Enquiries and formal applications for admission should be directed to the Registrar.
University of Waterloo, Waterloo, Ontario.
Telephone 744-6111 (Area Code 519).

The Registrar's Office is located in Room 113 of the Arts Library Building. Office hours are from 9 a.m. to 12 noon, 1 p.m. to 5 p.m., Monday through Friday.
The office is not open on Saturdays.

The Senate and the Board of Governors of the University of Waterloo reserve the right to make changes in this calendar without prior notice.
## Contents

### I The University of Waterloo

5

### II The Faculty of Arts

9

1. Degrees 10
2. Admission and Registration 11
3. Fees 13
4. Examinations and Promotions 15
5. Academic Programmes 18
   - The General Course 21
   - Honours Courses 22

### III The Faculty of Engineering

47

1. Degrees 50
2. Admission and Registration 51
3. Fees 54
4. Examinations and Promotions 56
5. Academic Programmes 57
   - Chemical Engineering 60
   - Civil Engineering 63
   - Design 67
   - Electrical Engineering 69
   - Mechanical Engineering 72

### IV The Faculty of Science

79

1. Degrees 81
2. Admission and Registration 81
3. Fees 83
4. Examinations and Promotions 85
5. Academic Programmes 88
   - General Courses 89
   - Honours Courses 93

### V The Faculty of Graduate Studies

105

1. Degrees 106
2. Admission and Registration 109
3. Fees 110
4. Examinations 113

### VI The Department of Physical and Health Education

115

1. Admission 116
2. Fees 117
3. Examinations 118
4. Physical Education Programme 118
Contents — (Continued)

VII  Course Descriptions

1. Anthropology  119
2. Biology       120
3. Chemical Engineering  125
4. Chemistry      134
5. Civil Engineering  143
6. Classics       152
7. Design        155
8. Earth Sciences  157
9. Economics      159
10. Electrical Engineering  161
11. English       173
12. French        178
13. General Engineering  181
14. Geography     183
15. German        188
16. Greek         152
17. History       195
18. Latin         153
19. Management and Systems Engineering  227
20. Mathematics   200
21. Mechanical Engineering  214
22. Music         231
23. Philosophy    232
24. Physical and Health Education  239
25. Physics       242
26. Political Science  251
27. Psychology    255
28. Religious Knowledge  264
29. Russian       192
30. Science       266
31. Sociology and Anthropology  266
32. Spanish       272
33. Ukrainian     195

VIII  The Department of Co-ordination and Placement

1. Functions of the Department of Co-ordination and Placement  275
2. Staff          276
3. Co-operative Plan  277
4. The Industrial Advisory Council  280
5. List of Companies Employing Co-operative Honours Mathematics Students  281
6. List of Companies Employing Co-operative Engineering and Applied Physics Students  283
Contents — (Continued)

IX General Information 293

X Scholarships, Prizes and Financial Aid 307

XI Governing Bodies and Staff 335

XII Faculty 343

XIII Academic Calendar 353
University of Waterloo

The University of Waterloo
The Faculty of Arts
The Faculty of Engineering
The Faculty of Science
The Faculty of Graduate Studies
The Department of Physical and Health Education
Course Descriptions
Department of Co-ordination and Placement
General Information
Scholarships, Prizes and Financial Aid
Governing Bodies and Staff
Faculty
Academic Calendar

Calendar 1966-67
The University
of Waterloo
The University of Waterloo

The University of Waterloo is incorporated as a non-denominational institution of higher learning offering courses, both at the undergraduate and graduate level, in Arts, Engineering, and Science. Classes commenced in July 1957 with the introduction of the Co-operative Engineering Programme. In March 1959 a Private Bill was approved by the Legislative Assembly of the Province of Ontario incorporating the University of Waterloo as a degree-granting institution. The University is a member of the Association of Universities and Colleges of Canada and of the Association of Universities of the British Commonwealth.

St. Jerome's College, a Roman Catholic church-related liberal arts college, which had been affiliated with the University of Ottawa since 1947, entered into federation with the University of Waterloo in July, 1960. It offers a basic undergraduate programme of Arts courses which can be supplemented by courses offered by the University. In September of 1962, St. Jerome's College opened three new buildings on the University Campus: a teaching and administration building, men's residence with accommodation for 100 students, and a women's residence with accommodation for 55 students under the supervision of the School Sisters of Notre Dame.

Renison College, an Anglican church-related liberal arts college incorporated in 1959, became affiliated with the University in July, 1960. The college, which is co-educational and residential, is located in new buildings on the University Campus. Renison College provides accommodation for 100 men and 80 women.

