# .. CALENDAR ...

RC82

OF THE

# SCHOOL OF MINING

(AFFILIATED TO QUEEN'S UNIVERSITY)

KINGSTON, ONTARIO.



EIGHTH SESSION

1900-1901.

KINGSTON ; PRINTED AT THE BRITISH WHIG, 1900.



# SCHOOL OF MINING



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# CALENDAR 1900-1901



#### VISITOR.

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| HIS | Honour  | SIR | OLIVER | MOWAT, | K.C.M.G. | O.C.  | Lieutenant, Governor | ~f |
|-----|---------|-----|--------|--------|----------|-------|----------------------|----|
|     | Ontario | э.  |        |        |          | 2.0., | Electremant Governor | OI |

| Chairman of the Board of Governors | JOHN MCKRUURY       |
|------------------------------------|---------------------|
| Vice Chairman                      | MCKELVEY            |
| vice-Chairman                      | W. BRUCE CARRUTHERS |

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| A. P. KNIGHT MA MD   |
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GEO. Y. CHOWN, B.A.....Secretary-Treasurer.

## ADVISORY COMMITTEE.

| The President of the Eastern Ontario Dairymen's | Association.   |
|---|----------------|
| W. R. WHITE, Q.C., Pembroke.                    | W. B. DALTON.  |
| D. M. MACPHERSON, Lancaster.                    | J. CARSON.     |
| JAS. STRATTON, M.P.P., Peterboro.               | J. L. HAYCOCK. |



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#### CALENDAR.

6

#### 1900.

September I-Notice of intention to appear at Matriculation or Supplemental Pass Examinations to be given in writing to the Registrar of Queen's University. Subjects upon which a candidate intends to write must be stated in his notice.

18—Supplemental Pass Examinations begin. (Held at Queen's University and such other points as may be fixed upon.)

18-Surveying Class (second year) begins.

20—Matriculation Examinations begin. (Held at Queen's University and such other points as may be fixed upon.)

October

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3-Classes open. (1st term.) Entrance Examination in Mathematics and English. (See p. 16.)

10-Holiday for Athletic Games.

December 22-Christmas Holidays begin.

#### 1901.

January 8-Classes re-open. (2nd term.)

February 20-Holiday.

April 6—Class work closes.
 8 Examinations begin.
 27—Meeting of Faculty to consider reports of examiners.
 May I—Convocation for distributing prizes, announcing honours, and laureating graduates.

TIME TABLE FOR MINING STUDENTS First Year. emental strar of late in-

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e p. 16.)

irs, and

TIME TABLE FOR MINING STUDENTS. First Year.

|        | VIII.               | IX.                             | X.                              | XI.                               | XII. | 11.                | III.            | IV.             | ν.      |   |
|--------|---------------------|---------------------------------|---------------------------------|-----------------------------------|------|--------------------|-----------------|-----------------|---------|---|
| Mon.   | *1. Elem.<br>Cryst. | 1. Elem.<br>Min.                | Jr.<br>Physics.                 | Jr.<br>Chemistry.                 |      | Workshop.          | Jr.<br>Math.    | ‡ Surveying.    |         | 1 |
| TUES.  | *1. Elem.<br>Cryst. | Drawing.<br>†Qual.<br>Analysis. | Drawing.<br>†Qual.<br>Analysis. | Jr.<br>Chemistry.                 |      | Workshop.          | Jr.<br>English. | ‡ Surveying.    |         | I |
| WED.   | *1. Elem.<br>Cryst. | Drawing.                        | Jr.<br>Physics.                 | Drawing.                          |      | Workshop.          | Jr.<br>Math.    | Jr.<br>English. |         |   |
| THURS. | Jr.<br>English.     | Drawing.                        | Drawing.                        | Jr.<br>Chemistry.<br>(Practical.) |      | Workshop.          | Jr.<br>English. | ‡ Surveying.    |         | I |
| FRIDAY | *1. Elem.<br>Cryst. | Drawing.                        | Jr.<br>Physics.                 | † Descript.<br>Astronomy.         |      | 1. Blow<br>Piping. | Jr.<br>Math.    | ‡ Surveying.    |         | T |
| SAT.   | 1. Elemen           | tary Mineralo                   | gy Excursio                     | ns-1st Term.                      |      |                    |                 |                 | T<br>bi | 1 |

<sup>†</sup>Second term only. <sup>‡</sup>First term only. \*Course of about 15 lectures at opening of term.

TIME TABLE FOR MINING STUDENTS.

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|-------|---------------|----------------------------------|----------------------------------|----------------------------------|------------------------|---------------------------------------|
| V.    | Surveying.    | . <b>i</b>                       | Surveying.                       | Surveying.                       |                        |                                       |
| IV.   |               | Qual. and<br>Quant.<br>Analysis. |                                  | Qual. and<br>Quant.<br>Analysis. | General<br>Engineering |                                       |
| III.  | Workshop.     | General<br>Engineering.          | Workshop.                        | Qual. and<br>Quant.<br>Analysis. | Workshop.              |                                       |
| II.   | Syst.<br>Min. | Geology.                         | Workshop.                        | Geology.                         | Workshop.              |                                       |
| XII.  |               |                                  |                                  | •}                               |                        | mber.                                 |
| XI.   | Drawing.      | Qual. and<br>Quan.<br>Analysis.  | 2. Syst.<br>Min.                 | Sr.<br>Chemistry.                | Sr.<br>Chemistry.      | Excursions.<br>ber and Nove           |
| X.    | Drawing.      | Sr.<br>Math.                     | Qual. and<br>Quant.<br>Analysis. | Sr.<br>Math.                     | Drawing.               | notabsenton<br>during Octo            |
| IX.   | Drawing.      | Sr.<br>Physics.                  | Qual. and<br>Quant.<br>Analysis. | Sr.<br>Physics.                  | Drawing.               | Analysis when<br>Excursions           |
| VIII. |               |                                  |                                  |                                  |                        | Qual. and {<br>Quant. }<br>Geological |
|       | Mon.          | TUES.                            | WED.                             | THURS.                           | FRIDAY                 | SAT.                                  |

TIME TABLE FOR MINING STUDENTS. Third Year.

Geological Excursions during Octo ber and Nove mber. Quant.

# TIME TABLE FOR MINING STUDENTS.

THIRD YEAR.

1

|        | VIII.               | IX.                          | X.             | XI.                     | IIX                         | II.                    | III.                     | IV.                               | V.                              |     |
|--------|---------------------|------------------------------|----------------|-------------------------|-----------------------------|------------------------|--------------------------|-----------------------------------|---------------------------------|-----|
| Mon.   | 3. Descrip.<br>Min. |                              | Geology.       | Metallurgy.             | General<br>Engineering      |                        | *Technical<br>Chemistry. | Ore<br>Dressing.                  |                                 |     |
| TUES.  |                     | General<br>Engineering.      | Geology.       | Mining.                 | Electricity<br>and<br>Heat. |                        | *Surveying.              | Ore<br>Dressing.                  |                                 |     |
| WED.   | 3. Deter.<br>Min.   | 3. Deter.<br>Min.            | Geology.       | Metallurgy.             | Electricity<br>and<br>Heat. | General<br>Engineering |                          | Spher. Trig.<br>and<br>Astronomy. | 3. Assaying.                    | -9- |
| TRURS. | 3. Deter.<br>Min.   |                              | Geology.       | Elementary<br>Calculus. |                             |                        | Co-ord.<br>Geom.         | Strength •<br>of<br>Materials.    | Statics<br>of Con-<br>struction |     |
| FRIDAY | 8. Deter.<br>Min    | General<br>Engineering.      | Geology.       | Mining.                 |                             |                        | Hydraulics.              | *Technical<br>Chemistry.          | •                               |     |
| SAT.   | 3. Assaying-        | -2nd Term<br>Geological Ex c | ursions will 1 | be made dur i           | ng Oct. and N               | Nov                    |                          |                                   |                                 |     |
| * 50   | mond town           |                              |                |                         | -                           |                        |                          |                                   |                                 |     |

second term.

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TIME TABLE FOR MINING STUDENTS.

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| à      | VIII.    | IX.                     | X.                | XI.                          | XII.                   | II.                    | III.        | IV.                          | V.                               |      |
|--------|----------|-------------------------|-------------------|------------------------------|------------------------|------------------------|-------------|------------------------------|----------------------------------|------|
| Mon.   |          |                         | Mining.           | Strength<br>of<br>Materials. | General<br>Engineering |                        | Metallurgy. |                              |                                  |      |
| TUES.  |          |                         | Mining.           |                              |                        |                        | Metallurgy. | * Mining<br>Law.             | i                                |      |
| WED.   |          | Mechanism.              | Mining<br>Projet. | Mining<br>Projet.            | Mining<br>Projet.      | General<br>Engineering |             | * Mining<br>Law.             |                                  | -10- |
| THURS. | Mılling. | Milling.                | Milling.          | Milling.                     | Milling,               | Milling.               | Milling.    | Strength<br>of<br>Materials. | Statics<br>of Con-<br>struction. |      |
| FRIDAY |          | General<br>Engineering. | Mining<br>Projet. | Mining<br>Projet.            | Mining<br>Projet.      |                        | Hydraulics. |                              | Strength<br>of<br>Materials.     |      |
| SAT.   |          |                         |                   |                              |                        |                        |             |                              | ~                                |      |
| * Seco | nd Term. |                         |                   |                              |                        |                        |             |                              |                                  |      |

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# JUNI

Thursd Friday, Monday Tuesday Saturda Day required of Quee

Thursda Monday Tuesday Wednese Friday, Saturday Dat

# JUNIOR AND SENIOR MATRICULATION EXAMINA-TIONS.

#### SEPTEMBER, 1900.

|           |        |       | 9 A.M.                   | 2 P.M.             |
|-----------|--------|-------|--------------------------|--------------------|
| Thursday, | 20th S | eptem | ber-English Composition. | English Literature |
| Friday,   | 21st   | **    | -History.                | Euclid             |
| Monday,   | 24th   | **    | -Physics.                | Eucliu.            |
| Tuesday,  | 25th   | **    | Arithmetic.              | Algebra            |
| Saturday, | 29th   | "     | -Chemistry.              | English Grammar    |
|           |        |       |                          |                    |

Dates for subjects not required for Matriculation into School of Mining, but required for University Matriculation, can be learned by addressing the Registrar of Queen's University.

# PASS SUPPLEMENTAL EXAMINATIONS.

#### September, 1900.

|            |      |         | 9         | A.M          | 2 P.M              |
|------------|------|---------|-----------|--------------|--------------------|
| Thursday,  | 20th | Septemb | er-Junior | English.     | 20 1.111.          |
| Monday,    | 24th | **      | Junior    | Physics.     | Senior Physics     |
| Tuesday,   | 25th | "       | -Junior   | Mathematics. | Senior Mathematics |
| Wednesday, | 26th |         | Minera    | alogy.       | Geology.           |
| Friday,    | 28th | **      | -Botany   | 1.           | Animal Biology     |
| Saturday,  | 29th | **      | -Junior   | Chemistry.   | Senior Chemistry.  |

Dates for the other subjects will be fixed in September.

\* Second Term.

PASS EXAMINATIONS.

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|            | 0 A   | 2 P M.  |
|------------|-------|---|
| Tuesday,   | April | 9thMineralogy II. (Systematic).   |
| Wednesday, | :     | roth- (Junior English. (Qualitative Analysis (Written). (Geology (Practical). ) |
| Thursday,  | :     | Itth- Faleonology I, and II.<br>Surveying I.<br>Calouis I.                      |
| Friday,    | :     | 12thSpherical Trigonometry and Astronomy  |
| Saturday,  | :     | I3th-Junior Mathematics   |
| Monday,    | :     | 15th—Petrography  |
| Tuesday,   | :     | 16th—Geology of Canada II   |
| Wednesday, | :     | 17th-{ Junior Physics Bectrical Engineering J                                   |
| Thursday,  | :     | 18th-{ Junior Chemistry.<br>General Engineering. }                              |
| Friday,    | :     | rgth-{Economic Geology.<br>Mathematical Instruments, }Chemistry (Technical).    |
| Saturday,  | :     | 20th—Geology  |
| Monday,    | :     | 22nd – [Metallurgy III.]<br>Chemistry (Organic). ]                              |
| Tuesday,   | :     | 23rd—General Engineering  |
| Wednesday, | :     | 24th{Botany.<br>Assaying and Quan. Analysis (Written).<br>}Animal Biology.      |

WILLI WILLE Court

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R. CAR

N. F. I

Joseph

Јони W C. W. J A. G. E M. B. F

## Profess

Mathem Physics, English, Biology,

--12---

#### FACULTY.

-13-

WM. L. GOODWIN, B.Sc. (LOND.), D.Sc. (EDIN.), F.R.S.C., DIRECTOR,

WILLIAM NICOL, M.A., Professor of Chemistry.

Professor of Mineralogy and Assaying.

WILLET G. MILLER, B.A., Professor of Geology and Petrography.

COURTENAY DE KALB,

Professor of Mining Engineering and Metallurgy.

R. CARR-HARRIS, Professor of General Engineering.

Lecturer on Drawing and Surveying.

N. F. DUPUIS, M.A., F.R.S.C.,

Lecturer on Mechanism. NORMAN R. CARMICHAEL., M.A.,

Lecturer on Electrical Engineering.

JOSEPH BAWDEN, Barrister-at-Law, Lecturer on the Law of Mines.

Lecturer on Industrial Chemistry.

#### **Demonstrators:**

JOHN WADDELL, B.A., D.Sc., Ph.D., Chemistry.

C. W. DICKSON, M.A., Chemistry.

Chemistry.

A. G. BURROWS, M.A., Mineralogy.

M. B. BAKER, B.A., Geology.

DR. WADDELL, Librarian.

