontario, this day of One thousand eight hundred and and have caused the Seal of this School to be hereunto affixed.

[L.S.]

..... Chairman.

..... Secretary.

DEPARTMENT OF
TIME

Instruction will be given during the Session

FIRST YEAR.		
HOURS.	MONDAY.	TUESDAY.
9-10.....	Drawing.	Descriptive Geometry.
10-11.....		Practical Chemistry.
11-12.....		Chemistry (lecture).
12-1.....		+Geometry & Trigonometry.
1-2.....	Statics.	Drawing.
3-4.....	Drawing.	Field Work.
4-5.....		
SECOND YEAR.		
9-10.....	Drawing.	Drawing.
10-11.....		+ Astronomy.
11-12.....	+ Calculus.	Chemistry (applied).
12-1.....	Strength of Materials.	Practical Chemistry.
1-2.....	+ Hydro-statics, Optics. (a)	
3-4.....	El. Mineralogy and Geology.	Field Work.
4-5.....	Drawing.	
THIRD YEAR.		
9-10.....	Drawing.	Drawing.
10-11.....		
11-12.....	Theory of Internal Stress.	Thermo-dynamics.
12-1.....	Drawing.	Mineralogy.
1-2.....		Constructive Design.
3-4.....	Hydraulics. (a)	Field Work.
4-5.....	Constructive Design.	

† Lectures given in University College.

Additional lectures are given at hours not specified in above time table,
and when the weather will not permit of field work.ENGINE
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ENGINEERING.

TABLE.

1885-6, according to the subjoined Programme.

FIRST YEAR.		
WEDNESDAY.	THURSDAY.	FRIDAY.
Drawing.	Practical Chemistry.	Drawing.
Chemistry (lecture).		
Drawing.	† Algebra & Trigonometry.	Dynamics. (a)
Statics.	† Conics.	Surveying (lecture).
Practical Chemistry.	Field Work.	Field Work.
SECOND YEAR.		
Drawing.	Drawing.	Experimental Physics.
	† Astronomy.	
Strength of Materials.	Chemistry (applied).	† Calculus.
	Descriptive Geometry.	Practical Chemistry.
† Hydro-statics, Optics. (a)	Spherical Trigonometry.	
El. Mineralogy & Geology.	Field Work.	Field Work.
Drawing.	Practical Mineralogy. (a)	
Practical Mineralogy. (a)		
THIRD YEAR.		
Geodesy and Astronomy.	Drawing.	Geodesy and Astronomy.
Descriptive Geometry.		Con. Design, Hydraulics. (a)
Chemistry (applied).	Thermo-dynamics.	Chemistry (applied).
Drawing.	Mineralogy.	Experimental Physics.
	Drawing.	
Rigid Dynamics.	Practical Mineralogy.	Field Work during first term.
	Field Work (a)	

(a) During second term.

This time table is subject to modification when necessary to prevent conflict of hours.

1. DEPARTMENT OF ENGINEERING.

This Department is intended to afford the necessary preliminary preparation to students intending to become Civil or Mining Engineers.

During the first year the course is common to the students of both branches (Civil and Mining). At the commencement of the second year the student will select the branch which he intends to specially pursue, and the studies of the second and third years will be arranged in conformity therewith.

SUBJECTS OF THE FIRST YEAR.

PURE MATHEMATICS.

Euclid, Algebra, Plane Trigonometry, Analytical Geometry of two dimensions.

APPLIED MATHEMATICS.

Statics and Dynamics (with special reference to Structures and Machines).

DRAWING.

Geometrical Model Drawing.
Map and Topographical Drawing.
Coloring and Lettering.
Orthographic, Isometric, and Oblique Projections.

SURVEYING.

Field and Office Work—Chain and Compass Surveys—Preliminary Instruction in the use of the Transit and Theodolite—Plotting, Mensuration.

CHEMISTRY.

General Chemistry.
Practical do.

FRENCH OR GERMAN.

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SUBJECTS OF THE SECOND YEAR.

PURE MATHEMATICS.

Differential and Integral Calculus.
Spherical Trigonometry.

APPLIED MATHEMATICS.

Hydrostatics.
Geometrical Optics.
Plane Astronomy.

EXPERIMENTAL PHYSICS.

Light: Use of the Heliostat and Spectroscope. Experiments with
Lenses and Mirrors. Theory of the Telescope and Microscope,
and of Reflecting instruments.

DRAWING.