St. Paul's College, a United Church residential college and student centre, became affiliated with the University in 1961. St. Paul's College provides accommodation for 100 men and 50 women.

Conrad Grebel College, a Mennonite residential college and student centre, became affiliated with the University in 1961. Conrad Grebel provides accommodation for 65 men and 40 women.

The buildings of the University of Waterloo are situated on an attractive site of 1,000 acres in the northwest section of Waterloo. The first of the major teaching buildings on the campus, the Chemistry-Chemical Engineering Building was occupied in September, 1958. Since 1958 the teaching facilities have expanded to include the Physics and Mathematics Building, the Engineering Building, the Arts Buildings and Theatre of the Arts, the Chemistry-Biology Building and the first stage of the University Residence Village.

At the focal centre of the campus rises a seven storey Arts Library Building which was opened in 1965. It provides immediate accommodation for 175,000 volumes as well as seating space for 400 readers.

A continuing programme of expansion includes additional teaching buildings, further stages of the University Residence Village, an auditorium, and a university centre to be completed within the next few years.
The general administrative offices are temporarily located in the Arts Library Building. The University Cafeteria is located in Annex 2, a temporary building east of the Engineering Building. The student offices are located in the Federation Buildings west of the Chemistry-Biology Building.

The athletic facilities of the University are located at Seagram Stadium and include a fully-equipped gymnasium, a regulation quarter-mile track, and a football field.

Residence accommodation for both men and women is provided on campus by the Church Colleges and the University Residence Village.

For students not admitted to residence, off-campus housing in private homes may be arranged, prior to registration, through the University Housing Service.
II

The Faculty
of Arts
The Faculty of Arts

What have the Arts to offer to a student in the latter half of the Twentieth Century?

They can train a person for a profession, they can greatly increase his value and effectiveness as a citizen, and they can, above all, equip him to receive much more from life than would otherwise be possible. These have always been worthwhile ends, and they have always been difficult to achieve. In the remaining thirty years of this century they will become even more valuable, and even more difficult to achieve.

Many things go into their achieving: the willingness of a student to work hard, the inspiration which a professor may provide, the exchange of ideas among students, and the maturing responsibility of holding office in student affairs. All of these are of tremendous assistance — and so is the curriculum which a student may choose to follow. At the University of Waterloo the various curricula in the Arts (both General and Honours) have been designed with the last thirty years of the Twentieth Century very much in mind.

The graduate in Arts from the University of Waterloo will have become acquainted with the various principal ideas influencing his life and that of his fellow citizens. He will also have been trained to think clearly, critically, and creatively. Consequently he will be well equipped to enter the various businesses and professions; he will make a well-informed and perceptive citizen; and he will be exceptionally well-fitted to derive the greatest amount of benefit and enjoyment from his life.

Degrees

The Degree of Bachelor of Arts (B.A.) is awarded by the University in the following undergraduate courses:

Pass Course (3 years)
The General Course in Arts

Honours Courses (4 years)

<table>
<thead>
<tr>
<th>Economics</th>
<th>German and Russian</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>History</td>
</tr>
<tr>
<td>English and French</td>
<td>History and Philosophy</td>
</tr>
<tr>
<td>English and German</td>
<td>Latin</td>
</tr>
<tr>
<td>English and History</td>
<td>Mathematics</td>
</tr>
<tr>
<td>English and Latin</td>
<td>Mathematics and Philosophy</td>
</tr>
<tr>
<td>English and Philosophy</td>
<td>Mathematics and Psychology</td>
</tr>
<tr>
<td>English and Russian</td>
<td>Philosophy</td>
</tr>
<tr>
<td>English and Spanish</td>
<td>Philosophy and Literature</td>
</tr>
<tr>
<td>French and German</td>
<td>Philosophy and Political Science</td>
</tr>
<tr>
<td>French and Latin</td>
<td>Philosophy and Psychology</td>
</tr>
<tr>
<td>French and Political Science</td>
<td>Political Science</td>
</tr>
</tbody>
</table>
Degrees

French and Russian Psychology
French and Spanish Psychology and Sociology
Geography Sociology

Graduation from any of the following courses with at least Second Class Honours standing qualifies a student for admission to the corresponding Type A course at the Ontario College of Education:

Honours English
Honours English and French
Honours English and German
Honours English and History
Honours English and Latin
Honours English and Spanish
Honours French and German
Honours French and Latin
Honours French and Russian
Honours French and Spanish
Honours Geography
Honours History
Honours Mathematics

Admission and Registration

General

Application for admission to the Faculty of Arts should be made as early in the year as possible on forms provided by the Office of the Registrar. Academic certificates (not diplomas) and other supporting documents should be forwarded as soon as they become available. Admission cannot be granted until all the requirements have been met and all documents submitted.