Secretary-Treasurer,

#### ALFRED DEAN, Janitor.

Professors of Queen's University whose classes are attended by students of the School of Mining.

| Mathematic | cs, | - | - | - | - | - | - PROFESSOR DUPUIS.            |
|------------|-----|---|---|---|---|---|--------------------------------|
| Physics,   | -   | - | - | - | - | - | - PROFESSOR MARSHALL           |
| English,   | -   | - | - | - | - | - | - PROFESSOR CAPPON.            |
| Biology,   | •   | - | - | - | - | - | - PROFESSORS FOWLER AND KNIGHT |

#### ANNOUNCEMENT.

The School of Mining is a branch of the *School of Mining* and Agriculture, incorporated by Act of the Legislature of Ontario. It is affiliated to Queen's University, which confers all degrees.

OBJECTS.—The objects of the School of Mining are to give a thorough scientific education, both theoretical and practical, to men studying for the professions of the mining engineer, the assayer, the consulting geologist, and the metallurgist; and to provide for prospectors, mine foremen, and others interested in the discovery and winning of minerals such instruction as shall make their occupations more interesting and less liable to failure.

SITUATION.—The school has been placed near Queen's University so as to take advantage of the instruction therein provided in English, mathematics, physics, and the biological sciences. It is in this way possible to equip and carry on a good technical school on a much smaller revenue than would otherwise be called for to maintain the high standard of scholarship which the age demands of the engineering profession.

Kingston is well situated as the seat of a Mining School. Geology and mineralogy, two of the fundamental subjects of a mining engineer's education, are studied to best advantage where the minerals can be seen as they lie in nature, and where geological formations can be examined in situ. In a few hours a class of students can be taken by carriage to a region so rich in mineral species that about forty different kinds have been secured in an afternoon. There is also a great variety of geological formations within easy access. If to this be added the neighborhood of mines in process of development or in operation, the result is an ideal Mining School city. The German Government has planted its mining schools in such cities, where the education of the mining engineer can be given that practical turn which not only lends a charm to the period of his study but shortens the time between graduation and thorough efficiency and confidence in the practice of his profession.

The possibilities of the country to the north of us are, in these respects, very great, and a glance at a geological map shows that Kingston itself is situated where the mineral-bearing formations, cutting like a broad wedge through the limestone, reach the St. Lawrence and Lake Ontario. The region of mineral-bearing rocks is thus brought almost to the city. On either side, the water exten

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chool. s of a where ologiclass ineral in an ations mines ideal ed its ining nds a tween actice

these s that tions, a St. earing e, the water front is bordered by a band of limestone, broadening as it extends east and west.

EMPLOYMENT FOR GRADUATES.—While no engagement is made to secure employment for graduates of the School, those who show themselves capable and industrious will, if possible, be recommended to positions for which they are qualified. It must be distinctly understood, however, that recommendations will not be given to men merely because they have been students at this School.

CERTIFICATES OF STANDING.—Employers of mining engineers and assayers are requested to note that men who have studied here can produce certificates stating clearly their standing in the School ; and that no one is entitled to style himself a graduate of the School unless he has completed either a three years' or a four years' course.

EXPENSES OF A COURSE.—The following statement of expenses is made from information obtained from students who have kept account of their expenditures. The average expense for class fees is taken in this estimate :

#### FOR EACH SESSION.

| Board, lodging and washing                  | 808 | 00 | to  | @rac |    |
|---|-----|----|-----|------|----|
| Books and stationery                        | #90 | 00 | 10  | φ120 | 00 |
| Incidentale                                 | 10  | 00 |     | 12   | 50 |
|   | 9   | 00 | **  | 16   | 00 |
| Excursions (geology, mineralogy and mining) | 8   | 00 | **  | 12   | 00 |
| Class and other lees                        | 63  | 00 | * * | 63   | 00 |
|   | -   | _  |     |      |    |

\$188 00 \$223 50

These estimates are based on board, &c., at from \$3.00 to \$4.00 a week, at which rates good board can be had in Kingston.

The fee for graduation (\$20.00 or \$10.00) is not included in the estimate.

#### **REQUIREMENTS FOR ADMISSION.**

The School of Mining is open to all who wish by earnest study to enlarge their knowledge of minerals and mines, or to pursue science for its own sake. The atmosphere of the School is suitable only for those who are fond of steady work.

REGISTRATION.—All students are required to register and to pay the registration fee at the beginning of each session. In addition, those who are pursuing degree or diploma courses are required to register in Queen's University and to pay a registration fee of one dollar. MATRICULATION.—A candidate may enter upon a course with a view to obtaining a diploma or the degree of B Sc. upon any one of the following conditions : —

1. Having matriculated in any university in the British Empire or in the United States.

2. Having passed the Junior Leaving Examination of the Department of Education of Ontario, in English Grammar, Composition and Literature, Arithmetic, Mensuration, Algebra and Geometry, History of Great Britain and Canada, Physics, and Chemistry. The matriculation examination may also be taken in Queen's University in September. (See page 11.) Other examinations will be accepted, so far as they are equivalent. Candidates who have made at least forty per cent. on the papers in any of the Senior Leaving Examination subjects are not required to take the junior classes in those subjects.

3. Having been engaged for one year in engineering or surveying, or in a manufacturing establishment, and having passed the October examination in (a) arithmetic, (b) algebra to quadratic equations inclusive, (c) the first three books of Euclid or their equivalent in any other work in Geometry, and (d) English composition and dictation.

While students are admitted upon matriculating in the subjects mentioned, it is strongly urged upon them to take the complete matriculation examination with the modern language and science option. (See page 33, Calendar of Queen's University). As a good grounding in mathematics is necessary, it will be found advantageous to have obtained the Senior Leaving standard in that subject before entering.

Students who have already taken, in a university arts or science faculty or in a recognized technical or military school, subjects included in a degree course in the School of Mining, will, on entering upon a course for the degree of M.E. or B.Sc. be admitted to the year for which they are qualified. Graduates of the Royal Military College who have taken the three years' course, will be allowed the following subjects of the course of Mining Engineering :—

FIRST YEAR.—Junior mathematics, junior English, junior chemistry, junior physics, drawing, surveying, French, (elementary mineralogy and blowpipe analysis, if taken in R. M. C.)

SECOND YEAR.—Senior mathematics, drawing, surveying (except mine surveying), general engineering, senior physics.

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eying cs. THIRD YEAR.—General engineering, spherical trigonometry and astronomy, co-ordinate geometry, elementary differential and integral calculus, surveying.

FOURTH YEAR.-Materials of construction.

The B.Sc. course in chemistry and mineralogy or in mineralogy and geology can be completed in one year after graduation in an honour course in arts, in chemistry, mineralogy and geology.

SPECIAL STUDENTS.—Unmatriculated students may take any classes for which they are prepared. The work in chemistry, mineralogy, geology, drawing, surveying, etc., is so arranged that those who wish to study these subjects, either for their scientific interest or as leading to professions other than mining engineering, may profitably pursue their studies here.

The practical work in assaying, mineralogy, milling and mining is of such a nature that those who wish to prepare themselves for any special department of work connected with mining and milling may profitably spend a session or two at the school. A two years' course might include junior chemistry, blowpipe analysis, qualitative analysis, systematic mineralogy, and geology, the first year; and chemistry of metals, assaying. descriptive and determinative mineralogy, mining, milling, ore dressing, and ore deposits, the second year.

EXAMINATIONS.—All examinations are held by Queen's University, and candidates must make application on forms supplied by the Registrar. Examination fees must be paid to the Registrar of the University not later than March 29th for the April examinations, and September 1st for the supplemental examinations.

GRADUATION.—Diplomas for the three years' course are given by the School of Mining, and applications for same must be made to the Secretary in writing and the fees paid before April 24th. Candidates for degrees must make application and pay the fees to the Registrar of the University. If a candidate fails in his examinations the graduation fee will be returned.

EXTRAMURAL STUDENTS.—Students who are not able to attend the School may register in the classes of junior English, mathematics, physics, junior and senior chemistry, elementary mineralogy and geology. Tutors are appointed to assist them by correspondence.

FEES.—Registration and Class fees must be paid annually on or before October 8, and Laboratory fees before students begin

work in the laboratories. Examination, degree graduation, ad eundum statum, and University registration fees are payable to the University Registrar. All other fees are payable to the Treasurer of the School of Mining.

| Registratio | n           | • • • • | • • • |        | • • • • | ••• | • • • • |         |        |           | \$1 | 00 |
|-------------|-------------|---------|-------|--------|---------|-----|---------|---------|--------|-----------|-----|----|
| University  | Registratio | n       | • • • |        |         |     | • • • • |         |        |           | I   | 00 |
| **          | **          | for     | stu   | idents | s not   | in  | atte    | endance | e upon | lec-      |     |    |
| E           | 0           |         |       | tures  |         | ••• | • • • • |         |        | • • • • • | 10  | 00 |
| Engineerin  | g Society   |         | • • • |        |         |     |         |         |        |           | I   | 00 |

FEES FOR A COURSE IN Mining Engineering, IN Analytical Chemistry and Assaying, OR IN Mineralogy and Geology:-

These fees cover all class and laboratory fees for the course.

| First Year  |       | ••• |     | • • |     | •   | • • |     |     |     |     |   | \$50 | 00 |
|-------------|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|------|----|
| Second Year | • •   | ••• | ••  | •   | • • | •   | •   | •   | • • | • • | • • | • | 50   | 00 |
| Fourth Year | • • • | • • | • • | • • | •   | • • | ••• | •   | •   | •   | •   | • | 55   | 00 |
|             | ••    | • • | •   | • • | ٠   | •   | • • | • • | • • | ٠   | ٠   |   | 00   | 00 |

#### FEES FOR SINGLE CLASSES, &C.

These are not additional to the year fees.

| Junior and Senior Chemistry, each                  | \$12 | 00 |
|--|------|----|
| Any other Course of Lectures                       | 8    | 00 |
| Drawing  | 0    | 00 |
| Surveying, per Session                             | 10   | 00 |
| Assaying Laboratory, per Session                   | 5    | 00 |
| Chemical Laboratory, per Session                   | 20   | 00 |
| Petrographical Laboratory, per Session             | 5    | 00 |
| Mechanical and Engineering Laboratory, per Session | 20   | 00 |

#### GRADUATION AND OTHER FEES.

| Graduation | I Fee fo | r Degre  | e     |         |       |     |     |    |     |     |    |    |    |     |     | <br>. \$20 | 00   |  |
|------------|----------|----------|-------|---------|-------|-----|-----|----|-----|-----|----|----|----|-----|-----|------------|------|--|
| "          | " fo     | r Diplo  | ma    |         |       |     |     |    |     |     |    |    |    |     |     | <br>. 10   | 00   |  |
| Admission  | ad eund  | lem stat | um.   | • • • • | • •   |     |     |    |     |     |    |    |    |     |     | <br>. 10   | 00   |  |
| Annual Ex  | aminati  | on Fee.  |       |         | • • • | • • | • • |    |     |     |    |    |    |     |     | <br>. (    | 5 00 |  |
| Tutor's Fe | e (Extra | mural    | Stude | ents    | ), (  | one | s   | ub | jec | :t. |    |    |    |     | • • |            | 5 00 |  |
| **         | **       |          | **    |         | 1     | mo  | re  | th | an  | 01  | ne | su | bi | ect |     | <br>. 10   | 00   |  |

DEPOSITS .- Each student is required to make a deposit of \$5.00 each session. At the close of the Session the balance of the deposit, remaining after deductions for loss and breakage of apparatus, &c., is returned.

#### **COURSES OF STUDY.**

The following courses are offered :

- Three years' courses for a diploma in : I.

  - (A) Mining Engineering.(B) Analytical Chemistry and Assaying.

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II. Four years' courses for the Degree of Bachelor of Science (B.Sc.) in

(A) Mining Engineering.

(B) Chemistry and Mineralogy.

(C) Mineralogy and Geology.

The degree of Mining Engineer or Engineer of Mines (E.M.) is also conferred. (See page 21.)

III. B.A. and M.A. courses in chemistry, assaying, mineralogy, geology, &c. (See calendar of Queen's University.)

IV. Post-graduate courses for the Degree of Doctor of Science (D.Sc.). (For further information see the calendar of Queen's University.)

#### 1.-THREE YEARS' COURSES.

These courses are intended to fit men to enter upon the practice of mining engineering and assaying. The scientific groundwork of these professions is included as completely as the length of the course will permit; and much time is given to those practical studies which best equip the student for the work of exploration, developing, supervision, construction, etc., connected with mining. The courses are so arranged that, upon completing them, students may, if they wish, by another years' study, complete the course for a degree.

Students are advised to follow the arrangement in years as closely as circumstances will permit. The first four subjects mentioned in the first year form the basis for the work of succeeding years, and they should be thoroughly mastered. The country needs for its development men of high scientific attainments combined with practical knowledge. It is impossible to reach this without a good preliminary training in mathematics, English, physics, and chemistry.

#### A.-MINING ENGINEERING.

The Diploma in Mining Engineering of the School of Mining, Kingston, is equivalent to the "diploma as civil engineer" mentioned in clause III. of the Dominion Lands Act; so that a candidate for D.L.S. having that diploma from the School of Mining is entitled to examination after one year's service with a D.L.S.

# The Ontario Land Surveyors' Act has been amended as follows:-

Section 28 of *The Ontario Land Surveyors' Act* is amended by inserting after the word "engineering," at the end of the fifth line thereof the words, "or the School of Mining, Kingston, in civil engineering or in mining engineering."

## FIRST YEAR.

-20-

First Term. Junior Mathematics, unior English, unior Physics, unior Chemistry, Drawing, Elementary Mineralogy and Blowpipe Analysis, Surveying. Workshop.

#### Second Term. Junior Mathematics, unior English, Junior Physics, Junior Chemistry, Descriptive Astronomy, Drawing, Elementary Mineralogy and Blowpipe Analysis, Qualitative Analysis, Workshop.