Subjects of First Year continued.
Descriptive Geometry, including Projections of the Sphere.
Machines and Constructions.

ENGINEERING.

Theodolite Surveying.
Principles of Geodesy (considering the Earth a Sphere).
Applied Mechanics.
Theory of Strength of Materials.
Materials of Construction.
Methods and Processes.

CHEMISTRY.

CHEMISTRY (APPLIED).

Combustion, Fuel, and Furnaces.
Artificial Lighting.
Explosives.
Laboratory Practice.

MINERALOGY AND GEOLOGY.

Elements of these Sciences
Blowpipe Practice.
Determination of Minerals.

FRENCH OR GERMAN.

SUBJECTS OF THE THIRD YEAR.

APPLIED MATHEMATICS.

Rigid Dynamics.
Thermodynamics and theory of the Steam Engine.
Hydraulics.

EXPERIMENTAL PHYSICS.

Heat: Use of Cathetometer, Dividing Engine, and Spherometer.
Thermometry and Calorimetry. Principle of Least Squares.

DRAWING.

Subjects of previous years continued.
Shades and Shadows, Stone Cutting, Perspective.
Original Designs (Bridges, Roofs, Floors, etc.).

ENGINEERING.

Subjects of previous years continued.
Levelling and Setting Out Work.
Application of principles to practical problems connected with the design and construction of various Structures and Machines, *e.g.*, Foundations, Retaining Walls, Arches, Roofs, Bridges, Roads, Railways, Canals, Sewers, Water Wheels, Steam Engines, Hydraulic Machinery, Mining Machinery, etc.
Practical Astronomy and Geodesy (considering the Earth a Spheroid).

CHEMISTRY (APPLIED).

Mortars and Cements.
Bricks and Artificial Stones.
Preservation of Wood, Iron and Stone.
Water, Air and Sewage.
Metallurgy of Iron and Steel.
*Metallurgy of Copper, Lead, Silver and Gold.

*Mining Engineering only.

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MINERALOGY AND GEOLOGY.

Economic Minerals of Ontario.

Blowpipe Analysis and Determinative Mineralogy.

*Assaying and Mining Geology, Mining Calculations.

*Crystallography and Palæontology.

FRENCH OR GERMAN.

NOTE.—Each Student is required to furnish himself with the following drawing instruments and materials, viz. :—

One drawing-board, 23" x 31"; 1 T square, 31 inch; 2 set squares, 60° and 45°, not less than 6" on the side; 1 6" (or larger) protractor; 1 12" triangular scale, containing 10, 20, 30, 40, 50 and 60 chain scales; 1 12" triangular scale, containing $\frac{1}{16}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$; 1, 2; $\frac{3}{8}$, $\frac{1}{2}$; 1 $\frac{1}{2}$, 3; $\frac{1}{8}$, $\frac{1}{16}$ open divided scales; 1 drawing pen; 1 pair dividers; 1 pair compasses with ink and pencil points, lengthening bar, etc.; 1 set spring bows, crow-quill pens, French curves, 1 2ft. pocket rule, Arkansas oil stone, thumb-tacks, paper, tracing vellum, pencils, rubber, colors, sponge, brushes, nest of saucers, water mug, etc.

The expenses for the three years forming the regular course in the department of Engineering are approximately as follows :—

Sessional Fees	\$120 00
Books, instruments, drawing materials, laboratory fees, etc.....	120 00
	120 00
Total	\$240 00

These expenses are divided equally between the three sessions.

Each student in this department will in future be required to contribute \$1 per annum to a fund for the purpose of covering breakages and losses occurring to apparatus and furniture.

The payment of this fee will, however, not free any student from the liability to make good any loss or damage to instruments or furniture, arising from want of proper care on his part, when the above fund may prove insufficient for the purpose.

* Mining Engineering only.

DOMINION AND PROVINCIAL LAND SURVEYORS.

Courses of instruction will be given in accordance with the requirements of the Statutes relating to Dominion and Provincial Land Surveyors, which will enable the students, who after examination obtain certificates therein, and who have otherwise fulfilled the provisions of the said Statutes, to present themselves for final examination before the proper Boards, at an earlier period in their apprenticeship than would otherwise be permitted.

Extracts from the Provincial Act respecting Land Surveyors and the Survey of Lands.

