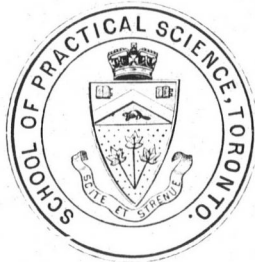


PROSPECTUS
OF THE
SCHOOL OF PRACTICAL SCIENCE
PROVINCE OF ONTARIO,
WITH A
SYLLABUS
OF THE

*Courses of Instruction and of the Regulations for
Diplomas.*

Tenth Session,



1887-8.

TORONTO:
PRINTED BY WARDWICK & SONS, 26 AND 28 FRONT STREET WEST.
1887.



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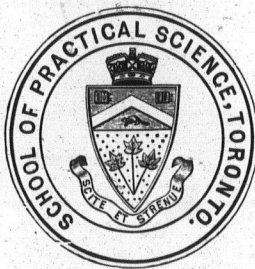
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Faculty of the School.

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

MEMBERS OF THE BOARD :

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

ASSISTANT INSTRUCTORS, 1886-7 :

A. BAKER, M.A.....*Mathematical Tutor.*
W. J. LOUDON, B.A.....*Demonstrator in Physics.*
F. W. BABINGTON.....*Demonstrator in Applied Chemistry.*
J. H. McGEARY, B.A.....*Fellow in Mathematics.*
L. H. BOWERMAN.....“ *Physics.*
A. B. McCALLUM, B.A.....“ *Biology.*
F. T. SHUTT, B.A.....“ *Chemistry.*
H. R. WOOD, B.A.....“ *Mineralogy and Geology.*
D. BURNS.....“ *Engineering.*

SECRETARY OF THE BOARD :

W. DALE, M.A.,

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

Engineering Department.

SESSION 1886-7.

STUDENTS IN ATTENDANCE.

REGULAR STUDENTS.

1st Year.

BOULTON, A.	HAULTAIN, H. E. T.	PEAKE, C.
BUCKE, M.	IRVINE, J.	PETERSON, C. E.
CAREY, B.	JAMES, D. D.	SHILLINGLAW, W. H.
CHALMERS, W. J.	McCOLLUM, T. B.	SULLIVAN, E. A.
CLEMENT, W. A.	MILL, F.	THACKER, H. C.
FAWELL, J. H.	MOBERLY, H. K.	WICKETT, T.
HANNING, G. F.	MOSS, F. H.	

2nd Year.

APSEY, J. F. (P.L.S.)	COYLE, J.	RITCHIE, N. T.
ASHBRIDGE, W. T.	GIBBONS, J.	ROSE, K.
BROWN, D. B.	McDOWALL, R.	ROSS, J. E.
CANNIFF, C. M.	McFARLEN, G. W.	STEVENSON, D.
CHEWETT, H. J.	MICKLE, G. R. (B.A.)	WITHROW, W. J.
COLQUHOUN, W. E.	RICHARDSON, G. H.	WRIGHT, C. H. C.

3rd Year.

BALL, E. F.	MARANI, C. J.	MOORE, J. H.
BURNS, J. C.	MARTIN, F. A.	PINHEY, C. H.
LOTT, A. E.	McCULLOCH, A. L.	ROGER, J.

SPECIAL STUDENTS.

1st Year.

Mechanical Engineering.

MATHER, C. D.	PRICE, A.	WILKIE, G.
STRICKLAND, H. F.		WILSON, C. H.

2nd Year.

Mechanical Engineering.

JAMIESON, J. W.	LEASK, J. L.	MURRAY, R.
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Surveying.

DRISCOLL, T.	FITZGERALD, JAS.	FLEMING, J.
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No
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1881.—

1882.—

1883.—

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GRADUATES.

NOTE.—Graduates are requested to inform the Professor of Engineering as to changes in their addresses.

1881.—J. L. Morris, C. E., P. L. S., Pembroke.

1882.—J. McAree, P. L. S., D. T. S., Toronto.

D. Jeffrey, Contractor, Winnipeg.

J. H. Kennedy, C. E., Architect, etc., St. Thomas, Ont.

1883.—G. H. Duggan, Dominion Bridge Co., Montreal.

J. W. Tyrrell, P. & D. L. S., Meteorological Observatory, Toronto.

D. Burns, Fellow in Engineering, School of Practical Science, Toronto.

1884.—E. W. Stern, Kansas City, Mo.