Second Term.

#### OPTIONAL SUBJECTS. Junior French.

SECOND YEAR.

Junior German.

First Term. Senior Mathematics, Senior Physics, Senior Chemistry, Applied Mechanics, Qual. Analysis of Minerals, Systematic Mineralogy, Geology, General Engineering, Drawing and Designing, Workshop,

Surveying.

THIRD YEAR. First Term. Co-ordinate Geometry. Elementary Differential and Integral Calculus, Spherical Trigonometry, Descriptive Mineralogy, Determinative Mineralogy, Geology and Petrography, Assaying, Mining, Ore Dressing, Metallurgy, Surveying, Civil Engineering, Elementary Electrical Engineering.

#### Senior Mathematics. Senior Physics,

Senior Chemistry, Quantitative Analysis, Applied Mechanics, Systematic Mineralogy, Geology General Engineering Drawing and Designing, Workshop.

Second Term. Co-ordinate Geometry, Elementary Differential and Integral Calculus, Practical Astronomy, Technical Chemistry, Descriptive Mineralogy, Determinative Mineralogy, Geology and Petrography, Assaying, Economic Geology, Mining, Ore Dressing, Metallurgy, Milling, Heat (Steam Engine).

#### B.-ANALYTICAL CHEMISTRY AND ASSAYING.

First Term.

**Junior Mathematics**, unior English, unior Physics, unior Chemistry, Drawing, **Blowpipe** Analysis, Surveying.

FIRST YEAR. Second Term. Junior Mathematics. unior English, unior Physics. unior Chemistry, Qualitative Analysis, Drawing, Blowpipe Analysis.

OPTIONAL SUBJECTS.

Junior French.

Junior German.

#### Senior Senior Qualitit System

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#### SECOND YEAR.

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Senior Mathematics, Senior Chemistry, Qualititative Analysis, Systematic Mineralogy.

#### First Term.

First Term.

Organic Chemistry, Descrip. and Det. Mineralogy, Geology and Petrography, Quantitative Analysis, Assaying, Metallurgy,

### Second Term. Senior Mathematics.

Senior Chemistry, Quantitative Analysis, Systematic Mineralogy.

THIRD YEAR.

Second Term.

General Chemistry. Technical Chemistry, Descrip. and Det. Mineralogy, Geology and Petrography, Quantitative Analysis, Assaying, Metallurgy. Ore Deposits.

#### **II.-FOUR YEARS' COURSES.**

These courses are arranged so as to give the extended scientific training required for the more highly specialized fields of professional work in mining, assaying, analytical chemistry, mineralogy and geology. Courses A and B may be completed in one year after completing the corresponding three years' course. Course C affords a general education in natural science with special training in mineralogical and geological work and studies. It is intended for those who have in view the profession of consulting geologist or the work of geological surveys.

#### A.-MINING ENGINEERING.

The first three years of this course are the same as for the Three Years' Course. (See page 19.)

FOURTH YEAR. First Term. Second Term. Metallurgy, Metallurgy. Mechanism. Mechanism, Materials, Construction, and Design, Materials, Construction, and Design, Mining Engineering, Mining Engineering, Milling, Milling, Mining Law. Mining Law.

The degree of Bachelor of Science (B.Sc.,) is awarded on the completion of this course, and the production of certificates for not less than three months' work in a mine or mines. The degree of Engineer of Mines (E.M.) is awarded in addition, on the production of certificates of not less than one year's experience in actual mining. These certificates must be signed by mine managers, and must state the character of the work done by the candidate.

#### **B.-CHEMISTRY AND MINERALOGY.**

The first three years of this course are the same as for the Three Years' Course. (See page 19.)

#### FOURTH YEAR.

I.—Special work in assaying and chemical analysis to give facility and precision in methods in use in mining, furnace, and analytical laboratories.

II. An original research in chemistry or mineralogy, the results of which must be reported in the form of a thesis on or before April 1st.

#### C .-- MINERALOGY AND GEOLOGY.

FIRST YEAR.

First Term.

Junior Mathematics, Junior English, Junior Physics, Junior Chemistry, Drawing, Elementary Mineralogy and Blowpipe Analysis, Animal Biology.

First Term.

First Term.

First Term.

Senior Mathematics.

Qualitative Analysis,

Systematic Mineralogy,

Simple Quantitative Analysis,

Descrip. and Det. Mineralogy,

Geology and Petrography,

Topographical Surveying,

Senior Chemistry,

Geology,

Surveying.

Second Term.

Junior Mathematics, Junior English, Descriptive Astronomy, Junior Physics, Junior Chemistry, Drawing, Elementary Mineralogy and Blowpipe Analysis, Botany.

#### OPTIONAL SUBJECTS.

Junior French.

Junior German.

SECOND YEAR.

#### Second Term

Senior Mathematics, Senior Chemistry. Qualitative Analysis, Systematic Mineralogy, Geology.

THIRD YEAR.

Second Term.

Spherical Trigonometry, Assaying, Descrip. and Det. Mineralogy, Geology and Petrography, Geological Maps and Sections.

FOURTH YEAR.

Second Term.

Petrography, Economic Geology.

Field Geology.

Petrography, Economic Geology.

Special work along lines to be chosen by the candidate; an original research in Mineralogy or Geology, the results of which must be handed in as a thesis on or before April 1st.

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CHEMISTRY LECTURE ROOM.



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#### SUBJECTS OF STUDY. CHEMISTRY.

-25-

Professor: William L. Goodwin, D.Sc., Edin.

Demonstrators: John Waddell, B.A., D.Sc., Ph.D.; C. W. Dickson, M.A.

1. Lectures on the principles of Chemistry as follows :

Chemical Species—Crystals and Crystallization—Chemical Change— Laws of Combination—Relations of Heat to Chemical Changes— Notation—Equations—Nomenclature—Volume Relations of Gases in Chemical Change—Volume Formulae—The Atomic Theory— Descriptive Chemistry of the Commoner Elements and their Compounds—Electrolysis—Spectrum Analysis.

Books.-Goodwin's Chemistry.

Remsen's Inorganic Chemistry (Advanced Course).

Waddell's Arithmetic of Chemistry.

Mondays and Tuesdays at 11 a.m.

2. Laboratory practice, consisting of simple experiments, by means of which the student may become acquainted with the properties of common substances. Wednesdays or Thursdays at 11 a.m.

3. Qualitative Analysis is begun in the second term.

SENIOR.

Before taking this class students must have passed in Junior Chemistry.

(Ist TERM). I. Lectures on Elementary Organic Chemistry.

2. Lectures on the chemistry of the metals, their occurrence in nature, reduction and uses. Thursdays and Fridays at 11 a.m.

3. Qualitative Analysis is continued. Notes on systematic qualitative analysis are given in a course of lectures in October.

(2nd TERM). I. Lectures on chemical laws and theories. Thursdays and Fridays at II a.m.

2. Qualitative Analysis of Minerals and Simple Quantitative Analysis. This work may occupy from two to four hours a day. The greater part of the time is spent in the laboratories. Lectures on Quantitative Analysis on Thursdays at 3 p.m. The minimum amount of work in quantitative analysis is comprised in Bolton's Quantitative Analysis, Nos. 1, 2, 3, 4, 5, 6, 7, 8 and 13. The practical work in qualitative analysis must be completed before admission to examination. This applies also to quantitative analysis.

Text-Books-Van Deventer's Physical Chemistry (J. Wiley & Sons.)

Goodwin's Chemistry and Supplement.

Thorpe & Muir's Qualitative Analysis (Longmans, Green & Co.) Bolton's Quantitative Analysis.

#### THIRD YEAR.

(Ist TERM). I. Lectures and Class Work on Organic Chemistry. (Course B only.) The student is expected to master the contents of Remsen's Organic Chemistry. Wednesdays at 3 p.m.

2. Quantitative Analysis is continued throughout the third year by students taking the courses in Chemistry and Assaying, or Chemistry and Mineralogy. Special attention is given to the quantitative analysis of minerals.

Text-Book-Fresenius' Quantitative Analysis.

(2nd TERM). I. Lectures on selected subjects in Technical Chemistry. Mondays at 3 p.m.

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Text-Book-Thorp's Industrial Chemistry.

2. Lectures on General Chemistry. (Course B only). For the session of 1900-1901 the subjects will be Thermochemistry, Electrochemistry, the Properties of Solutions and the Kinetic Theory of Gases. Wednesdays at 3 p.m. *Text-Book*—Ostwald's Outlines of General Chemistry.

3. Quantitative Analysis.

#### FOURTH YEAR.

The work for the fourth year consists entirely of laboratory work in quantitative analysis. Students taking the M.E. course may extend their acquaintance with analysis of minerals, slags, etc. Those taking the B.Sc. course in Chemistry and Mineralogy will, in addition, carry on experimental work in some selected field, such as rock analysis, organic analysis, analysis of water, air, foods, fertilizers, soils, etc.

All students are urged to make daily use of the library, reading along the lines of their laboratory work.

#### THE CHEMICAL LABORATORIES.

The practical work in chemistry is carried on in three laboratories: No. 1 for qualitative analysis, No. 2 for quantitative analysis, and No. 3 for experimentation in class, and drill on the subjects treated of in the junior lectures. No. 1 and No. 2 are fitted up with 62 and 42, respectively, locked work places, so that 104 students can be provided each with a set of apparatus under lock and key. These laboratories are open from 8 a.m. to 5 p.m., and students are allowed to carry on their analytical work when not otherwise engaged. The number of hours a day to be spent in the laboratories depends, to some extent, on the aptitude of the student for experimentation. The average is about two and a half hours. No. 3 serves both as a laboratory and a class room. It is furnished with seats and desks which are at the same time work tables. Besides these larger laboratories there are smaller rooms devoted to special branches of analytical chemistry and to research.

Each student, before entering any practical class, is required to deposit five dollars with the Bursar. (See Deposits p. 18.) On presenting to the instructor of the class the receipt for this and the class ticket, the student receives the key of his place and a set of apparatus. The deposit is returned at the end of the session, breakages, etc. having been deducted.

#### BLOWPIPE ANALYSIS.

Professor: William Nicol, M.A. Demonstrator: A. G. Burrows, M.A.

The work in this class for mining students extends over two sessions. It should be taken in the first session along with junior chem syste

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two inior chemistry and junior physics, as an aid to qualitative analysis and systematic mineralogy in the following session.

The blowpipe laboratory is arranged to accommodate fortyeight students, working twenty-four at one time. Students must supply their own blowpipe apparatus, but a locker and key are provided for each student. For junior students, the class meets on Friday afternoon, 1-3 o'clock. For senior students, the hours are arranged so as not to conflict with other classes. The work of the fall term in the junior class, consists in learning the use of the blowpipe, the various operations and the reagents employed ; the winter term is occupied in applying the knowledge acquired during the fail term, in the determination of minerals. The work of the primary class is continued during the third session in connection with the classes of descriptive and determinative mineral-The quantitative assay of gold and silver ores, by means of ogy. the blowpipe, forms part of the work of the class in assaying. Text-books-Chapman's Blowpipe Practice, 2nd ed. (Copp-Clark Co.)

Kolbeck's 6th ed. of Plattner's Probirkunst mit dem Lothrohre. Books for reference :

Brush and Penfield's Manual of Determinative Mineralogy and Blowpipe Analysis. (Wiley and Sons) 15th ed. 1899.

Endlich's Manual of Qualitative Blowpipe Analysis.

Moses' and Parson's Mineralogy, Crystallography and Blowpipe Analysis. Landauer's Blowpipe Analysis.

#### ASSAYING.

#### Professor : William Nicol, M.A. Demonstrator : A. G. Burrows, M.A.

Before taking this class students must have passed in junior and senior chemistry, qualitative analysis, and must have completed the primary part of quantitative analysis. (See page 25.)

The work of the Assaying Class is carried on partly in the assaying laboratory and partly in the quantitative chemical laboratory, as assaying is a branch of quantitative analysis. The laboratory is furnished with the plant necessary for conducting assays of gold, silver, copper, iron nickel, zinc and lead ores by furnace, titration and electrolytic methods. With the various furnaces students are taught the use of hard coal, soft coal, coke, gasoline and illuminating gas as fuel. The laboratory is well supplied with ore-bins and samples of pulverized ore from the mining laboratory, so that practice may be had with a variety of The mineral cabinets contain typical examples of the comores. monly occurring ores of the various metals treated in the course ; . these are used for illustrating the lectures which supplement the text-books used.

In the limited time, it cannot be expected that students taking part in the work of this class will become expert assayers, but they can learn methods and the manipulation of apparatus, so that later in practice they will be able to make an intelligent use of the text-books and manuals on the subject.

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The work of the class is progressive and students will not be permitted to go on with the later parts of the work till the earlier parts have been satisfactorily performed. The standing of the members of the class is determined by the practical work performed during the session. There is no final practical examination held. This class should be taken along with quantitative analysis, ore-deposits and metallurgy. Students taking it must make arrangements to spend the greater part of each Saturday of the winter term in the laboratory. Lectures are delivered at periods convenient for the members of the class. The practical work must be completed before admission to examination.

Text-Books—Chapman's Assay Notes, 2nd ed. (Copp-Clark Co.) Brown's Manual of Assaying, 7th ed. (Sargent & Co.) Blair's Chemical Analysis of Iron, 2nd ed. (Lippincott Co.)

Books for Reference :

Furman's Manual of Assaying. (Wiley & Sons.) Ricketts and Miller's Notes on Assaying. (Wiley & Sons.) Beringer's Text-Book on Assaying. (C. Griffin & Son.) Bodemann and Kerl's Assaying. Lord's Notes on Metallurgical Analysis. Kerl's *Probirkunde*. Ledebur's *Probirkunde*.