(1) Any person who has followed a regular course of study at the Ontario School of Practical Science in the subjects of drawing, surveying and levelling, and geodesy and practical astronomy, and who has thereupon received, after due examination, a certificate of having passed one session, two sessions, or three sessions, as the case may be, in the study of the aforesaid subjects, may, after having passed the preliminary examination hereinbefore required for admission to apprenticeship with a land surveyor, be received as an apprentice by any practising land surveyor, and shall thereupon, if he has received a certificate of having passed three sessions in the study of the said subjects, be only holden to serve as such apprentice during twelve successive months of actual service; or, in case he has only received a certificate of having passed only one or two sessions, as the case may be, in the study of the said subjects, then, for such time of actual service as, with the period spent by him at such session or sessions, suffices to make up the full time of three years.

(2) After such actual service, such person shall, subject to the other provisions of this act, have the same right to present himself for and to undergo the examination required by law, and if found qualified, then to be admitted to practise as a land surveyor as if he had served the full three years' apprenticeship otherwise required by law.

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Extract from the Dominion Lands Act.

Any person who shall have followed a regular course of study in all the branches of education required by this Act for admission as a Dominion Land Surveyor, through the regular sessions, for at least two years in any College or University where there may be organized a complete course of such instruction, and who has thereupon received from such college or university a certificate, diploma or degree vouching therefor, shall not be obliged to serve three years as aforesaid, but shall be entitled to examination after one year's service under articles with a Dominion Land Surveyor as aforesaid.

NOTE.—The above applies to those taking the regular course for the Diploma of the School as well as to those who obtain the special Certificate in Surveying.

The fee for special Students in surveying is \$30 per Session.

The attention of Candidates for the certificate in Higher Surveying, given by the Dominion Board of Examiners, is directed to the facilities afforded for preparation in the School.

 DEGREE OF C. E.

The attention of regular Students in the Civil Engineering course is directed to the following Statute, lately passed by the Senate of the University of Toronto :—

DEGREE OF C. E.

BY THE SENATE OF THE UNIVERSITY OF TORONTO.

Be it enacted :

- I. That all previous Statutes of the University relating to Degrees or Diplomas in Civil Engineering, be hereby repealed.
- II. That the Degree of C. E. be hereby established, to be granted subject to the following conditions and regulations :
 1. Candidates for the said degree shall hold the Diploma in Civil Engineering of the Ontario School of Practical Science.

2. Candidates shall have spent three years after receiving the said Diploma in the actual practice of the profession of Civil Engineering.
3. Candidates shall have spent at least two years of the said period in the construction and operation of engineering works, as distinguished from surveys merely.
4. Satisfactory evidence shall be offered as to the periods spent on the different classes of engineering employment, and intervals during which the candidate was not engaged in the construction or operation of engineering works, or in the prosecution of surveys, shall not be included as portions of the aforesaid period of three years.
5. It shall not be necessary that the several intervals required to make up the period of three years be consecutive.
6. Each candidate shall prepare for the approval of the Senate an original essay on some engineering subject, accompanied with detailed explanations, drawings, specifications and estimates ; he shall also be examined on the subject of the essay, as well as on the work or works on which he has been engaged, unless exempted therefrom on the special recommendation of the examiners.
7. The subject of the said essay shall be forwarded to the Registrar for the approval of the Senate, not later than the first day of February.
8. Candidates shall notify the Registrar of their intention of proceeding to the Degree of C. E., not later than the first day of April.
9. The evidence required in section 4, together with the essay, drawings and estimates, shall be sent to the Registrar not later than the first day of May.
10. The examination of the essay, drawings and estimates, and any further examination of the candidate that may be considered necessary, may be held in May.
11. The fee for the Degree of C. E. shall be \$20, and shall be paid to the Registrar not later than the first day of May.
12. The essay, drawings and estimates, submitted by the candidate, shall be the property of the University.

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2. DEPARTMENT OF ASSAYING AND MINING GEOLOGY.

In this Department the student is fully prepared in all the methods of analysis necessary to render him a competent Assayer. He is also qualified to survey and report upon the value of mineral lands.

SUBJECTS OF FIRST YEAR :

1. Elementary Mathematics, including Mensuration and Plane Trigonometry.
2. Elements of Natural Philosophy, including Mechanics and Hydraulics.
3. Inorganic Chemistry.
4. Elementary Mineralogy and Blowpipe Practice.
5. Elementary Biology.
6. Physical Geography, Palaeontology and Geology.
7. Drawing.