A. R. Raymer, Assistant Engineer, Canadian Pacific Railway, Greenville, Maine.

J. Robertson, P. L. S., Coad & Robertson, Civil Engineers, P. L. Surveyors, etc., Glencoe, Ont.

W. C. Kirkland, Canadian Pacific Railway.

J. McDougall, B. A., Canadian Pacific Railway, London, Ont.

1885.—B. A. Ludgate, P. L. S., Peterboro', Ont.

O. McKay, P. L. S., Windsor.

E. E. Henderson, Architect's Office, London, Ont.

F. W. Bleakley, care of A. W. Keadie, Quincy, California.

H. J. Bowman, P. L. S., Berlin, Ont.

1886.—T. K. Thompson, Dominion Bridge Co., Montreal.

H. G. Tyrrell, Assistant Engineer C. P. R., Sherbrooke.

R. Laird, Surveyor's Office, Willowdale, Ont.

A. M. Bowman, Surveyor's Office, Berlin, Ont.

E. B. Hermon, P. & D. L. S., Vancouver, British Columbia.

FELLOWSHIP IN ENGINEERING.

A Fellowship of the value of \$500 per annum paid in eight monthly installments, has been established, open only to Graduates in Engineering of the School.

The Fellow is required to take such portions of the work of instruction as may be assigned to him by the Professor of Engineering.

Candidates for the Fellowship are required to make written application to the Secretary on or before 20th September.

PRIZEMEN.

1879.—	I. Year	J. McAree	1st prize.
1880.—	II. Year	J. L. Morris	1st prize.
1881.—	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 prize.
	II. Year	G. H. Duggan	1st prize.
	III. Year	D. Jeffrey	1st prize.
1883.—	I. Year	B. A. Ludgate	1st prize.
	" "	A. M. Bowman	2nd prize.
	II. Year	A. R. Raymer	1st prize.
	" "	E. W. Stern	2nd prize.
	III. Year	G. H. Duggan	1st prize.
1884.—	II. Year	B. A. Ludgate	1st prize.
	III. Year	E. W. Stern	1st prize.
	" "	A. R. Raymer	2nd prize.
1885.—	I. Year	A. E. Lott	1st prize.
	" "	J. Roger	2nd prize.
	II. Year	T. K. Thompson	1st prize.
	III. Year	B. A. Ludgate	1st prize.
1886.—	I. Year	C. H. C. Wright	1st prize.
	" "	J. E. Ross	2nd prize.
	II. Year	A. E. Lott	1st prize.

UNIVERSITY OF TORONTO.

DEGREE OF C. E.

Date of Admission.

1885.....	J. L. Morris.
1886.....	J. H. Kennedy.

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 BATES
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Department of Analytical and Applied Chemistry.

REGULAR STUDENTS.

1st Year.

BOUSTEAD, W. JAMES, O. S.

2nd Year.

BUSH, J. E. JOHNSTON, R. A. A.

SPECIAL STUDENTS.

HARRISON, F. S. HEDLEY, R.

Medical Students.

1st Year.

AMTOT, J. A.	GORDON, A. R.	MASON, R. H.
ARCHER, D.	GORDON, E. P.	MATBURY, A. W.
BAKER, W. A.	HARDIE, R. A.	MILLMAN, M. G.
BARKER, L. F.	HANSBERGER, J.	MORTON, —
BATES, S.	HERRIMAN, W. C.	PHILIP, W. H.
BLEWETT, W. J.	HUTCHISON, D.	PUGH, W. M.
BOND, W. A.	IRVINE, EMILY.	REID, W.
BOWIE, E. F.	IRWIN, E. F.	ROONEY, R. W.
BUEGLASS, A. S.	JAMISON, F. H.	ROTCK, G.
CARVETH, C. E.	LUNDY, P.	SHANNON, G. A.
CLENDENNAN, C. W.	MCGILLIVRAY, W.	SHIEL, R.
DAVIS, LELIA A.	MCLEOD, J. A.	STARR, C. L.
DOWNES, H.	MASALES, W. L.	STRAIN, E.

2nd Year.