#### MINERALOGY.

#### Professor: William Nicol, M.A. Demonstrator: A. G. Burrows, M.A.

The work in this department for mining students extends over three years, and is divided into four parts: (a) Elementary Mineralogy; (b) Systematic Mineralogy; (c) Descriptive Mineralogy; (d) Determinative Mineralogy.

#### (A) Elementary Mineralogy.

The work in this class is intended as a preparation for those entering upon the studies of geology, petrography and metallurgy. The class should be taken in the first session along with junior chemistry and junior physics, as a knowledge of chemistry and physics is necessary for a proper comprehension of the subject. The regular work consists of (1) a course of about fifteen lectures and demonstrations on crystallography, held at the beginning of the fall term at eight o'clock a.m. on Mondays, Tuesdays, Wednesdays and Fridays; (2) lectures on the physical, optical

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and other properties of minerals; (3) the description of forty or fifty prominent Canadian minerals, followed by practical work in the determination of these. (See under Blowpipe Analysis.) The practical work of the class is conducted in the mineralogical and blowpipe laboratory, where cabinets containing specimens of commonly occurring minerals are arranged for use. Students are taught to recognize minerals by simple field tests, such as form, colour, streak, hardness, specific gravity, etc. For this work students must provide themselves with a pocket lens, knife, streak-plate, and magnet. The class meets at 9 a.m. on Mondays, and at 8 a.m. three days per week during the last month of the session.

Excursions to mineral localities in the vicinity of Kingston are held on the Saturdays of the fall term.

Text-Books—Williams' Crystallography (Henry Holt & Co.) Dana's Minerals and How To Study Them. Crosby's Tables for the Determination of Minerals.

#### (B) Systematic Mineralogy.

Before taking this class, students must have passed in elementary mineralogy, junior chemistry and junior physics. The work is preparatory to that in petrography, geology and descriptive mineralogy, which should be taken in the session following.

The regular work consists of a course of lectures, two hours per week, dealing with the physical, optical and other properties of minerals, illustrated by specimens from the lecture-cabinet, microscopic slides, thin sections, models and charts, supplemented by a course of evening lectures, illustrated by lantern slides, and intended as a review of the work in the day classes. Students taking this class must attend the course of lectures on crystallography delivered early in-the fall term, and those intending to do advanced work in mineralogy must attend the lectures on crystallography delivered in connection with first honour mineralogy, during the fall term. Essays on prescribed subjects are required. The class meets at 2 p.m. on Mondays and 11 a.m. on Wednesdays.

Text-Books-Dana's Text-Book of Mineralogy, 18th ed. 1899. (Wiley & Sons.) Tschermak's Mineralogie.

Williams' Crystallography. (Henry Holt & Co.)

Book for Reference :

Naumann-Zirkel's Mineralogie.

#### (C) Descriptive Mineralogy.

Before taking this class, students must have passed in elementary and systematic mineralogy. It should be taken along with petrography, ore deposits and metallurgy. The work of this class consists in the exhibition and description of the mineral specimens contained in the museum collection. Special attention is given to ores, gangue minerals, those having a commercial value and those of importance as rock-forming minerals, in geology. The specimens are constantly being increased by collection, donation, exchange and purchase, the aim being to make the museum as complete and representative as possible. Dana's *System of Mineralogy* is used as the text-book. No attempt is made to learn the minerals mechanically, the desire being rather to acquire a practical working knowledge, such as would be useful to the assayer, consulting geologist or mining engineer. The class meets at 8 a.m. on Mondays.

#### (D) Determinative Mineralogy.

Before taking this class students must have passed in elementary mineralogy, blowpipe analysis, and systematic mineralogy.

As far as possible the work of this class is carried on parallel with that in descriptive mineralogy, as the pyrognostic characters are of importance in the description of minerals.

The objects of the class are to assist students in acquiring a knowledge of the chemical properties of minerals and to enable them to test and recognize minerals in the field by simple tests such as streak, specific gravity, etc., or more leisurely at home, by means of the blowpipe and chemical reagents. (See under Blowpipe Analysis.)

Cabinets filled with mineral specimens are provided for use. Students are permitted to handle and examine these, under supervision. The advantage that this class affords to the prospector and field geologist will be at once apparent. On Saturday, during the fall term, excursions are made to interesting mineral localities. In this way the nucleus of a collection may be secured at a small cost.

Text-Book-Crosby's Tables for the Determination of Common Minerals.

#### GEOLOGY AND PETROGRAPHY.

Professor: Willet G. Miller, B.A. Demonstrator: M. B. Baker, B.A.

The instruction in this department is adapted to the needs of the prospector, the mining engineer, and the professional geologist. Provision is also made for persons who desire a knowledge of the subject as part of a general education. Graduates and others who wish to pursue some special line of investigation, or to have the use of the laboratories and apparatus, in order to work up n place

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Students have access to the museum of Queen's University, which contains a large number of specimens illustrative of the geology of Canada, as well as to the collections of the school.

Advice concerning field work in geology during the summer vacation will be given by the professor.

Students are advised to procure copies of some of the textbooks, and to gain some acquaintance with them during the long vacation preceding the beginning of the session in October.

#### Second Year.

#### GEOLOGY.

Before taking this class students must have passed in elementary mineralogy and in junior chemistry.

The object of this course is to give a general knowledge of the subject as an introduction to the work of the third and fourth years.

The following themes will be treated of in the lectures:-

The planetary relations of the earth ; the atmosphere ; waters ; solid crust ; probable nature of the earth's interior ; rocks, their general megascopic and microscopic characters and classification ; volcanic action ; earthquakes ; upheaval ; subsidence ; geological effects produced by heat, air, water and life ; bosses ; dykes ; veins ; stratification ; dip ; strike ; anticline and syncline ; faults ; foliation ; nature and uses of fossils ; stratigraphical geology; outline of the geological history of the globe, etc.

The lectures are illustrated by means of maps, diagrams, and lantern views.

The laboratory work will consist of the examination of typical specimens of the different groups of fossil plants and animals, and of hand specimens of the more common rocks.

During the months of October and November excursions will be made to places of geological interest in the vicinity of Kingston.

Students are expected to take part in all these excursions. The cost will not exceed five dollars. Each student should provide himself with a suitable hammer, specimen bag and note-book.

Students are required to provide themselves with a copy of W. B. Scott's "An Introduction to Geology" (The Macmillan Co., price \$1.90,) which is used as a text-book.

Books for Reference :

Kemp's " Hand-book of Rocks," (price \$1.50.)

LeConte's Compend of Geology.

Dana's Manual of Geology (last edition.)

Chapman's Minerals and Geology of Ontario and Quebec.

#### Third Year.

#### GEOLOGY,

Before taking this class, students must have passed in geology of the second year.

In this course special attention will be given to stratigraphical geology and the geology of Canada. Type fossils of the different formations will be studied.

Text-books and books for Reference :

Chapman's Minerals and Geology of Ontario and Quebec. Dawson's Geology of Canada. Dana's Manual of Geology. Wood's Elementary Palæontology. Geological Survey Reports of Canada.

#### PETROGRAPHY.

Candidates must have passed in second year geology and systematic mineralogy.

This Course will consist of lectures on the use of the petrographical microscope and accessories in the determination of the rock-forming minerals, together with the determination of some of the more common igneous rocks.

The lectures will be illustrated by means of microscopic projections of thin sections of minerals and rocks, and will be supplemented by a large amount of laboratory work.

A considerable variety of dyke rocks occurs in the Kingston district. These will be studied in the field, and specimens will be collected by each student for examination in the laboratory.

Boxes for holding slides and material used in the preparation of thin sections may be obtained from the Janitor.

Each student must provide himself with a copy of Kemp's Hand-book of Rocks (price \$1.50.) and a copy of Luquer's Minerals in Rock Sections.

Text-books and Books for Reference:

Rosenbusch-Iddings' Microscopical Physiography of Rock-Forming Minerals.

Lœwinson-Lessing's Tables for the Determination of the Rock-Forming Minerals. Hatch's Petrology.

Harker's Petrology for Students.

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#### ORE DEPOSITS.

Lectures on the origin, modes of occurrence and uses of metalliferous minerals, with mention of the chief localities. The characters by which ore bodies are sometimes indicated to the prospector will be described. A sketch will be given of the geology of some of the leading mining districts.

Each student is to provide himself with a copy of Kemp's Ore Deposits of the United States and Canada (price \$5.00.)

Text-books and Books for Reference :

Philips' Ore Deposits.

Mineral Statistics, Geological Surveys of Canada and the United States, Rothwell, The Mineral Industry. Vols. I, II, III, IV and V.

#### Fourth Year.

#### GEOLOGY.

A study will be made of structural and dynamical geology in connection with their bearings on economic problems.

Opportunities will be offered for those wishing to prosecute any special line of investigation.

Students are advised to devote as much time as possible to field work during the preceding long vacation, and to collect material for study in the laboratory during the winter.

Text-Books-Geikie's Text-Book of Geology. Dana's Manual of Geology. Geikie's Field Geology. Geikie's Founders of Geology. Nicholson's Palæontology. Williams' Geological Biology.

#### PETROGRAPHY.

A course of lectures will be given on the microscopic characters and classification of the igneous rocks and on the characters, origin and classification of the pre-Cambrian formations.

Special attention will be paid to the metamorphic series of the Kingston district, as exceptional opportunities are here offered for the study of the field relations of these rocks, and for attacking those problems as to their origin which are now attracting the attention of geologists.

The *petrographical laboratory* is supplied with electrical power and provided with diamond saws and other apparatus needed in the preparation of thin sections of minerals and rocks for examination with the microscope.

Laboratory facilities are also provided for micro-chemical tests, and for the use of heavy solutions in separating the constituents of the rocks. The school owns several petrographical microscopes of the latest and most improved designs.

Text-Books and Books for Reference :

Rosenbusch - Die Mussige Gesteine.

Zirkel-Lehrbuch der Petrographie. Vols. I, II and III.

Levy and Lacroix -- Les Mineraux des Roches.

Rosenbusch-Iddings-Microscopical Physiography of Rock-Forming Minerals

Iddings—The Origin of Igneous Rocks.

Van Hise-Correlation Papers, Archæan and Algonkian.

#### ECONOMIC GEOLOGY.

Lectures on the origin, modes of occurrence and uses of the metals and their ores; materials used in the production of light and heat; minerals used in chemical manufactures; fertilizers; mineral pigments; salt, brine and mineral waters; building materials; cements; refractory materials; abrasive materials; gems and precious stones; miscellaneous.

#### MINING ENGINEERING AND METALLURGY.

Professor: Courtenay De Kalb. Engineer:....

These courses are given by lectures and text-book work supplemented by models, drawings, photographs, the actual examination of mines and works, and practical work in gold milling, ore dressing, and sampling, in the mining laboratory.

#### THE COURSE IN MINING.

Before taking these classes students must have passed in junior and senior mathematics and in junior and senior physics.

The lectures on the art of mining are designed to make the student familiar with the operations in vogue in this and other countries for finding, developing, extracting and mechanically treating minerals of economic value. It brings to a practical issue the information acquired by the lectures on mathematics, mechanics, surveying and physics. A knowledge of chemistry and mineralogy is also necessary to give a satisfactory appreciation of the character of the ores searched for or extracted. Connected with the mining of the ore, its geological association is considered.

The topics discussed are the following :

Ore Deposits. A brief review of the manner of occurrence of economic minerals, and their relations to the enclosing country rocks, so far as such relations can be generally stated. Also the influence of ore deposits under certain conditions upon topography, and t geolo ore. ed tro desig to the

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ce of ntry the phy, and the connections between topographic forms dependent upon geological structure and the probability of the existence of veins of ore. This discussion is merely supplementary to the more extended treatment of the subject in the Department of Geology, being designed to further emphasize circumstances of practical moment to the prospector and miner.

*Prospecting*. Systematic methods of rapid geological and mineralogical reconnoissance for the purpose of discovering mineral deposits. Gossan and "float" phenomena fully discussed. Minerals found in gravel beds in water courses, and their importance as indices of near-by deposits of valuable ores. Systematic methods for locating an indicated vein. Application of pits and the method of approximation by trenching for discovery of deposits.

*Mine Development.* Preliminary consideration of conditions affecting the probable success or failure of mining operations in any particular locality; fuel, water, food supplies, transportation facilities and costs. Location of development workings. Choice of method of approach. Blocking out the ore for measurement. Systematic methods of obtaining accurate samples of ore "in place" and on the dump. Methods of estimating the value of the mine.

*Boring*. Use of bore holes. Methods of boring. Boring by percussion. Methods by rods and by ropes. Boring tools; casing; recovery of lost tools, etc. Rotary boring. Earth augers. Diamond drills worked by hand and by machinery.

*Excavation.* Tools for breaking ground. Hand tools; machine tools; steam excavators and dredgers. Hand drilling. Power drills,—types, management and maintenance. Theory and practice of blasting. Kinds and effects of explosives. Location of holes. Charging and firing holes, singly, simultaneously and in series. Precautions in blasting. Substitutes for explosives.

Mining Methods. Works for approach and underground communication. Shaft sinking. General principles. Protection of shaft mouth. Methods of sinking, ventilating, hoisting and unwatering during sinking. Winzes,—location, and methods of sinking and upraising. Tunnels, drifts, gangways, adits, slopes, contour levels. Advancing by single breast, and by benches. Trimming up and maintaining alignment.

Works for winning minerals. Stoping. Overhand and underhand stoping methods; their application and limitations. Cross-cut methods for wide veins. Contouring, and application of cross-cut methods to masses. Stripping. Methods suitable for soft ore bodies. Pillar and breast methods, and their variations. Longwall advancing and retreating methods. Methods applicable to steeply inclined coal seams. Chutes; "ore mills"; loading bins; staging for overhand work; storage of "deads" or waste; gob walls; robbing of pillars, etc.

*Hydraulic Mining*. Methods of breaking down banks. Bringing water under high pressure, and delivery by monitors. Flumes; sluices; cleaning up, etc.