SUBJECTS OF SECOND YEAR :

1. Higher Mathematics, including Spherical Trigonometry, etc.
2. Chemistry, with Laboratory practice in Qualitative Analysis.
3. Blowpipe Analysis and Determinative Mineralogy.
4. Geology and Economic Minerals of Canada.
5. Surveying and Levelling.

SUBJECTS OF THIRD YEAR :

1. Quantitative Chemical Analysis.
2. Metallurgy.
3. Assaying.
4. Study of Metallic Veins and other Mineral Deposits, Mining Calculations, Examinations of Mineral Lands.

3. DEPARTMENT OF ANALYTICAL AND APPLIED CHEMISTRY.

This Department is under the charge of the Professor of Applied Chemistry.

The course is intended to render the student proficient in all the methods of Analytical Chemistry, and to fit him for such positions as that of Public Analyst, Consulting Chemist in regard to Manufactures, or Resident Chemist in manufactories where such is required.

SUBJECTS OF FIRST YEAR :

1. Algebra, Euclid and Plane Trigonometry.
2. Natural Philosophy, with work in the Laboratory.
3. Elementary Biology.
4. Elementary Chemistry, with work in the Laboratory.

SUBJECTS OF SECOND YEAR :

1. Elementary Mineralogy and Geology.
2. Blowpipe Practice and Assaying.
3. Laboratory Work in Qualitative and Quantitative Analysis.

SUBJECTS OF THIRD YEAR :

1. Applied Chemistry.
2. Organic Chemistry.
3. Laboratory Work, including Technical Analysis, Quantitative Mineral Analysis, a prescribed course in Physiological Chemistry, and in Chemistry in its relations to Hygiene and Forensic Medicine.

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COURSES SUITABLE FOR MEDICAL STUDENTS.

In arranging the courses under this heading, the Board has been guided by the New Medical Curriculum of the University of Toronto. The Board proposes to provide instruction in all the extra-professional and more purely scientific studies there laid down, and it does so in the hope that Medical Students may be able to take advantage of the commodious laboratory accommodation which is provided in each Department, and acquire that personal familiarity with the use of Physical and Physiological apparatus which forms such an admirable training for the scientific medical man.

The courses (for details of which see pp. 25-28) comply, as to duration, with the regulations of the University of Toronto.

No fees are charged for the lectures if taken along with the practical courses. The fee for each practical course is \$10. (See Regulations 6 and 7.)

Synopsis of the Courses of Lectures
AND PRACTICAL INSTRUCTION GIVEN IN EACH
DEPARTMENT,

WITH FEES FOR SPECIAL STUDENTS.

N.B.—Students who take the Practical Courses may attend the Lectures free of charge.

Special Students are advised to enter at the beginning of the Session (October 1st), as many subjects begun in the first are continued through the Second Term, and Lectures cannot be repeated.

I. ENGINEERING.

(Reductions will be made to Students taking several Courses.)

☞ Text-Books for First Year marked (a) ; for Second Year, (b) ; for Third Year, (c).

(I.) DRAWING.

Model Drawing, Machines and Constructions, Map and Topographical Drawing, Designs and Estimates.

Descriptive Geometry, including Practical Geometry (Plane and Solid) ; Orthographic, Oblique and Perspective Projections ; Intersections of Surfaces, Shades and Shadows, Stone-Cutting, Principles of Mechanism, etc.

Text-Books and Books of Reference.—Davidson's Projections.

Angel's Plane and Solid Geometry.

Binns' Orthographic Projection.

Church's Descriptive Geometry (a), (b),
(c).

Warren's Stone-Cutting (c).

McCord's Lessons in Mechanical Drawing.

Worthen's Topographical Drawing (a),
(b), (c).

Fee for Special Students, \$10.

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(II.) SURVEYING AND LEVELLING.

LAND SURVEYING—

- Chain Surveys.
- Compass and Theodolite Surveys.
- Methods of keeping Field Notes.
- Determination of Heights and Distances.
- Determination of the Meridian, Local Time and Latitude.
- Plotting.

LEVELLING—

- Longitudinal and Cross Sections.
- Plotting.

SETTING OUT—

- Setting out Straight Lines and Curves.
- Setting out Levels.

MENSURATION—

- Lines, Surfaces and Solids.
- Timber, Masonry, Iron and Earthwork.
- Capacities of Reservoirs, Discharge of Streams, etc.

Lectures will also be given on the distinctive features of Hydraulic, Mining and Hydrographic Surveying.