AYLSWORTH, A. C.	GRUNDY, H.	SILVERTHONE, G.
BALDWIN, W.	LOCKYER, C. D.	SISELEY, E.
BARBER, W. C.	MCBRIDE, J.	SISELEY, O.
BOWLEY, G. H.	MCCOLL, H.	SMITH, W. A.
BOWMAN, J. E.	MCFAY, T. H.	STEWART, H. A.
CAMPBELL, J. T.	MCGILLAWEE, J.	STONE, J. A.
CLARK, E. P.	MCLACHLIN, C.	WALKER, N.
CHISHOLM, W. P.	MACNAMARA, C.	WALWIN, H.
COLLINS, J. H.	MULCAHY, M. V.	WEBSTER, J.
EARLEY, W. I.	PALMER, R. H.	WHITEMAN, G. A.
FARRISH, M. J.	PATTON, J. C.	WILLSON, A. J.
FERGUSON, T. A.	PHAIR, W. R.	WILMOT, W. E.
GILLIE, M. B.	REYNOLDS, A.	WRIGHT, W. C.
GODFRET, F. E.	SANGSTER, W. A.	

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School of Practical Science,

PROVINCE OF ONTARIO.

PROSPECTUS FOR THE SESSION 1887-8.

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, and assistants in the several departments.

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.

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 offers to Medical Students thoroughly practical courses of instruction in those sciences which form the best preliminary training for the study of Medicine. The Lectures and Laboratory Courses are arranged so as to conform with the Regulations of the University of Toronto.

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*.

MECHANICAL ENGINEERING.

Students intending to become mechanical engineers will enter as special students, and receive instruction in the principles of

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mechanism, the theory of machines and drawing, together with such work in the civil engineering course as may be suitable for their purpose.

ELECTRICAL ENGINEERING.

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 furnished with a good collection of electrical instruments; and a separate room will be set apart for experimental work in this department. Special attention will be given to the subject of Electrical Testing. In connection with the Physical Laboratory there is a workshop, the power being given by a 4 H.-P. gas engine.

ARCHITECTURE.

Students who intend to pursue Architecture as a profession, are advised to take, if possible, the regular course in civil engineering, as the instruction given in this course in the subjects of Drawing, Colouring, Principles of Construction (Carpentry, Masonry and Ironwork), Strength and other Properties of Building Materials, Flow of Water and Air, Theory of Heat, etc., will be as useful to them as to civil engineers. They may enter as special students if they please.

REGULATIONS
RESPECTING THE
SCHOOL OF PRACTICAL SCIENCE.

*Approved by His Honour the Lieutenant-Governor in Council the
4th day of February, 1887.*

1. The internal management and discipline of the School shall be vested in the Board consisting of the Professors and the Chairman, as nominated by the Lieutenant-Governor in Council.
2. The Academic Year shall consist of two Terms, the First Term extending from 1st October to 23rd December; and the Second Term from 8th January to 18th April.
3. There shall be three Departments in which Diplomas shall be granted, viz :—
 - (1) Civil Engineering (including Mining Engineering.)
 - (2) Assaying and Mining Geology.
 - (3) Analytical and Applied Chemistry.

A Diploma shall be granted to each student who shall have completed to the satisfaction of the Faculty, the Regular Course in any one of the above Departments.

4. The Regular Course for the Diploma of the School in each Department is three years in duration.
5. A student who proposes to obtain the Diploma of the School in one of the above Departments must have passed the Matriculation Examination required for admission to a University in any part of Her Majesty's Dominions, or the Entrance Examination of the Law Society of Upper Canada, or of the College of Physicians and Surgeons, or any of the Examinations prescribed for Teachers in Public or High Schools of the Province of Ontario, or must present a certificate signed by a Head Master of a High School or Collegiate Institute that he possesses qualifications equivalent to those required for such teachers.

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6. Special Students may be permitted to attend such lectures or courses of instruction or of practical work, as the Board may think proper.
 7. Certificates of attendance and standing may be given upon due examination to Special Students, and such-students shall not be required to pass an Entrance Examination.
 - (6 and 7 apply to Medical Students taking special work, also students preparing themselves to be Surveyors, Mechanical or Electrical Engineers, Architects, etc.)
 8. At the conclusion of each term, examinations will be held in the different 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.
 9. 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.
 10. Students of the School of Practical Science shall attend such courses of lectures as are delivered by the Professors of the 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 especially appointed for students of the School.
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REGULAR COURSES FOR THE DIPLOMA.

See especially regulations 2, 3, 4, 5, 8, 9, 10 : pp. 12 and 13.

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 Diploma.