Supports. Timber; kinds of timber used for supporting excavations; dry rot; processes used for the preservation of timber; modes of timbering levels, shafts, winzes, slopes and other excavations; masonry and iron or steel supports for similar purposes; special methods of support in the cases of watery and running strata; compressed air, freezing and other processes; saving of timber resulting from the adoption of caving and filling methods.

*Transportation.* Underground. Wheelbarrows, their limit of efficiency. Cars,—types, capacity, and maintenance. Tracks, gage; weight of rail; ballasted and unballasted and paved; turnouts; turn-tables and plates; cross-ties; sectional portable track. Haulage; man and animal power; rope traction by single, main and tail, and endless rope; gravity roads; chain traction; underground locomotives; electric traction. Surface transportation; Decauville railroads; electric, and endless cable traction; aerial wire rope tramways,—single and double rope systems.

*Hoisting*. Head frames, temporary and permanent. Winding drums and engines,—types, and efficiency. Koepe endless rope system of hoisting. Cables, —kinds, efficiency, maintenance and inspection. Buckets; kibbles; cages; skips. Safety appliances, —to prevent fall of cage or skip.; to prevent over-winding. Signalling.

Loading and Unloading Works. Dumping frames or chairs; tipples; elevating and conveying machinery for handling ores and coal; terminal facilities.

Drainage. Preventing access of surface water; adits or drainage tunnels; siphons; removal of water by winding machinery; pumping plant; Cornish system; steam, compressed air and electrical pumping; dams.

Ventilation. Composition of air; gases met with underground; causes of the deterioration of air; dangers of dust; natural ventilation, its limitations; ventilation by furnaces; mechanical ventilators of various kinds; distribution of air through the workings; method of testing the purity of the air; fire-damp detectio passin

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deratunanthe detection; methods of measuring and recording the volume of air passing through the workings.

*Lighting*. Candles; lamps fed by tallow, and by animal, vegetable or mineral oils; safety lamps; gas and electric lamps; expense of lighting.

Descent and Ascent. Steps and slides; ladders; winding machinery; safety appliances; man-engine.

*Principles of Employment.* Day wages; contract work by weight or measure; contracts in which men have an interest in the value of the minerals extracted; administration, organization and business management; mine accounts.

Legislation. Special acts relating to mining properties and their operation.

Accidents. In hoisting, traction, roof falls, blasting, sudden ingress of waters, explosion, mine fires; rescuing of miners under various conditions; fire extinguishment, etc.

# Mine Examination and Valuation.

Ore Dressing. Picking and cobbing; crushing methods, and comparative effects in liberation of valuable minerals from gangue; sizing by screens and trommels; theory of fall of bodies in water; classification by the spitzkasten and spitzlutte; jigging, theory of; types of jigs; the jig indicator; sizing versus classification in the preparation of ores for jigging; friction-surface concentrators; riffle-washers; magnetic separators, —types, and application; special modifications of concentrators, etc., for coal washing; schemes of practical working plants for all classes of ores.

Gold and Silver Milling. Free milling plants; types of stamp mills, their efficacy and limitations. Construction and maintenance of stamp mills. Other methods of crushing for amalgamation. Principles and practice of amalgamation. Treatment of tailings; concentration, roasting, and chlorinating; cyaniding. Washoe process for silver ores; Boss continuous pan amalgamation. Lixiviation methods. Retorting amalgam; treatment of gold and silver precipitates; melting; refi ..ng; sampling bullion.

#### THE COURSE IN METALLURGY.

The subject of metallurgy is treated mainly by lectures, but students are required to do parallel reading in certain manuals, and to be prepared to be questioned upon the matter given in these as well as in the lectures.

Introduction. A thorough drilling in fuels, the special metallurgical uses of each kind; determination of calorific power experimentally and by calculation from composition; charcoal manufacture; coals, coke, coking methods, physical and chemical tests of coke; by-product coking; producer gas and its manufacture in modern approved appliances; liquid fuels, etc., constitutes the introduction to the course. This is followed by a discussion of the physical properties of the common metals, the effects of different impurities, and the constitution and character of the more important alloys; methods of pyrometry.

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*Furnaces.* Furnaces, their kinds and development; special uses; principles of construction, The modern iron blast furnace; low shaft furnaces for lead and copper,—types and relative efficiency; reverberatories for solid fuel; regenerative furnaces; retort furnaces, etc.

*Slags.* Types of slags; functions of slags; properties of fluxes; calculation of slags.

Supplying Air to Furnaces. Blowers and blowing engines; chimneys and chimney construction; hot blast stoves; resistance of column of fusion; regulation of blast; causes and effects of irregularity of blast pressure.

*Roasting and Calcination.* The preparation of ores for smelting by roasting in heaps, kilns, reverberatories, revolving, and various mechanical roasters, is fully explained.

Metallurgy of Special Metals. After the introductory course, the metalluagy of iron and steel, copper, lead, zinc, tin, aluminium, bismuth, antimony, cobalt, uickel, mercury, arsenic, platinum, and matte smelting for gold and silver are taken up in detail.

#### MINE SURVEYING.

As a continuation of the work in general surveying, the special conditions met with underground, and the methods of dealing with them, are discussed in a short series of lectures, supplemented by practical instruction in mine surveying in mines in the vicinity of Kingston.

#### LITERATURE ON MINING AND METALLURGY.

Text-books required :

Kent's Mechanical Engineers' Pocket-book. (John Wiley & Sons, New York.) Third year students.

Thurston's Iron and Steel. (John Wiley & Sons, New York.) Fourth year students.

Hofman's Metallurgy of Lead. (Scientific Publishing Co., New York.) Fourth year students. Rooks T A

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s, New th year York.) **Rooks** recommended to students:

Trautwine's Engineers' Pocket-book (John Wiley & Sons, New York.)

An Introduction to the Study of Metallurgy. W. C. Roberts-Austen. (Chas. Griffen & Co., London.)

A Manual of Mining. M. C. Ihlseng. (John Wiley & Sons, New York.)

The Coal and Metal Miners' Pocket-book. (Colliery Engineer Co., Scranton, Pa.)

Beard's Mine Ventilation. (John Wiley & Sons, New York.)

Steel: A Manual for Steel Users. William Metcalf. (John Wiley & Sons, New York.)

Gold : The Metallurgy of. T. Kirke Rose. (Chas. Griffin & Co., London.)

Parallel reading, as an aid to the lecture courses, is required. Assignments are made to works on mining and metallurgy in the library of the School of Mining, which is amply provided with the best treatises in all branches of technology, as well as with the transactions of American and European societies.

# THE MINING LABORATORY AND ORE TESTING WORKS.

The School of Mining has developed from modest beginnings a large and comprehensive laboratory, with first-class modern equipment for the practical milling and dressing of all kinds of ores. With but few exceptions the appliances are of standard sizes, such as are employed in actual practice in large works, so that students may obtain efficient instruction in the adjustment, operation and care of this kind of machinery. An elaborate training is also given in the methods of testing ores for process, in which respect the School of Mining offers peculiar advantages, since many mine owners throughout the Dominion avail themselves of the facilities of this laboratory for working out problems in ore milling and dressing on such a scale as to furnish reliable data for the specification of projected plants. Thus large quantities of widely different classes of ores are being tested throughout each session, affording students valuable experience of the most practical sort.

A systematic course of study is carried out, involving comparative investigations into the effects produced on different ores by varying methods of crushing ; hydraulic classification; jigging; buddling ; vanning ; riffle-washing ; etc, etc.

The plant is being constantly augmented, and extensive additions are now being made to the building and equipment. Inclusive of appliances now under order, to be installed before October, 1900, the mining laboratory contains the following : Blake jaw crusher; high-speed rolls; 3-stamp battery; cone grinder; Krupp ball mill; inlet-discharge hydraulic classifier;

vertical line hydraulic classifier; U-tube hydraulic classifier; Spitzkasten, 3-compartment; Hartz jig, 3-compartment; Frue vanner; Wilfley concentrator, (riffle-washer); buddle; Wetherill magnetic concentrator; barrel chlorination plant, (350 lbs cap'y); cyanide plant, 2 leach vats, with solution and sump vats, (1000 lbs cap'y); reverberatory roasting furnace; Sturtevant exhauster and blower; German dust tower; Heald and Sisco centrifugal pump; Frenier and LeBlanc spiral sand pump; Cazin water motor; Northey mine pump; gyratory screen; centrifugal machine for slime treatment; Johnson filter press for slime treatment; Ingersoll-Sergeant rock drill; 30 H.P. boiler; 25 H.P. Robb engine.

#### MECHANISM.

#### Lecturer: N. F. Dupuis, M.A., F.R.S.C.

Before attending this class students must have passed in junior and senior mathematics and the mathematics of the third year.

The instruction in mechanism is both theoretical and practical.

The theoretical part consists in lectures, with numerous illustrations, upon the nature and actions of the various mechanical elements, and upon their aggregations into machines.

Particular attention will be given to the relative velocities of moving parts, and thence to the ratios between power and resistance. Important machines, such as the clock, the lathe, the steam engine, etc., will be considered in some detail.

Exercises in the theory of mechanism will be given from time to time.

A good knowledge of Algebra, and plane Geometry and Trigonometry, with a competent knowledge of perspective, of conics and of the differential calculus, is necessary to a full understanding of the subject.

#### MECHANICAL LABORATORY.

Students must enter their names in the mechanical laboratory at the beginning of the session, and, except for special reasons, each student is allowed to work only at the hours allotted to him. Students must take the workshop practice in the first two years of their attendance, unless specially exempted by the faculty.

In the mechanical laboratories the student constructs parts of machines or pieces of mechanism *ab-initio*, making his own draw-

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ings and patterns, and working the crude material into complete form. In this way he is introduced to the actual use of tools, both simple and complex, such as saws, chisels, files, lathes, planers, shapers, gear cutters, drills, borers, etc.

Every student will have allotted to him the work which he is required to do, and his standing in the work will depend upon the quality of the work done, and the spirit in which it is done, rather than upon quantity.

While the student must do his own work, he will receive the personal direction and guidance of a competent instructor.

#### GENERAL ENGINEERING.

#### Professor: R. Carr-Harris.

Students are required to provide themselves with exercise books of standard size and quality.

#### Text-Books-Fanning's Hydraulics. Paton's Civil Engineering.

Students may purchase these books from the Janitor, and at the close of the session the books, if in good condition, may be returned, and the price will be refunded, after deducting one dollar for rental of each book.

#### SECOND YEAR.

Before this class is taken the examination in junior mathematics must be passed.

NATURE, PRODUCTION AND USE OF MATERIALS OF CON-STRUCTION.—Building stones, limes, cements, mortars, woods, brickmaking, puddle, drafting of joints.

DESIGNING OF STRUCTURES.—Earth and rock excavation, borrow pits, types and forms of culverts.

#### THIRD YEAR.

Before this class is taken the examinations in junior and senior mathematics and junior and senior physics must be passed.

ADVANCED SURVEYING.—Trial lines for railways, canals, roads, barometric explorations, principles governing routes, field notes topography methods, preliminary plans, profiles, cross sections.

DESIGNING OF STRUCTURES.—Forms and construction of bridge abutments and piers, retaining walls, forms and types of trusses. FOUNDATION BEDS.—Foundation materials, clay, sand, boulder drift, bearing piles, sheet piles, platforms of wood and of concrete, matrasses.

CONSTRUCTION OF COMMON ROADS AND STREETS AND PER-MANENT WAY FOR RAILWAYS.—Drainage, metalling surface, forformations, substructures, superstructures.

HYDRAULICS. — Consumption, rainfall, storage, reservoirs, flow of water in pipes.

STRENGTH OF MATERIALS.-

#### STATICS OF CONSTRUCTION. -

#### FOURTH YEAR.

Before this class is taken the examinations in junior, senior, and third year mathematics, and in junior and senior physics must be passed.

ADVANCED SURVEYING.—Projected locations, compiled profiles, field locations, plans and profiles, cross sections for quantities, estimates of quantities, railway curves, gradients.

FOUNDATIONS OF STRUCTURERS. — Principles of culvert foundations, principles of bridge foundations, false works, cribs, coffer dams, caissons.

CONSTRUCTION OF COMMON ROADS AND STREETS, AMD PER-MANENT WAY FOR RAILWAYS.-

HYDRAULICS. — Construction of embankments, penstocks, dams, pipe laying, hydrants, gates, etc., street mains, sewerage.

STRENGTH OF MATERIALS.-

STATICS of CONSTRUCTION. -

#### ELECTRICITY AND HEAT.

#### Lecturer: N. R. Carmichael, M.A.

The course taken by students of Mining Engineering includes: 1. Lectures and experiments upon the fundamental laws of electricity and magnetism, typical electrical machines and the transmission and use of electrical energy; 2. Lectures upon thermodynamics, the steam engine, and other heat engines; 3. Practical problems, calculations, and tests. I quired A have i

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#### -47-DRAWING.

#### Lecturer : Mr. C. E. Wrenshall.

In each year attendance of at least five hours a week is required.

At the beginning of each session all students are required to have in possession sets of drawing instruments, colours, brushes and other materials of approved standard. Students must supply their own drawing paper, which must be of an approved quality.

The lectures and practical work in the second year are arranged with a view to the contemplated pursuits of students in the several branches of engineering. Working drawings of portions of machinery, with details, dimensions, etc., will be frequently assigned as exercises outside of class hours.

Candidates are not admitted to examinations in drawing until they have completed the practical work of the year.

#### FIRST YEAR.

Drawing methods, instruments and materials; linear drawing; blackboard practice in freehand geometrical figures; descriptive geometry; projection of solids; elementary machine drawing; elementary perspective; isometric drawing; tinting and lettering.

Text-Books-Rawle's Linear Drawing and Projection; Lewis' Elementary Perspective; Cryer and Jordan Machine Drawing; Sherman's Lettering.