Text Books.—Murray's Manual of Land Surveying (a).

- Gillespie's Higher Surveying (b), (c).
- Henck's or Trautwine's Railway Curves (b).
- Fee for Special Students, \$10.

(III.) GEODESY AND PRACTICAL ASTRONOMY.

(Only the more elementary work under this head will be obligatory.)

- Field work.
- Calculation of the Triangles.
- Projections of the Sphere.
- Methods of determining Latitude, Local Time, Direction of the Meridian, and Difference of Longitude.
- Theory of the Instruments.

Text Books.—Gillespie's Higher Surveying (b), (c).

- Chauvenet's Spherical and Practical Astronomy.
- Nautical Almanac for 1886 (c).
- Chambers' Practical Mathematics (c).
- Fee for Special Students, \$15.

(IV.) APPLIED MECHANICS.

STATICS—

The Calculation of the Stresses in Framed Structures, Solid Beams, Stone Arches, etc. Both Graphical and Analytical Methods used.

THEORY OF THE STRENGTH OF MATERIALS.

DESIGNING OF STRUCTURES in Timber, Iron and Masonry—Arches, Retaining Walls, Foundations, Roofs, Bridges, etc.

DYNAMICS—

Representation and Measurement of Forces and Motions.

Principles of *Work* and *Energy*.

Efficiency of Machines. Friction.

Transmission of Energy—Belts, Shafts, Crank and Connecting Rod, etc.

Fly-Wheels, Governors.

Balancing of Machinery.

Etc., etc.

STRENGTH OF THE PARTS OF MACHINES.

MACHINE DESIGN.

HYDRAULICS—

Discharge of Water through Orifices, Notches, etc., Flow in Pipes and Channels. Water Power. Water Wheels, Turbines, Pumps.

THERMO-DYNAMICS AND THEORY OF THE STEAM ENGINE.

Text Books and Books of Reference.—Von Ott—Graphic Statics (a).

DuBois—Graphical Statics.

Wood—Resistance of Materials.

“ Bridges and Roofs.

Rankine—Applied Mechanics (b), (c).

Rankine—Steam Engine and other Prime Movers.

Unwin—Elements of Machine Design.

Shann's Elementary Treatise on Heat (c).

Kutter—Hydraulic Tables (c).

Neville's Hydraulic Tables and Formulae (c).

Fee for Special Students, \$15.

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(V.) PRINCIPLES OF MECHANISM.

Principles of the Transmission of Motion without reference to force :—

Pitch Surfaces, Spur Wheels, Bevel Wheels, Skew-bevel Wheels,
Trains of Wheelwork, Teeth of Wheels, Cams, Cranks, Eccentrics,
Links, Bands and Pulleys, Hydraulic Connections, Frictional
Gearing, Link Motion for Slide Valves, etc., etc.

Text-Books and Books of Reference.—Rankine—Machinery and Millwork.

Camus—Teeth of Wheels.

MacCord—Slide Valve and Eccentric.

Goodeve—Elements of Mechanism.

Fee for Special Students, \$15.

The foregoing comprises the work to which the lectures and practical instruction will be principally confined. In addition, the Student will be required to obtain, by reading and observation during his course, a certain amount of information regarding the processes and details of Engineering Works, as below :

(VI.) ENGINEERING WORKS.

Roads and Bridges.

Canals and Harbours.

Water and Sewage Works.

Manufacture of Iron and Steel.

Manufacture of Mortars and Cements.

Workshop and Foundry Practice.

Mining Machinery and Processes.

Since information on these subjects is given in a plain and intelligible manner in the various treatises relating thereto, which can always be consulted by the Engineer when engaged in the actual practice of his profession, it has not been deemed expedient that much time should be given to them in the School.

(VII.) MATHEMATICS.

The Pure Mathematics included in this course will be taught in University College.

The Applied Mathematics will be taught partly in University College and partly in the School.

(VIII.) VACATION WORK.

THESIS AND CONSTRUCTION NOTES.

A subject will be given at the end of each session on which the student will be required to write a Thesis (accompanied with drawings and specifications when necessary), during the subsequent vacation.

The student will also be required to make, during the vacation, full and clear notes of various constructions of engineering interest that may fall under his notice.

The value of both the Thesis and the construction notes will be taken into account in determining his standing at the next following examination.

Subject of Thesis for Second Year.—Roads, Streets and Pavements.

“ “ *Third* “ Sanitary Drainage.