Admission to Year I

In order to qualify for admission to the first year of the Arts programme, ordinarily the applicant should have completed the requirements for the Ontario Secondary School Honour Graduation Diploma (Senior Matriculation) or its equivalent, showing an overall average of 60% in the required papers. A somewhat higher average may be required of applicants who have taken two years or more to complete the work of Grade XIII.

Standing is required in the following:

- English (Two credits)
- One language other than English (Two credits)
- Four additional credits chosen wherever possible in accordance with the student’s proposed major field of study.

Additional papers can be selected from any of the optional subjects offered at the Grade XIII level with the qualification that no more than one of the following papers may be counted as an “additional” paper: Accountancy Practice. Secretarial Practice. Mathematics of Investment, Art, or Music
(Departmental Examination). The marks received in one of these papers will be included in the computation of the applicant's average. Standing with the Royal Conservatory of Music in Grade VIII practical and Grade II theory will be considered one 'additional paper' on the same terms as these papers except the marks received will not be computed in the average.

**Note 1.** Single combined papers in English and other language subjects are counted as two credits each. All other papers are counted as one credit each, (e.g. Biology, History, Geometry).

**Note 2.** The University will continue to use the results of Grade XIII final examinations as the major criterion for admission to first year in September 1966. Applicants are encouraged to submit College Entrance Examination Board (S.A.T.) Scores as supplementary data where feasible. Applicants who are unable to submit these test results are assured, however, that their admission will not be jeopardized as a result.

The following certificates, recognized as being equivalent to the Ontario Grade XIII certificate, may be accepted insofar as they meet the admission requirements of the University of Waterloo in subjects and percentages:

- **Alberta**
  - Senior Matriculation (Grade XII)
- **British Columbia**
  - Senior Matriculation (Grade XIII)
- **Manitoba**
  - Senior Matriculation (Grade XII)
- **New Brunswick**
  - Senior Matriculation (Grade XIII)
- **Newfoundland**
  - Year I Memorial University
- **Nova Scotia**
  - Senior Matriculation (Grade XII)
- **Prince Edward Island**
  - Third Year Certificate from Prince of Wales College
- **Quebec**
  - McGill Senior Matriculation or Quebec Senior High School Leaving Certificate
- **Saskatchewan**
  - Senior Matriculation (Grade XII)
- **England and Wales, West Indies, East and West Africa**
  - The General Certificate of Education with passes in at least five subjects, two of which must be at Advanced Level.
- **Scotland**
  - The Scottish Leaving Certificate
- **United States of America**
  - High School Graduation plus an additional year of formal study in subjects comparable to Ontario Grade XIII.

**Admission to Advanced Standing**

An applicant for admission to advanced standing must submit an official transcript from the University which he has attended, showing in detail the courses he has taken and his standing in each.
Admission and Registration

Admission as an Adult Student
Any student of mature age who has been away from formal education for more than two years, and who does not possess the minimum requirements for admission may apply to enter as an adult student. Each application will be considered on its merits by the Admissions Committee. Under certain circumstances, the applicant may be required to write a qualifying examination.

Admission as a Part-time Student
Any candidate wishing to enrol as a part-time student may be allowed to take a maximum of two courses per session, provided he meets the regular admission requirements.

Admission of Students from Other Countries
Students from areas where English is not the common language must provide certified translations of academic certificates. In addition, the applicant may be required to take either "The English Proficiency Tests" prepared by the English Language Institute of the University of Michigan, or the examinations for "The Certificate of Proficiency in English" of the University of Cambridge, in order to satisfy the Admissions Committee that his knowledge of the English language is adequate to pursue his studies successfully. The expenses involved in administering the test must be borne by the applicant.

Re-Admission
The University reserves the right to refuse admission to any candidate, and to refuse re-admission if, in the opinion of competent authority, a student is not profiting from University studies.

Registration

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>September 14</td>
<td>Wednesday</td>
<td>Co-operative Mathematics — Year I</td>
</tr>
<tr>
<td>September 15</td>
<td>Thursday</td>
<td>Regular programmes — Years I and II</td>
</tr>
<tr>
<td>September 16</td>
<td>Friday</td>
<td>Regular programmes — Years III and IV</td>
</tr>
<tr>
<td>September 16</td>
<td>Friday</td>
<td>Co-operative Mathematics — Advanced Years</td>
</tr>
</tbody>
</table>

Fees
All fees for the academic session are due and payable on the day of registration. Credit for scholarships or bursaries will be given only on the authority of the Registrar after presentation of proof of the award.