The work comprised in the above books is the minimum expected of students in the first year; and no student will be admitted to examination who has not satisfactorily completed this work.

#### SECOND YEAR.

Freehand drawing; advanced problems in perspective; advanced plane and solid geometry; elementary and advanced machine design, involving mining, electrical and other machinery; elementary architecture; working designs for the erection of framed structures in wood, iron and steel, hoists, mills, ore tipples etc.; ornament; freehand sketching of machinery; tracing; blue printing.

Text-Books:—Cartledge's Perspective; Cryer and Jordan's Machine Construction and Mechanical Drawing; Harrison and Baxandall's Plane and Solid Geometry. (Macmillan.)

Books for Reference:-MacCord's Mechanical Drawing; Unwin's Elements of Machine Design, vols. I. and II.; Smith and Slater's Classic and Early Christian Architecture; Low and Bevis' Machine Drawing and Design; T. and C. Jones' Machine Drawing.

#### SURVEYING.

#### Lecturer : Capt. J. L. H. Bogart.

All branches of Surveying receive full consideration. Students during the out-door instruction of the first term are given every opportunity to become familiar with the instruments. The notes of this work are plotted during the second term. Every student must provide himself with "Raymond's Plane Surveying." Students about to take second year's work are required to be present at the School of Mining on the 18th of September, 1900, to begin field work. Candidates are not admitted to examinations in surveying until they have completed the field work of the year and the plotting of such work has been satisfactory executed.

#### FIRST YEAR.

#### Lectures First Term :

Form of the earth, latitude, longtitude, meridian, meridan plane, vertical plane, horizon, azimuth, etc; surveying defined and classified; instruments used; methods of fixing a point.

Conventional signs used in land aud hydrographical surveying; scales and verniers; use and construction.

Engineer's and gunter's chains, tapes, rods, etc.; errors involved in chaining; corrections for temperature, sag, pull and slope; principles of chain surveying, chain survey, field notes, etc.; field geometry with chain only; laying out perpendiculars, etc.; passing obstacles; theory of the level bubble; angular value of one division; compass, use and adjustments; Jacob's staff; traversing, etc.; local attraction; magnetic declination; prismatic compass, etc.; field geometry with chain and angle measuring instrument; determining length and bearing of inaccessible lines, etc.

Direct leveling principles; methods of operation; effects of refraction and curvature of the earth; perpendicular levels; water levels; spirit levels; Gurley's telescopic and Locke's hand levels; Y level; dumpy levels; Egault's level, etc.; construction of different form; adjustments and use; levelling rods; targets; field books; recording of notes; definitions; field work; difficulties met with; profiles; cross sections; grade lines; reciprocal levelling; indirect levelling; methods employed; instruments used; clinometers; angular profiles; surveyor's transit; engineer's transit; theodolite; tachymeter; construction, use and adjustments; methods of measuring horizontal angles; traversing by back angle and deflection angle; line surveying; ranging; farm surveying, etc. Farm of ma posts I plan. I spacin Books o

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Pocket Sextant-description use and adjustments.

Plotting—inking-in; colouring; areas from measurement on plan.

Lettering—upper and lower case Gothic and Roman letters ; spacing, titles, etc.

Books of Reference: Raymond's Plane Surveying. Gillespie's Surveying.

#### SECOND YEAR

Students of this class are required to buy two field note books, viz., a transit book and a level book, the cost of which is not more than 70 cents each.

#### Lectures First Term.

Methods of plotting transit surveys; protractors; scale of chords; table of chords; table of sines; latitudes and departures; method of computation; balancing closed traverse; error of closure; distribution of error; double longtitudes; double areas; co-ordinates; areas by co-ordinates; graphic method of balancing traverse; traverse tables; supplying omissions; laying out, parting off and dividing up land into squares, quadrilaterals, triangles, town lots, &c., of desired area; the stadia; theory and deduction of formula; spacing wires; how to graduate stadia rod; inclined readings; differences of elevation; procedure of stadia survey; field notes, &c.; micrometer or gradienter, description and use; city surveying; precision required; instruments; description of city lot; marking corners; discrepancies; additions; survey and map; curves; principles; method of laying out curves; location by chain alone; compound curves.

Topographical surveying ; forms of ground and representation in plan by horizontal contour lines, lines of greatest slope, &c.

Field methods for small and larger areas; transit and stadia methods; earthwork computations; prismoidal formula; area grading; street grading; excavation under water; estimating volumes from contoured plan by different methods.

Simple angular levelling ; accuracy required up to 5 miles ; calculations, curvature and refraction ; barometric levelling ; compound angular levelling ; simple triangulation ; requirements and measurements of base line ; reduction of base to sea level ; methods -50-

Hydrographical surveying; objects; methods employed to locate soundings; geometrical and trigonometrical solutions of the "Three point problem"; three arm protractor; the chart; velocity of currents, &c.; the marine sextant, description, use and adjustments.

Mine surveying, objects and methods employed; marking of stations; measurements required; sights; plummet lamps; mining transit; connecting underground and surface surveys by one shaft, two shafts, an adit or incline; care required in plumbing shaft; traversing with three tripods and target lamps; location of new lines; how to obtain azimuth and inclination of tunnel to tap a shaft; other problems met with; plan, longtitudinal and transverse sectional elevations, descriptive geometry employed.

Books of Reference :

Raymond's Plane Surveying; Gillespie's Surveying; Brough's Mine Surveying; Trautwine's Engineers' Pocket Book.

#### THIRD YEAR.

Students of this class are recommended to purchase "Notes on Geodesy," by Major General Oliver, and Manual of Dominion Land Surveying.

#### Lectures Second Term.

Figure of the earth an oblate spheroid ; eccentricity and compression of the earth ; geocentric and astronomical latitude ; angle of the vertical ; radius of terrestial spheroid ; length of great normal ; radius of curvature of terrestial meridan ; pendulum experiments.

Geodetic operations; principal steps taken; measurement of base line and instruments used; measurement of broken base; reduction of base to sea level; measurement of base by sound and astronomically; triangulation; signals; lengths of sides; instruments; measuring angles; "reduction to the centre;" reduction of inclined angles; spherical excess; correcting angles; calculation of sides.

Adjustment of observations; examples; calculations and formulae; determination of geodetic latitudes, longtitudes and azimuths of triangulation stations, earth considered elliptical; calculations of distances and areas; method of delineating a spherical surface on a plane; horizontal projection; central projection; projection by development.

Trigonometrical levelling; reciprocal observations for cancelling refraction; reduction to the summits of signals, etc.

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#### Domion Land Surveying :

Numbering and dimensions of townships, sections and quarter sections; boundary lines; initial meridans; ranges; correction and base lines; jog; allowances for surplus and deficiency; fractional ranges, etc., corners; different systems of survey and where carried out; field work; instruments; blazing; boundary corners; Indian reserve; boundaries; dimensions and positions of posts, mounds and pits at corners and on correction lines; witness posts, mounds and pits; marking posts; field book; description of lines; information required in notes; sub-division of townships; method of survey; chaining; lines to be run; correction lines near initial meridan; quarter sections adjoining correction lines; limits of error; survey of rivers and lakes, etc.; progress reports; returns of survey; survey of block outlines under different systems; closing of blocks; deflection of baseline; measurements; corrections in chaining, etc.; direction of lines; production of lines.

Survey of township outlines; posts to be planted; observations for azimuth, latitude, etc. Surveys in the railway belt, British Columbia. Extracts from the Dominion Lands Act 49 Vic. Chap. 54. Construction and use of tables.

The Classes in English, Mathematics, Physics, and Animal Biology are taken in Queen's University.

# ENGLISH LANGUAGE AND LITERATURE.

Profesor: James Cappon, M.A. Tutors; Thurlow Fraser, Jas. Duff.

UNIOR CLASS.

1. Practical course in Rhetoric and Composition.

2. Analysis of style in connection with the study of passages from Bacon, Jeremy Taylor, Addison, Johnson, White of Selborne, De Quincey, Washington Irving, Macaulay, Ruskin.

The following texts (from which passages for analysis will be selected) may be procured from Maynard Merrill & Co., New York, 12 cents each :

Bacon's Essays (selected).

Irving's Sketch-Book (Westminster Abbey, Visit to Shakespeare's Birthplace). De Quincey's Joan of Arc

Macaulay's Essay on Boswell's Johnson. Ruskin's Modern Painters (Calais Tower).

3. A. detailed study (in class) of the following works :

Chaucer, Prologue to Canterbury Tales (The descriptions of the Knight, Squire, Prioress, Monk, Friar, Student, Merchant, Doctor, Shipman, Parson).

Shakespeare, Merchant of Venice.

Longfellow, Prelude, Nuremberg, The Belfry of Bruges, The Skeleton in Armour, Amalfi, The Village Blacksmith, The Day is Done, The Secret of the Sea.

Tennyson, In Memoriam, Sections I to XII.

#### MATHEMATICS.

Professor: N. F. Dupuis, M.A., F.R.S.C. Assistants: N. R. Carmichael, M.A.; and ...

#### JUNIOR CLASS.

The theory and practice of Algebra to the Binomial theorem inclusive. Dupuis' Algebra—the first thirteen chapters, omitting chapter XI.

Geometry of the point, line and circle in the plane. Parts I and II and selections from Part III, Dupuis' Plane Geometry.

Besides numerous class-exercises, weekly written exercises will be required. Mondays, Wednesdays and Fridays at 3 p.m.

#### SENIOR CLASS.

Algebra-Dupuis' Algebra, from the twelfth chapter to the end.

Geometry-Part III of Dupuis' Plane Geometry, and the first 131 pages of Dupuis' Solid Geometry.

Trigonometry-Preceding De Moivre's theorem.

Besides numerous class-exercises, periodical written exercises will be required. Owing to recent changes in the curriculum this class will be made as practical appossible.

#### THIRD YEAR.

Students failing, after attending one session, to pass the examination in either Junior or Senior Mathematics, and desiring to attend either class second session, must pay the tutorial fee of  $\$_{3.00}$ .

Elementary Co-ordinate Geometry. Thursdays at 3 p.m. Elementary Differential and Integral Calculus. Thursdays at 11 a.m. Spherical Trigonometry and Astronomy. Wednesdays at 4 p.m.

#### PHYSICS.

Professor: D. H. Marshall, M.A., F.R.S.E. Demonstrator: W. C. Baker, M.A.

#### JUNIOR AND SENIOR CLASSES.

Lectures and Experiments are given in the following subjects :

Properties of Matter.

. Extension-Inertia-Mass-Density-Gravitation-Specific weight-Weight of Gases-Molecular Forces-Energy.

Dynamics.

Kinematics-Statics of Solids and Fluids-Kinetics of Solids and Fluids.

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Thermometry—Calorimetry (Specific and Latent Heats)—Hygrometry— Transference of Heat (Conduction and Radiation)—Dynamical Theory of Heat.

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#### Magnetism.

Heat.

With special reference to Terrestrial Magnetism.

#### Electricity.

Frictional Electricity--Voltaic Electricity-Electro-Magnetism-Dia-Magnetism-Magneto-Electricity-Thermo-Electricity-Electro-Dynamics.

Light.

General Laws of Radiant Energy—Geometrical Optics—Physical Optics— Construction and use of Optical Instruments—Spectrum Analysis.

Sound.

Propagation of Waves-Physical Theory of Music.

Algebra, Geometry and Trigonometry are applied to the solution of problems, and weekly exercises are given throughout the session.

In the Junior Class the following subjects are principally studied : Properties of matter, dynamics, heat, magnetism and frictional electricity. In the Senior : dynamics, voltaic electricity, electro-magnetism, magneto-electricity, thermo-electricity, light and sound.

Text-Book-Marshall's Introduction to the Science of Dynamics, new edition, published by R. Uglow & Co., Kingston. Price \$1.50.

The following books should be consulted in connection with the lectures:

Gage's Elements of Physics. Tait's Properties of Matter. Balfour Stewart's Heat. Silvanus Thompson's Electricity and Magnetism. Taylor's Sound and Music. Deschanel's Natural Philosophy or Ganot's Physics. Clerk Maxwell's Matter and Motion. Chambers' Mathematical Tables.

NOTE.—Copies of all these works are kept in the Physical Laboratory and may be freely consulted by any student during the session.

Students who have not studied the Ontario High School Physics are recommended to do so, as questions from this work will be given at the monthly examinations.

Students in the Junior and Senior Classes are offered the privilege of experimenting in the Physical Laboratory under regulations to be explained at the beginning of each session.

#### ANIMAL BIOLOGY.

Professor: A. P. Knight, M.A., M.D. Tutors: E. C. Watson, M.A., M.D., T. T. Bower.

PASS CLASS.

The course in this subject begins on the 1st of October and lasts until the end of January. Lectures or demonstrations will

be given tri-weekly at 9 a.m. For laboratory work the class will be divided into sections, which will be taken on Thursdays from 10 to 12 a.m., and on Fridays, 10 to 12 a.m.

The lectures treat of protoplasm, cells, cell division, reproduction, early stages of development, tissues, organs, differences between animals and plants, general view of invertebrata and of vertebrata, organic evolution.

The laboratory work consists of such dissections and demonstrations as will elucidate the subject of the lectures. The lectures are illustrated by diagrams, charts, and lantern transparencies.

The senior leaving examination in Biology of the Educational Department is accepted in lieu of attendance and examination in this class.

#### BOTANY.

# Professor : Rev. James Fowler, M.A.

#### PASS CLASS.

This class will commence about the first of February, after the Pass Class in Animal Biology has been discontinued; 9 a.m. daily. Lectures embrace the following subjects:

General morphology of the plant body, segmentation symmetry, arrangement of lateral members on the common axis, branch systems.