Books of Reference.—Gillmore—Roads, Streets and Pavements.

Waring—Sanitary Drainage of Houses and Towns.

Any other works on the above subjects may be consulted, and results of original observation should be given.

II. CHEMISTRY.

All the instruction in this subject is given in the School of Science.

COURSES OF LECTURES.

1. Inorganic Chemistry.

Text-Books and Books of Reference.—Fownes' Manual of Chemistry, vol. i. (Inorganic Chemistry).

Miller's Elements of Chemistry, vol. ii.

Roscoe and Schorlemmer—Treatise on Chemistry, 3 vols.

Remsen—Principles of Theoretical Chemistry.

2. Organic Chemistry.

Text-Books.—Fownes' Manual of Chemistry, vol. ii. (Organic Chemistry).

Armstrong, Organic Chemistry.

Miller's Elements of Chemistry, vol. iii.

Roscoe and Schorlemmer, Treatise on Chemistry, vol. iii., parts 1 and 2.

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3. Historical Development of the Theories of Chemistry.

Books of Reference.—A Dictionary of Chemistry, by H. Watts.

Die Moderne Theorien der Chemie—A. Meyer.

Geschichte der Chemie—H. Kopp.

History of Chemistry—Thomson.

4. Applied Chemistry.

Building Materials. Paints and Preservation of Wood, Iron and

Stone. Explosives. Artificial Lighting. Fuel and Furnaces.

Metallurgy. Water Supply and Sewage.

PRACTICAL WORK IN THE LABORATORY.

1. Qualitative Analysis.

Text-books.—Qualitative Analysis—Fresenius.

Qualitative Analysis—Douglas and Prescott.

Practical Chemistry—Jones.

Fee, \$10 per annum.

2. Quantitative Analysis.

Text-books.—Quantitative Analysis—Fresenius.

For Reference—Volumetric Analysis—Sutton.

Volumetric Analysis—Fleischer.

Gasometrische Methoden—Bunsen.

Titrimetrische Methoden—Mohr.

Fee, \$50.

3. Special Analytical Courses required for the Diplomas in the Departments of Engineering and Analytical and Applied Chemistry.

Fee, \$10.

4. Physiological Chemistry.

Text-book.—Hand-book for the Physiological Laboratory, Dr. Lauder—

Brunton, pp. 421, 572.

For Reference—Hoppe-Seyler.

Neubauer and Vogel.

Fee, \$10.

5. Chemistry in relation to Hygiene and Forensic Medicine.

Text-book.—Taylor's Medical Jurisprudence.

For Reference—Otto's Ausmittlung der Gifte.

Dragendorff's Manuel de Toxicologie.

Gautier's Chimie appliquée à l'hygiène, etc.

Fee, \$10.

The work included under 3, 4, and 5 is under the charge of the Professor of Applied Chemistry.

MINERALOGY AND GEOLOGY.

COURSES OF LECTURES.

1. Elementary Course.—Rudiments of Mineralogy.
Geology and Palæontology.
Physical Geography.

Text-Books and Books of Reference.—Chapman's Mineralogy and Geology of Canada, 2nd edition.

Dana's Manual of Mineralogy.

Dana's Text-Book of Geology.

Page's Physical Geography.

Johnston's Elementary Physical Atlas.

2. Advanced Course.—Mineralogy and Crystallography.

Geology and Palæontology.

Mathematics of Crystallography.

Physical Geography.

Geology and Palæontology of Canada.

Text-Books and Books of Reference.—Dana's System of Mineralogy.

Chapman's Outline of the Geology of Canada, 1876.

Nicholson's Palæontology.

Chapman's Synopsis.

PRACTICAL COURSES.

1. Use of Blowpipe.—Chapman's Blowpipe Practice.

Fee, \$10.

2. Blowpipe Analysis, Determinative Mineralogy. Economic Minerals of Canada.

Kerl's Leitfaden bei qual. u. quant. Löthrohr-Untersuchungen, 2te. Aufl. Plattner's Blowpipe Treatise. Von Kobell's Tabellen. Chapman's Mineral Tables.

\$15.

3. Assaying.—Mitchell's Assaying, by Crooks.

Kerl's Probirkunst.
Chapman's Assay Notes.

Fee, \$50.

4. Mining Geology.—*Books of Reference.*—Burat's Géologie Appliquée and Cours d'Exploitation des Mines. Niederist's Bergbaukunde. Von Cotta's Erzlagerstätten.