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

- (1) Civil Engineering (including Mining Engineering).
- (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

.....
 of the 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 satis-
 faction 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 TABLE OF

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.
2-3.....		
3-4.....	Drawing.	Field Work.
4-5.....		
SECOND YEAR.		
9-10.....	Drawing.	*Calculus.
10-11.....		*Astronomy.
11-12.....		Chemistry (applied).
12-1.....	Strength of Materials.	Practical Chemistry.
1-2.....	Drawing.	
2-3.....	El. Mineralogy & Geology.	Field Work.
3-4.....		
4-5.....		
THIRD YEAR.		
9-10.....	Drawing.	Drawing.
10-11.....		
11-12.....	Theory of Internal Stress.	Thermodynamics.
12-1.....	Drawing.	Mineralogy.
1-2.....		Constructive Design.
2-3.....	Hydraulics. (a)	
3-4.....	Constructive Design.	Field Work.
4-5.....		

*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.

CIVIL ENGINEERING.

REGULAR COURSE.

1887-8, according to the subjoined Programme.

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

(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 Engineers (including under this term Mining Engineers).

Students who wish to devote themselves to the practice of Mining Engineering are allowed to take the work specially mentioned under this head, in the Third Year, and to omit the work in Experimental Physics.

They are advised, however, to take, if possible, the regular course in Civil Engineering and the special work subsequently as Special Students.

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.

Copying from the Flat. Lettering.

Model Drawing.

Map and Topographical Drawing.

Orthographic (including Isometric), and Oblique Projections. Graphics.

SURVEYING.

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

CHEMISTRY.

General Chemistry.

Practical do.

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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.
Coloring and Shading.
Descriptive Geometry, including Projections of the Sphere and
Theory of Mapping.
Machines and Structures.

ENGINEERING.

Theodolite Surveying (including laying out Railway Curves).
Principles of Geodesy (considering the Earth a Sphere).
Applied Mechanics.
Theory of Strength of Materials.
Materials of Construction.
Methods and Processes.
Theory of the Theodolite, Transit Theodolite and Level.

CHEMISTRY.

Practical Chemistry.

CHEMISTRY (APPLIED).

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

MINERALOGY AND GEOLOGY.

Elements of these Sciences.
Blowpipe Practice.
Determination of Minerals.

MINERAL

SUBJECTS OF THE THIRD YEAR.

APPLIED MATHEMATICS.

Dynamics of Machines.
Thermodynamics and Theory of the Steam Engine.
Hydraulics.

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EXPERIMENTAL PHYSICS.

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

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ink and
pens, I
paper,
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DRAWING.

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

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ENGINEERING.

Subjects of previous years continued.
Levelling. Setting out Excavation, Cross-sectioning, Calculation of Quantities.
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.
Geodesy (Considering the Earth a Spheroid).

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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.

MINERALOGY AND GEOLOGY.

Economic Minerals of Ontario.

Blowpipe Analysis and Determinative Mineralogy.

*Assaying and Mining Geology, Mining Calculations.

*Crystallography and Paleontology.

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

One drawing-board, 23"×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 $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$; 1 2; $\frac{3}{8}$, $\frac{1}{2}$; 1 1, 3; $\frac{1}{2}$, $\frac{1}{4}$ 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., and one portfolio for drawings.

The expenses for 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
Total	<u>\$240 00</u>

These expenses are divided equally between the three sessions.

Each student in this department is 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 the 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.

12. (2) 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 term of three years.

(3) 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 practice as a land surveyor, as if he had served the full three years' apprenticeship otherwise required by law.

14. The privilege of a shortened term of apprenticeship shall also be accorded to any graduate of the Military College at Kingston and of the Ontario School of Practical Science, and such person shall not be required to pass the preliminary examination hereinbefore required for admission

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to apprenticeship with a land surveyor, but shall only be bounden to serve under articles with a practising land surveyor duly filed as required by section 17 of this Act, during twelve successive months of actual practice, after which, on complying with all the other requirements, he may undergo the examination by this Act prescribed.

Extract from the Dominion Lands Act.

Every graduate in surveying of the Royal Military College of Canada, and every person who has 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 a complete course of theoretical and practical instruction in surveying is organized, and who has thereupon received from such College or University a Diploma as Civil Engineer, shall be exempt from serving three years as aforesaid, and shall be entitled to examination after one year's service under articles with a Dominion Land Surveyor, at least six months of which service has been in the field, on producing the affidavit required by the next preceding clause as to such service; but it shall rest with the Board to decide whether the course of instruction in such college or university is that required by this clause.