If, for reasons acceptable to the Comptroller, the fees for the year cannot be paid in full on the day of registration, they may be paid in two instalments but an extra charge of $5.00 will then be added to the total fee. The first instalment, to be paid on the day of registration, is a minimum of 60% of the tuition fees plus all incidental fees. The balance must be paid in full on the first day of the second term.
A charge of $2.00 per month will be made on overdue accounts. Failure to pay an overdue account before conclusion of lectures will bar a student from writing examinations or obtaining credit for previous work.

A student who finds it necessary to withdraw from attendance is required to obtain a withdrawal voucher from the Registrar. This voucher, when signed by both the Dean and the Registrar, may entitle him to a refund of a portion of his fees. No fees will be refunded unless this procedure is followed.

Refunds of tuition fees are made at the discretion of the University. Incidental fees are not refundable.

The fee schedule shown is the one in effect for the 1965-66 year and at the time of printing is still subject to review and possible change for the 1966-67 year. If a fee change is made, a notice will be issued with a new fee schedule; however, the University does not undertake or accept responsibility to so notify all recipients of this calendar. The Board of Governors reserves the right to make changes in the published schedule of fees without notice.

Sessional Fees

<table>
<thead>
<tr>
<th></th>
<th>$510.50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuition</td>
<td></td>
</tr>
<tr>
<td>Incidental &quot;a&quot;</td>
<td>46.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>556.50</td>
</tr>
</tbody>
</table>

Co-operative Mathematics —

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Other Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuition</td>
<td>$292.50</td>
<td>$317.50</td>
</tr>
<tr>
<td>Incidental &quot;a&quot;</td>
<td>24.75</td>
<td>24.75</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$317.25</td>
<td>$342.25</td>
</tr>
</tbody>
</table>

Part-time Students

Fee per course (limit, 2 courses per session) $100.00

Miscellaneous Fees

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Examination — Supplemental, each paper</td>
<td>$10.00</td>
</tr>
<tr>
<td>— Presiding fee (at an outside centre, each half day)</td>
<td>$5.00</td>
</tr>
<tr>
<td>Photograph (at first registration only)</td>
<td>1.00</td>
</tr>
<tr>
<td>Late Registration</td>
<td>10.00</td>
</tr>
<tr>
<td>Transcript of record</td>
<td>1.00</td>
</tr>
<tr>
<td>Degree and Graduation — Final year only</td>
<td>10.00</td>
</tr>
</tbody>
</table>

* Incidental fees include student activities, athletics, health insurance and health services.
Examinations and Promotions

The Health Insurance Plan does not include the premiums or benefits of the Ontario Hospital Services Commission. Such coverage is the student's own responsibility.

Residence Fees

Residence fee for both men and women is:

<table>
<thead>
<tr>
<th>Type of Room</th>
<th>Single per academic year</th>
<th>Semi-private per term</th>
<th>Double per academic year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$800.</td>
<td>$760.</td>
<td>$700.</td>
</tr>
<tr>
<td>per term</td>
<td>$400.</td>
<td>$380.</td>
<td>$350.</td>
</tr>
</tbody>
</table>

All students may pay residence fees on a term basis; payments are due and payable on or before the day of registration or the first day of each term.

This fee does not include the period between the end of the first term and the beginning of the second. Students occupying residence in this period will be charged an additional $2.00 per day for their room. (food if available, will be an extra charge).

Rooms may be occupied for twenty-four hours before registration and after the final examination.

Examinations and Promotions

The following regulations govern the practice of the Faculty of Arts in regard to final examinations, promotions and supplemental examinations. These regulations with necessary adaptations apply to part-time students and special programmes.

1. Final Examinations

(a) The faculty constitutes the examining body for all examinations. Appeals against faculty decisions made under these regulations may be made in writing to the Examinations and Promotions Committee of the Arts Faculty Council. Final written examinations for all years are held in April and May; oral examinations may be required at the discretion of individual departments. The normal time for written examinations is three hours.

(b) In every year each student is required to submit, in such form and at such time as may be determined by the instructor, evidence of satisfactory participation in term work. The marks obtained for work during term are used, in part, in determining standing. At the discretion of the chairman of the department concerned, and the Dean, a student may be barred from the final examination if the course requirements are not completed to the satisfaction of his instructor.

(c) Failure to write an examination is considered a failure to pass. A student who defaults a final examination, except for a properly certified reason, shall have no supplemental examination privileges and must repeat the work in class. If a student fails for medical reasons to write, a Doctor's certificate,
covering the precise period of absence, must be filed in the Registrar’s Office within one week after the examination should have been written.