Fee, \$20.

IV. BIOLOGY.

LECTURES (IN UNIVERSITY COLLEGE).

1. Elementary Biology, inclusive of Rudiments of Animal and Vegetable Morphology and Physiology.

Text-Books.—Thomé's Botany.

Huxley's Physiology.

Packard's Zoology.

2. Cryptogamic Botany : a short course.

Text-Book.—Sach's Text-Book of Botany.

3. Zoology.

Text Books.—Huxley's Invertebrata.

Claus' Zoologie.

Gegenbaur's Manual of Comparative Anatomy.

4. Comparative Anatomy of Vertebrata.

Text-Books.—Huxley's Vertebrata.

For Reference.—Owen's Vertebrata.

For Diagnosis.—Jordan's Manual of American Vertebrates.

 PRACTICAL COURSE (IN SCHOOL OF SCIENCE).

1. Elementary Practical Biology, with the use of the Microscope and the study of Animal and Vegetable Tissues.

Text-Books.—Huxley and Martin's Biology.
Rutherford's Histology.

2. Advanced Course.

Text-Book.—Rolleston's Forms of Animal Life.

3. Specialized Course for Study of Vertebrate Anatomy.

Works of Reference.—Foster and Balfour's Elementary Embryology.
Morphology of the Skull—Parker and Bettany.

(Various standard works of reference in connection with above courses may be found in the Laboratory, as Carus' *Icones Zootomicæ*; Broon, *Classen und Ordnungen*, etc.)

4. Histology.

Works of Reference.—Descriptive.—Stricker's Manual of Histology.

Frey's Histology and Histo-chemistry.

Technical.—Klein, Hand-book for Physiological Laboratory, pp. 1-163.

Rutherford, Histology.

 V. MATHEMATICS AND PHYSICS.

The ordinary Course embraces Euclid, Algebra, Plane Trigonometry, Statics of Solids and Fluids, Dynamics of a particle, Geometrical Optics, Sound, Heat, Electricity, and Plane Astronomy.

The Lectures in Physics will be fully illustrated by experiments.

The advanced Course embraces Spherical Trigonometry, Analytical Geometry (Plane and Solid), Differential and Integral Calculus, Theory of Equations, Statics of Solids and Fluids, Particle and Rigid Dynamics, Hydrodynamics, Optics, Acoustics, Thermo-dynamics, Electricity, and Astronomy.

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VI. ETHNOLOGY.

Anthropology. The skull, its bones and sutures. Structure and functions of the brain. Typical race-forms of head. Hair, colour and other distinctive ethnical elements. Succession of races. The Prehistoric, Unhistoric and Historic races.

Physical evidences of diversity of race.

Philological evidence.

The lectures are illustrated by means of maps, drawings, specimens of typical skulls, primitive implements, etc.

Text-Books.—Tylor's Anthropology: an Introduction to the Study of Man and Civilization.

Brace's Manual of Ethnology.

Latham's Ethnology of British Isles.

“ Ethnology of Europe.

“ Man and his Migrations.

Max Müller's Science of Language, 1st Series.

Additional Books of Reference.—Pritchard's Researches into the Physical History of Man.

Pritchard's Eastern Origin of the Celtic Language (Latham's Ed).

Latham's Varieties of Man.

Neibuhr's Ethnography.

Wilson's Prehistoric Man (3rd Ed.)

 PHYSICAL LABORATORY.

The Physical Laboratory which has been lately established is furnished with a large collection of apparatus for lecture experiments in the departments of Mechanics, Sound, Light, Heat and Electricity. It is also well supplied with instruments of precision for individual work in the same departments. In addition to an Elementary Laboratory, there are several special Laboratories, which offer unusual facilities for the conduct of experiments in the various branches of Physics.

A workshop is being fitted up in connection with the Physical Laboratory.

MODERN LANGUAGES.

Students in the regular courses are admitted, without extra charge, to the French and German classes in University College (see regulation 9). No special examinations are held in these languages, but it is expected that every student of a regular course should be able to acquaint himself with the contents of any of the works necessary to his profession, written in these languages. Such books may be prescribed for the terminal examinations.

LIBRARIES, MUSEUMS, ETC.

The library of the School is well provided with works bearing upon the more technical parts of the regular courses.

It is open to regular students under certain restrictions imposed by the Board.

The Library, Museums and Herbarium of the University of Toronto are open to regular students.