Special morphology of the members (1) Roots, different forms, duration, parasites
(2) Stems, their forms, climbing stems, etc.; (3) Leaf, phyllotaxis, venation, vernation, forms; (4) Trichomes, etc.; (5) Flowers; (6) Fruits; (7) Arrangements for cross-fertilization, close-fertilization.

Anatomy of plants (Histology), cell-wall, protoplasm, chlorophyll, starch, etc.; formation of new cells, tissues, system of tissues.

Study of specimens belonging to leading orders. Text Book-Spotton's Canadian Flora.

# FIELD CLASSES IN GEOLOGY AND PROSPECTING.

The attention of students and others is called to the practical study of geology, mineralogy and prospecting methods. Some of the chief mineral localities of the Kingston district are visited each session, and abundant opportunities are offered for collecting specimens and studying the modes of occurrence of substances of economic value. All students in geology and mineralogy are expected to take advantage of these excursions.

#### MINERAL AND GEOLOGICAL SPECIMENS.

It is desired to make the collections of this School as complete and representative as possible of the mineral resources of Canad charge with the for reference Sature over the

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comces of Canada. Specimens sent to the School will be named free of charge. Good specimens presented to the School will be labelled with the name of the donor and the locality, and will be preserved for reference.

Samples under 25 lbs. in weight may be sent by express; over that weight, by freight.

Specimens should be addressed to the Professor of Mineralogy, or to the Professor of Geology, School of Mining, Kingston, Ont.

# THE BRUCE CARRUTHERS SCHOLARSHIPS.

The following are the conditions upon which these scholarships (of the value of \$100 each) are awarded and held :

I. The candidates must have sufficient practical knowledge to give efficient help in the mining laboratory and in assaying. It is particularly required that they be acquainted with amalgamating.

2. The candidates must have entered upon, or be prepared to enter upon, or have finished, one of the courses of study as at page 19, and preference will be given to the students farthest advanced in their course.

3. It is understood that these duties are to be so arranged as to interfere as as little possible with the studies of the scholars.

4. The scholarships may be held for more than one session.

5. Applications will be received up to April 1st.

#### THE CHANCELLOR'S PRACTICAL SCIENCE SCHOLARSHIP.

Value \$70. Given by Sir Sanford Fleming, C.E., K.C.M.G., LL.D., Chancellor of the University. Awarded to the Practical Science student passing the best examination at the end of the first year. This Scholarship is open to students of Mining Engineering.

#### SCHOLARSHIP IN CHEMISTRY.

This scholarship, of the value of \$50, the gift of a graduate, is open to all who have not yet begun the honour course in chemistry. The holder must enter upon and complete the honour course in chemistry (see Calendar of Queen's University). The next examination will be held in April, 1901, on the syllabus of the senior chemistry class.

# THE CHAIRMAN'S MATRICULATION SCHOLARSHIP.

A scholarship of \$50 offered by John McKelvey, Esq., chairman of the Board of Governors, will be awarded to the candidate making the highest total number of marks in the mathematics, physics, and chemistry of the SENIOR MATRICULATION examination. This scholarship is awarded on the results of the departmental examination in July, and the winner must enter the School of Mining the following session.

#### PRIZE IN METALLURGY.

The gift of B. T. A. Bell, Esq., Secretary of the Canadian Mining Institute. Value, \$25. To be awarded to the student who makes the highest mark in the examination on Third Year Metallurgy.

#### **GIFTS OF MINERALS.**

1. Silver ores from Porcupine mine, Port Arthur. Harry Richardson, Esq.

2. Molybdenite, Bancroft. R. T. Hodgson, M.A.

3. Cassiterite, turquoise, grey copper ore, malachite, cinnabar and various ores from Arizona, Mexico, etc. Fred J. Pope, M.A., Ph.D.

4. Clay nodules, tufa. Oswald N. Scott, Grand Forks, B.C.

5. Native gold, with chalcocite and bornite. J. Legatt, Parry Sound.

6. Specimen of labradorite, &c. Collection of British Columbia silver ores, etc. R. W. Brock, M.A., geol. survey.

7. Calcite crystals, garnets, etc. J. Walter Wells, B.Sc., Belleville.

8. Argentite, West End Mine, Silver Mountain. W.C. Dobie, Port Arthur.

9. Zinc blende, Zenith Mine, Rossport. R. M. Hunter, Duluth.

10. Turquoise, Thibet. Dr. T. L. Walker, Calcutta, India.

11. Mispickel, Deloro, Hastings Co. A. H. Brown.

12. Colorado silver ores, copper ores and arsenic ores, Cripple Creek. C, Garnet Rothwell.

13. Fossilized wood, California. E. L. Weatherhead, Brockville.

<sup>14</sup> Minerals and ores from Dufferin Mine, Salmon River, N.S. J. C. Murray and F. G. Stevens.

15. Group of mica crystals. Joseph Franklin, Kingston.

#### GIFTS OF MACHINERY, &c.

One 10-inch brass Centrifugal Machine. American Tool & Machine Co., 109 Beach Street, Boston, Mass.

Two 15-inch brass wire riddles, Nos. 180 and 200 mesh; 94 samples wire cloth. The W. S. Tyler Wire Works Co., Cleveland, Ohio.

Nine photographs of mining machinery; 20 blue prints of working drawings of mining and metallurgical plants. Fraser & Chalmers, Chicago, Ill.

Six samples of mining candles. The Will & Baumer Co., Syracuse, N.Y. One double-load wheelbarrow. Creelman Bros., Georgetown, Ont.

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Sample of peat. R. & J. Ransford, Clinton, Ont.

Three safety lamps; I coal auger and brace; I coal shovel; I coal pick; 2 jumper drills; I pricker; I spoon; I box of coal samples. James Hargreaves, Springhill, N.S.

Samples of gas rock from Essex county natural gas fields. H. Smith, Ruthven, Ont.

One No. 6 Spiral Sand Pump. Frenier & LeBlanc, Rutland, Vt.

One dynamite thawer. Ontario Powder Co., Kingston, Ont.

One No. O Krupp Ball Mill, from Fried. Krupp, Magdeburg-Buckau, Germany, through James W. Pyke & Co., 205 St. James street, Montreal, Que., --Value \$300.

One Filter Press for Slimes. John Johnson & Co., Franklin Square, New York City.

#### GIFTS OF BOOKS, &c.

1. Annual Report (new series) Vol. X.; Summary Report for 1898; Mineral Statistics and Mines, Annual Report for 1898. From Geological Survey Department of Canada.

2. Nineteenth Annual Report, Twentieth Annual Report, 1897-98, parts 6 and 6 continued; Bulletins 157 to 162 inclusive; Monograph XXXII to XXXVIII inclusive, also Annual Reports II—X. From United States Geological Department, Washington, D.C.

3. Thirtieth Annual Report of the State Board of Health. From State Board of Health, Boston, Mass.

4. Proceedings of Society, Vol. 29, Nos. 1 to 8 inclusive. From Boston Society of Natural History, Boston, Mass.

5. University Circulars, various.

6. Boletin del Instituto Geologico de Mexico, num. 13. From Instituto Geologico de Mexico.

7. Statistical Year Book of Canada for 1898; Report of Commissioner on Agriculture and Dairying for Dominion of Canada for 1898. From Department of Agriculture, Ottawa.

8. Bulletins No. 63, No. 64, No. 65 From Inland Revenue Department, Ottawa.

9. Annual Reports, Bureau of Industries, Ont., Roadmaking. From Ontario Department of Agriculture, Toronto.

10. Report of the Bureau of Mines, Vol. VIII., parts 1 and 2. From Bureau of Mines, Toronto.

11. Journal of Canadian Mining Institute, 1898, Vol. III. From B. T. A. Bell, Ottawa.

12. Papers read before the Engineering Society, No. 13, 1899-00. From School of Practical Science, Toronto.

13. Proceedings of the Rochester Academy of Science. Vol. 3 Brochure 2.

14. Proceedings and Transactions, Session 1898-9 Vol. X., part I. From Nova Scotian Institute of Science, Halifax, N.S.

15. Five copies descriptive catalogue of Mining Machinery. Messrs. Fraser and Chalmers, Chicago.

16. Bauerman's Mineralogy; Meyer's History of Chemistry; Shepard's Synopsis of Mineralogy. From Mr. A. Monmouth Boyd.

#### --58---GRADUATES.

In this list are included graduates in the Faculty of Practical Science (B.Sc. and E.M.) and those graduates in Arts (B.A., M.A. and D.Sc.) since 1887, who after graduation have devoted themselves to scientific pursuits.

\* Deceased.

#### LIST OF STUDENTS.

#### I.-MATRICULATED STUDENTS.

FIRST YEAR.

| Name.              | Address.          | Branch of Engineering. |
|--------------------|-------------------|------------------------|
| Anglin, C. S       | Kingston          | Mechanical.            |
| Baker, C. J        | Osnabruck Centre. | Mining.                |
| Bartlett, Jas      | Gananoque         | Mining.                |
| Chappelle, J. W. S | Baie Verte, N.B.  | Mining.                |
| Craig, H. B. R     | Kingston          | Mining.                |
| Drummond, L. E.    | Winnipeg, Man     |                        |
| Gordanier, W. N    | Napanee           | Electrical.            |
| Graves, R. B. S    |                   | Mining.                |
| Hardy, J. G        | Kingston          | Mining.                |
| Jackson, H. E      | Lindsay           | Mining.                |
| Malone, E. E.      | Kingston          |                        |

Nat MacDian Mackie, Mackie, Rose, S. Sutherla Tett, Ber Wilgar, I Workma

Carr-Hai Dwyer, Fairlie, M Ferguson Gleeson, Grover, C Horsey, J Knight, C McNab, A Noble, D Redmond Reid, G. C Reid, J. A

Hargreav Huffman, Murray, J McLennar Rawlins, J Sutherlan

Craig, J. I Fraleck, E Graham, S Jones, D. J McLennan Smeeton, M Stevens, F

Name Chaplin, G Finlayson, Gilbert, F. Hunt, H. J Robertson, Spencer H Taylor, G. Thompson,

Dobbs, W. Silver, L. P ce (B.Sc. 887, who

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| Name.             | Address            | Described De la       |
|-------------------|--------------------|-----------------------|
| MacDiarmid, S. S. | A sulman           | Branch of Engineering |
| Mackie, F. H      | Ayimer             | Mining.               |
| Mackie, G. A      | . Osnawa           | Mining.               |
| Rose, S. E. L     |                    | Mining.               |
| Sutherland, F     | New Carlin D.      | Electrical.           |
| Tett, Benjamin    | New Carlisle, P.Q. | Mining.               |
| Wilgar, Percy     | Cohours            | Mining.               |
| Workman, I, K     | Vincetter          | Mining.               |
| , j               | Kingston           | Mining.               |

#### SECOND YEAR.

| -                  | L'AR.           |             |
|--------------------|-----------------|-------------|
| Carr-Harris, R. R. | Kingston        |             |
| Dwyer, Edmund      | Vingston        | Mining      |
| Fairlie M F        | Kingston        | Electrical. |
| Forgueon Mallie    | Lansdowne       | Mining.     |
| Clease Meins       | Kingston        | Mining      |
| Gleeson, J. V      | Kingston        | Mining.     |
| Grover, George A   | Kingston        | Mining.     |
| Horsey, B. T       | Iltica NIX      | Mining.     |
| Knight C W         | Utica, N.Y.     | Mining.     |
| McNab A I          | Kingston]       | Electrical  |
| Nahla D. O.        | Douglas         | Mining      |
| Noble, D. S        | Clarkson        | Mining.     |
| Redmond, A. V.     | Kingston        | aining.     |
| Reid, G. C.        | Middleter NO    | Mining.     |
| Reid, I A          | Middleton, N.S  | Mining.     |
| Workman C W        | Middleton, N.S. | Mining.     |
|                    | Kingston        | lining      |
|                    |                 | s.          |

#### THIRD YEAR.

| The second se |              |
|---|--------------|
| Hargreaves, James Springhill M  | 0            |
| Huffman A E D A   | S Mining.    |
| Gilead. Ont.  | Mining       |
| Murray, J. C., B.A. Holifon M.C.  | mining.      |
| McLennan K D  | Mining.      |
| Lindsav   | Civil        |
| Rawlins, J. W., B.A. Dorth  |              |
| Sutherland F  | ···· Mining. |
| Belleville  | Flootningt   |
|   | Electrical.  |

#### FOURTH YEAR.

|                      | Southand a longe.    |
|----------------------|----------------------|
| Craig, J. D., B.A.   | Kingston             |
| Fraleck, E. L., B.A. | Belleville           |
| Graham, S. N.        | Kingston             |
| Jones, D. Ford.      | Gananagua Civil.     |
| McLennan, I. D.      | Dort Hone Mining.    |
| Smeeton, W. F.       | Ochaille Mining.     |
| Stevens, F. G.       | Halifer N.C. Mining. |
|                      |                      |
|                      |                      |

# II.-UNMATRICULATED STUDENTS.

| FIRST | YEAR. |
|-------|-------|
|       |       |

| Name.                        | Address             | 영양 영양 방송 영양 |
|------------------------------|---------------------|---|
| Chaplin, G. W.               | Address.            | Branch of Engineering.                          |
| Finlayson, M. D.             | St. Catharines      | · · · · · Mining.                               |
| Gilbert, F.                  | Montand River, N.S. | Mining.   |
| Hunt, H. R.                  | Bareida             | ···· Mining.                                    |
| Robertson, L. M.             | Kingston            | Mining.   |
| Spencer H. H.                | Kingston            | Mechanical.                                     |
| Taylor, G. D.                | Belleville          | ·· ···· Mining.                                 |
| Thompson, A. T               | Kingston            |   |
|                              | SECOND YEAR.        |   |
| Dobbs, W. S<br>Silver, L. P. | Kingston            |   |

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#### THIRD YEAR.

| Name.            | Address.      | Branch of Engineering |
|------------------|---------------|-----------------------|
| Dickson, G. H    | Kingston      | Mining.               |
| Middlemiss, A. H | Montreal, Que | Electrical            |
| Scott, O. N      | Listowel      | Mining.               |

#### **III.-SPECIAL STUDENTS.**

| Name.             |         | Address             |
|-------------------|---------|---------------------|
| Cartwright, R. H. | M       | Peterboro.          |
| Curtis, Guy H     |         | Delta.              |
| Edey, N. W        | <b></b> | Onslow.             |
| Foster, R.        | 1       | Chesterville        |
| Jameson, D. B     |         | Newlands Eltham Eng |
| Weatherhead, E. I |         | Brockville.         |

#### GRADUATES, 1900.

| Craig, J. D., B.A., Mining Engineering (B.Sc.). | Kingston.     |
|---|---------------|
| Graham, S. N                                    | Kingston.     |
| Smeeton, W. F Mining Engineering (B.Sc.).       | Oakville.     |
| Stevens, F. G Mineralogy and Geology (B.Sc.)    | Halifax. N.S. |

#### PASS LISTS.

SUPPLEMENTAL EXAMINATIONS, SEPTEMBER, 1899. Junior Physics—Jas. Hargreaves.