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

The attention of Candidates for the Diploma of D. T. S. 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, passed by the Senate of the University of Toronto in 1884 :—

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.

11. 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, Paleontology 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. Inorganic Chemistry, Elementary and Advanced, with work in the Laboratory.

SUBJECTS OF SECOND YEAR :

1. Elementary Mineralogy and Geology.
2. Blowpipe Practice and Assaying.
3. Organic Chemistry with Applied Chemistry, Laboratory Work in Qualitative and Quantitative Analysis.

SUBJECTS OF THIRD YEAR :

Candidates are expected to be able to read Chemical Works in the French and German Languages.

1. Applied Chemistry.
2. Inorganic Chemistry including Thermo Chemistry and the study of Mendelejeff's Periodic Law. Advanced Organic Chemistry, Historical Development and Chemical Theory and Physiological Chemistry.
3. Laboratory Works, 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 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 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. 33 & 37) 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 Term are continued through the Second, and Lectures cannot be repeated.

I. ENGINEERING.

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

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

(I.) DRAWING.

Model Drawing, Machines and Structures, Map and Topographical Drawing, Designs and Estimates, Graphical Calculations.

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

Fees 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.
 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, etc.

Lectures will also be given on the distinctive features of 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.

GEODESY—

Field Work.
 Computation of the Triangles (considering the Earth, 1st as a Sphere; 2nd, a Spheroid).
 Determination of the Figure of the Earth.

PRACTICAL ASTRONOMY.

Methods of determining Latitude, Local Time, Direction of the Meridian, and Difference of Longitude.

Theory of the Theodolite, Transit-Theodolite, Level, Sextant, and Solar Compass.

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

Chauvenet's Spherical and Practical Astronomy (c).

Nautical Almanac for 1888 (c).

Chamber's Practical Mathematics (c).

Fee for Special Students, \$15.

(IV.) APPLIED MECHANICS.

STATICS—

The Calculation of the Stresses in Framed Structures, Solid and Rivetted 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 Open Channels. Water Power. Water Wheels, Turbines, Pumps, etc.

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THERMO-DYNAMICS AND THEORY OF THE STEAM ENGINE.

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

DuBois—Graphical Statics.

“ Strains in Framed Structures.

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—Elementary Treatise on Heat
(c).

Jackson—Hydraulic Manual (c).

Neville—Hydraulic Tables and For-
mule (c).

Fee for Special Students, \$15.

(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 Con-
nections, Frictional Gearing, Link Motion for Slide Valves,
etc, etc.*Text-Books and Book 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 :

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 Practical Science.

COURSES OF LECTURES.

I. Inorganic Chemistry.—A course on Elementary Inorganic Chemistry suited to the Pass Examination, University of Toronto; to the Medical Examination, First Year, University of Toronto; and to the First Year, Engineering Course, School of Practical Science.

A Course on the Application of Chemical Theory to Calculation for the First Year, Engineering Course.

A Course on Advanced Inorganic Chemistry for the Second Year, Honour Science Examination, University of Toronto.

A Course on the Theory of Qualitative Analysis for the Second Year, Honour Science Examination, University of Toronto.

II. Organic Chemistry.—A Course on Organic Chemistry for the Third Year, Honour Science Examination, University of Toronto.

A Course on Elementary Organic Chemistry, for the Medical Examination, Second Year, University of Toronto.

III. Historical Development of Chemical Theory.—A Course for the Fourth Year Examination in Science, University of Toronto.

IV. Physiological Chemistry.—A Course for the Fourth Year Examination in Science, University of Toronto.

V. Applied Chemistry.—A Course on the Chemistry of Combustion, Fuel, Furnace, Artificial Lighting and Explosives, suited to the Examination for Second Year, Engineering Course.

A Course on the Chemistry of Building Materials, Water, Air, and Sewage, and on Metallurgy, suited to the Examination for Third Year, Engineering Course.

PRACTICAL WORK IN THE LABORATORY.

- I. Courses including Qualitative Analysis, suited to the Examinations for
 - (a) First Year, Engineering Course.
 - (b) Second Year, Honour Science, University of Toronto.
 - (c) First Year, Medicine, University of Toronto.
- II. Courses including Quantitative and Qualitative Analysis, for
 - (a) Second Year, Engineering Course.
 - (b) Third Year, Honour Science, University of Toronto.
- III. Physiological Chemistry for Second Year Examination in Medicine, University of Toronto.
- IV. Forensic and Hygienic Chemistry for Third Year Examination in Medicine, University of Toronto.
- V. A Course for Fourth Year Examination in Science, University of Toronto.

MINERALOGY AND GEOLOGY.

COURSES OF LECTURES.

1. Elementary Course.—Rudiments of Mineralogy.
Geology and Palaeontology.
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 Palaeontology.
Mathematics of Crystallography.
Physical Geography.
Geology and Palaeontology of Canada.

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

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

Nicholson's Paleontology.

Chapman's Synopsis.

PRACTICAL COURSES.

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

Fee \$10.

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

Keral's Leitfaden bei qual. u. quant. Lothrohr-Untersuchungen, etc.
Auf. 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 Geologie Appliquee and Cours d'Exploitation des Mines. Niederist's Bergbaukunde. Von Cotta's Erzlagerstätten.

Fee, \$20.

IV. BIOLOGY.

LECTURES.

1. The Elementary Course, largely demonstrational in character, discusses the Rudiments of Animal and Vegetable Morphology and Physiology.

Books of Reference.—Bessey's Botany.

Martin's Human Body.

Packard's Zoology.

2. The Second Year Lectures are chiefly devoted to Phanerogamic Botany, and the Zoology of the Vertebrata in reference to the Canadian Flora and Fauna.

For Reference.—Gray's Manual of Botany.

Jordan's Manual of Vertebrata.

3. The Lectures to Third Year Students discuss Cryptogamic Botany, Vegetable Physiology, and the Zoology of the Invertebrata.

For Reference.—Sachs' Text Book of Botany.

Claus' Zoology, translated by Sedgwick.

4. Fourth Year Students will receive instructions in the Comparative Anatomy and development of the Vertebrata, in Animal Physiology, and in the Biology of Microbes.

For Reference.—Wiedersheim's Text Book of Comparative Anatomy.

Balfour, Comparative Embryology, Vol. II.

PRACTICAL COURSES.

1. Methods of Biological research.

For Reference.—Behrens' Guide to the Microscope in Botany.

Whitman, Methods of Research in Microscopical Anatomy.

Practical study of the typical forms described in Huxley and Martin's Elementary Biology, with special attention to Histology.

For Reference.—Shafer's Essentials of Histology.

2. Study of typical forms of Cryptogamic Plants and Invertebrate Animals.

For Reference.—Bower and Vines, and Strassburger's Practical Botany.

Brooks' Invertebrate Zoology.

3. Study of the forms described in Parker's Zootomy of the Vertebrata and of the Embryology of the Fowl and Rabbit.

Text Books.—Foster and Balfour's Embryology.

Foster and Langley's Text-Book of Practical Physiology.

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COURSES FOR MEDICAL STUDENTS.

It is proposed to offer during the Session of 1887-8 Courses of Lectures and accompanying Laboratory Courses in Elementary Biology, Physiology and Histology which will qualify students for the examinations in these subjects held by the University of Toronto.

The Fee for each Course will be \$10.

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.

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 AND WORKSHOP.

The Physical Laboratory which has been lately established in connection with the University College 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.

The following is a list of the Electrical apparatus.

1. Gramme machine—Small size, (laboratory model.)
2. Deprez's motor and other small motors.
3. Sine and Tangent galvanometers.
4. Thomson's galvanometer.
5. Resistance coils—Wheatstone's Rheostat.
6. Wheatstone's bridge, etc.
7. Telephone transmitter (Ader's) and receivers.
8. Faraday's diamagnetic apparatus.
9. Holtz Electrical machine.
10. Carré Electrical machine.
11. Leyden Jars—Separate and in Batteries.
12. Collection of apparatus for experiments in Static Electricity.
13. Two Ruhmkorff coils—giving two-inch and ten-inch spark.
14. Geissler tubes, etc.
15. Electric radiometer.
16. Thermopiles.

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17. Clamond's thermo-electric battery.
 18. Collection of apparatus for showing the action of currents on other currents.
 19. Collection of permanent and electro magnets.
 20. Declination Compass and Dipping Needle.

A workshop has been begun in connection with the Physical Laboratory, provided with a gas engine, lathes, forge and tools, etc., for imparting elementary practical instruction in metal working.

MODERN LANGUAGES.

Students in the regular courses are admitted, without extra charge, to the French and German classes in University College (see regulation 10.) 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, Museums and Herbarium of the University of Toronto are open to regular students.