Junior Chemistry-W. S. Dobbs.

#### SESSIONAL EXAMINATIONS, APRIL 1900.

Junior English—(Div. I.) W. N. Gordanier; (Div. II.) Jas. Bartlett, F. Sutherland, S. L. Rose, G. W. Chaplin; (Div. III.) H. G. Jackson, S. S. McDiarmid, M. D. Finlayson, L. E. Drummond, E. Malone, C. Anglin.

Junior Mathematics—J. Bartlett, W. N. Gordanier, H. G. Jackson, S. L. E. Rose, W. P. Wilgar, F. Sutherland, F. H. Mackie, M. D. Finlayson, A. V. Redmond, J. A. Reid.

Senior Mathematics—E. W. Henderson, C. J. Baker, G. A. Grover, C. W. Knight, R. R. Carr-Harris, J. Hargreaves, L. P. Silver.

Conics-W. F. Smeeton, E. Sutherland, E. Dwyer, R. R. Carr-Harris.

Synthetic Solid Geometry-E. Sutherland, P. W. Currie.

Calculus I-W. F. Smeeton.

Analytic Solid Geometry-S. N. Graham.

Spherical Trigonometry-W. F. Smeeton, J. D. Craig, F. G. Stevens, P. W. Currie.

Junior Physics-W. N. Gordanier, S. S. McDiarmid, Sydney L. E. Rose, F. Sutherland, H. G. Jackson, E. Malone, V. Gleeson, W. P. Wilgar. J. A. Reid, C. J. Baker, M. D. Finlayson, C. W. Knight, D. S. Noble, W. S. Dobbs, B. T Horsey.

Senior Physics—(Div. I.) A. J. McNab; (Div. III.) M. F. Fairlie, E. Sutherland, K. R. McLennan, C. W. Workman, G. A. Grover, E. L. Fraleck, L. P. Silver, J. Hargreaves, J. D. McLennan.

#### Jui Wilgar, C. J. Bi Malone Redmon

Sen Knight, E. Dwy

Tech G. A. G Murray,

Gen

Qua J. A. Re Dwyer, G. C. Re

Qua J. W. Ra Hargrea

Assa

Qua

Elen J. K. Wo J. Baker H. R. H Harris.

Syst. Gleeson

Desc III.) O. Murray,

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Stevens,

y L. E. P. Wil-S. Noble,

irlie, E. L. FraJunior Chemistry—(Div. I.) S. S. McDiarmid, M. D. Finlayson, W. P. Wilgar, J. Bartlett, W. N. Gordanier, E. W. Henderson, H. G. Jackson, C. J. Baker; (Div. II.) F. Sutherland, J. K. Workman, S. L. Rose, E. Malone; (Div III.) B. Tett, G. W. Chaplin, L. E. Drummond, A. V. Redmond, J. W. Chapelle.

Senior Chemistry—(Div. I.) J. A. Reid, A. J. McNab; (Div. II.) C. W. Knight, B. T. Horsey, D. S. Noble; (Div. III.) M. F. Fairlie, G. C. Reid, E. Dwyer, R. R. Carr-Harris, V. Gleeson, C. Workman, L. P. Silver.

Technical Chemistry—(Div. I.) J. D. Craig, J. A. Fife, G. H. Dickson, G. A. Grover, E. L. Fraleck, A. F. Huffman, O. N. Scott; (Div. II.) J. C. Murray, J. Hargreaves.

General Chemistry-(Div. II.) J. A. Fife.

Qualitative Analysis—(Practical and Written)—(Div. I.) A. J. McNab, J. A. Reid; (Div. II.) Chas. Workman, Geo. A. Grover, M. F. Fairlie, E. Dwyer, O. N. Soott, V. Redmond; Mellis Ferguson, D. S. Noble, equal; G. C. Reid; (Div. III.) L. P. Silver, V. Gleeson.

Quantitative Analysis and Assaying—(Practical and Written)—(Div. I.) J. W. Rawlins; (Div. II.) W. F. Smeeton, A. F. Huffman, J. D. Craig, J. Hargreaves, G. H. Dickson; (Div. III.) J. C. Murray.

Assaying Only-Geo. A. Grover, O. N. Scott.

Quantitative Analysis Only-J. D. McLennan.

Elementary Mineralogy—(Div. I.) S. S. McDiarmid, M. D. Finlayson, J. K. Workman, W. P. Wilgar; (Div. II.) H. G. Jackson, J. Bartlett, C. J. Baker; (Div. III.) B. T. Horsey, F. H. Mackie, F. Sutherland, B. Tett, H. R. Hunt, G. A. Mackie, E. E. Malone, L. E. Drummond, R. R. Carr-Harris.

Systematic Mineralogy—(Div. II.) D. S. Noble, C. W. Workman, V. Gleeson; (Div. III.) J. A. Reid. L. P. Silver, M. F. Fairlie.

Descriptive and Determinative Mineralogy—(Div. I.) J. Rawlins; (Div. III.) O. N. Scott, G. A. Grover, J. D. McLennan, A. F. Huffman, J. C. Murray, G. H. Dickson.

Blowpipe Analysis—(Div. I.) J. Bartlett, S. S. McDiarmid, M. D. Finlayson, W. P. Wilgar; (Div. II.) E. E. Malone, C. J. Baker, F. Sutherland, B. T. Horsey; (Div. III.) H. G. Jackson, J. K. Workman, B. Tett, F. H. Mackie, L. E. Drummond, J. W. S. Chapelle, G. W. Chaplin, G. A. Mackie, R. R. Carr-Harris.

Surveying—(First Year)—H. G. Jackson, W. N. Gordanier, E. W. Henderson, S. S. McDiarmid, S. L. E. Rose, R. R. Carr-Harris, W. P. Wilgar, J. Bartlett, F. Sutherland, M. D. Finlayson, J. K. Workman, A. T. Thompson, C. J. Baker, F. H. Mackie, L. P. Silver, E. Malone, C. Anglin, J. W. S. Chapelle, G. A. Mackie, B. Tett, G. W. Chaplin, L. Drummond.

Surveying—Second Year)—(Div. I.) A. J. McNab, J. W. Rawlins, D. S. Noble, A. F. Huffman, C. Workman, M. F. Fairlie; (Div. II.) L. P. Silver, E. Dwyer, V. Gleeson, A. V. Redmond, J. C. Murray; (Div. III.) M. Ferguson.

Surveying—(Third Year)—(Div. I.) S. N. Graham, J. D. Craig; (Div. II.) J. D. McLennan, K. R. McLennan, J. Hargreaves; (Div. III.) E. L. Fraleck.

Advanced Surveying—Trial Lines—(Third Year, Junior)—(Div. I.) J. W. Rawlins, A. J. McNab, J. D. McLennan; (Div. II.) M. F. Fairlie, A. F. Huffman, J. C. Murray.

Advanced Surveying—Railway Curves—(Fourth Year, Senior)—(Div. I.) J. W. Rawlins, M. F. Fairlie, A. J. McNab, J. C. Murray; (Div. II.) A. F. Huffman, J. D. McLennan.

Descriptive Astronomy—W. N. Gordanier, G. A. Grover, S. L. E. Rose, J. Bartlett, E. W. Henderson, H. G. Jackson, G. W. Chaplin, S. S. Mc-Diarmid, J. K. Workman, L. E. Drummond, F. Sutherland, A. F. Huffman, B. Tett, A. V. Redmond, M. D. Finlayson, A. T. Thompson, L. P. Silver.

Geology—(Second Year)—(Div. I.) A. J. McNab; J. A. Reid, C. Workman, equal; (Div. II.) L. P. Silver; G. A. Grover, D. S. Noble, equal; G. C. Reid; (Div. III.) M. F. Fairlie.

Petrography—(Div. II.) J. W. Rawlins, A. F. Huffman; (Div. III.) J. C. Murray, O. N. Scott.

Economic Geology—(Div. II.) J. W. Rawlins; (Div. III.) O. N. Scott, G. H. Dickson, A. F. Huffman.

Geology of Canada—(Div. I.) J. W. Rawlins; (Div. II.) A. F. Huffman; (Div. III.) G. H. Dickson, O. N. Scott.

Geology-(Fourth Year)-(Div. I.) F. G. Stevens.

Mining-(Third Year)-(Div. II.) J. W. Rawlins, S. N. Graham, A. J. McNab; (Div. III.) M. F. Fairlie.

Mining—(Fourth Year)—(Div. I.) F. G. Stevens; J. D. Craig; (Div. II.) W. F. Smeeton; (Div. III.) J. D. McLennan.

Metallurgv—(Third Year)—(Div. I.) J. W. Rawlins, A. F. Huffman; (Div. II.) O. N. Scott; (Div. III.) G. H. Dickson, J. C. Murray.

Metallurgy-(Fourth Year)-(Div. II.) J. D. Craig.

Ore Dressing—(Third Year)—(Div. II.) A. F. Huffman, J. W. Rawlins, equal; J. D. McLennan; (Div. III.) G. H. Dickson, E. L. Fraleck, O. N. Scott.

General Engineering, Nature, Production and Use of Materials of Construction—(Senior)—(Div. II.) R. R. Carr-Harris, C. Workman, C. W. Knight, J. A. Reid, E. Dwyer; A. V. Redmond, D. S. Noble, equal; L. P. Silver; (Div. III.) G. A. Grover.

General Engineering, Strength of Materials—(Third Year, Junior)—(Div. I.) R. C. Rawlins; (Div. III.) A. J. McNab, M. F. Fairlie.

Statics of Construction—(Third Year, Junior)—(Div. I.) A. J. McNab; (Div. II.) J. C. Murray; (Div. III.) A. F. Huffman.

Hydraulics-(Third year, Junior)-(Div. I.) E. Sutherland, J. D. Mc-Lennan. Stev

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E. Rose, 5. S. Mc-F. Huffon, L. P.

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Hydraulics-(Fourth year, Senior)-J. D. Craig, E. L. Fralick, F. G. Stevens, equal.

Nature, Production and Use of Materials of Construction—(Junior)—(Div. I.) R. R. Carr-Harris, G. Grover, L. P. Silver, equal; D. S. Noble, C. Workman, A. V. Redmond, equal; J. A. Reid; (Div. II.) E. Dwyer, J. D. McLennan, equal; C. W. Knight, F. G. Stevens.

Strength of Materials-J. W. Rawlins, A. J. McNab, M. F. Fairlie.

Designing Structures—(Second year, Junior)—(Div. I.) A. V. Redmond; R. R. Carr-Harris. C. Workman, equal; (Div. II.) E. Dwyer, C. W. Knight, G. Grover, J. A. Reid, D. S. Noble, L. P. Silver.

Drawing—(First year)—(Div. I.) W. L. Gordanier; (Div. II.) S. L. Rose, S. McDiarmid; E. W. Henderson, J. K. Workman, G. W. Chaplin, A. Thompson, E. Malone, D. S. Noble, equal; (Div. III.) P. W. Currie, F. H. Mackie, J. G. Jackson, equal; C. J. Baker, J. Bartlett, equal; W. P. Wilgar, R. R. Carr-Harris, equal; F. Sutherland, L. P. Silver; M. D. Finlayson, W. S. Dobbs, equal.

Drawing-(Second year)-(Div. I.) J. W. Rawlins; (Div. II.) C. Workman; (Div. III.) Cyril Knight, G. A. Grover, D. S. Noble, A. J. McNab, A. F. Huffman, A. Redmond, E. Dwyer, M. F. Fairlie.

Mechanism-W. F. Smeeton, J. D. Craig, K. R. McLennan, F. G. Stevens.

Elementary Electricity-E. Sutherland, E. L. Fralick, W. F. Smeeton, F. G. Stevens.

Electricity-S. N. Graham.

Workshops—(First Year.)—C. Anglin, C. J. Baker, J. Bartlett, J. W. Chapelle, G. W. Chaplin, L. E. Drummond, M. D. Finlayson, W. N. Gordanier, R. B. S Graves, R. R. Carr-Harris, E. W. Henderson, H. R. Hunt, H. G. Jackson, F. H. Mackie, G. A. Mackie, E. Malone, S. S. Mc-Diarmid, S. L. Rose, F. Sutherland, B. Tett, G. D. Taylor, A. T. Thompson, P. Wilgar, J. K. Workman, B. T. Horsey, L. M. Robertson.

Workshops—(Second Year.)—W. S. Dobbs, E. Dwyer, M. F. Fairlie, J. V. Gleeson, G. A. Grover, A. J. McNab, J. D. McLennan, D. S. Noble, J. W. Rawlins, E. Sutherland, L. P. Silver, C. W. Workman.

Workshops-(Third Year.)-K. R. McLennan, A. H. Middlemiss, O. N. Scott, E. Sutherland.