2. Term Examinations

There will be no formal mid-year examinations in any year. Instructors will report the progress of all first year students to the Dean before the end of the first term. Students who are not progressing satisfactorily may be interviewed by the Dean of the Faculty of Arts of the University and in some cases may be required to withdraw for the remainder of the session.

3. Standing

(a) Letter grades signify the following standings in individual subjects:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>75 - 100%</td>
</tr>
<tr>
<td>B</td>
<td>66 - 74%</td>
</tr>
<tr>
<td>C</td>
<td>60 - 65%</td>
</tr>
<tr>
<td>D</td>
<td>50 - 59%</td>
</tr>
<tr>
<td>F</td>
<td>less than 50% (Failure, no supplemental allowed)</td>
</tr>
<tr>
<td>S</td>
<td>less than 50% (Supplemental allowed)</td>
</tr>
</tbody>
</table>

Standing in an individual subject is determined by combining the marks assigned for term work with those obtained in the final examination.

(b) Standing in Year I is indicated by the following terms:

<table>
<thead>
<tr>
<th>Range of average marks</th>
<th>Standing</th>
</tr>
</thead>
<tbody>
<tr>
<td>75 - 100%</td>
<td>A</td>
</tr>
<tr>
<td>66 - 74%</td>
<td>B</td>
</tr>
<tr>
<td>60 - 65%</td>
<td>C</td>
</tr>
<tr>
<td>50 - 59%</td>
<td>D</td>
</tr>
<tr>
<td>49 or less</td>
<td>F</td>
</tr>
</tbody>
</table>

(c) Promotion to the next higher year or to Graduation will be based on passing the complete year’s work in one academic year.

(d) In order to enter Second and subsequent years of the General Arts course a student must obtain a minimum over-all average of 50% and a minimum of 60% in the subjects of the field of specialization.

(e) In order to enter the second year of an Honours Arts Course, a student must obtain a minimum over-all average of 60% in his first year studies, and a minimum of 60% in the proposed field of specialization. To obtain standing in the second and subsequent years of an Honours Arts Course, a student must obtain an over-all average of at least 60% and a minimum average of at least 66% in the subjects of his field of specialization unless otherwise specified in a departmental honours programme.

(f) Standing in the second and subsequent years, is indicated by the following terms:
## Examinations and Promotions

<table>
<thead>
<tr>
<th>Range of Average Mark</th>
<th>Honours Course*</th>
<th>General Course*</th>
</tr>
</thead>
<tbody>
<tr>
<td>75 - 100</td>
<td>First Class Honours</td>
<td>A</td>
</tr>
<tr>
<td>66 - 74</td>
<td>Second Class Honours</td>
<td>B</td>
</tr>
<tr>
<td>60 - 65</td>
<td>Third Class Honours</td>
<td>C</td>
</tr>
<tr>
<td>50 - 59</td>
<td></td>
<td>D</td>
</tr>
</tbody>
</table>

*The marks obtained in the subjects of specialization and related subjects will also be taken into account in assigning standing.

### 4. Failure

(a) A student who fails more than two full courses at the annual examinations fails his year. He is not eligible for supplemental privileges and may either repeat the year or be required to withdraw if the Faculty Council considers that he will not profit by further study.

(b) A student who achieves 50% in each of his courses in his year, but does not achieve the required overall standing or the required standing in his field of specialization in either an honours or general programme, fails his year.

(c) Any student granted permission to repeat his year must take a full complement of courses.

(d) A student may be granted the privilege of repeating one year only.

(e) All failings papers are re-read.

### 5. Supplemental Examinations

(a) To be eligible for supplemental examinations at the end of Year 1, a student

(i) must have attended a reasonable number of lectures in the course in which he proposes to write, and must have satisfied all term work requirements;
(ii) must not have failed more than two full courses;
(iii) must not have defaulted the final examination except for a properly certified reason;
(iv) must have obtained a final overall average of at least 50%.

(b) To be eligible for supplemental examinations beyond Year 1, a student

(i) must have shown satisfactory term work progress to at least grade "C" in the subject in question;
(ii) must not have failed more than two full courses;
(iii) must not have defaulted the final examination except for a properly certified reason;
(iv) must have obtained a final overall average of 50% and an average of 60% in the subjects of specialization in a General Course, and a final over-all average of 60% and an average of 66% in the subjects of specialization in an Honours Course.
(c) A student who fails to obtain at least 40% in a final examination may be granted supplemental privileges only at the discretion of the Council of the Faculty of Arts.

(d) Supplemental examinations are held in late July or early August. Application for these examinations must be filed by June 24th on forms provided by the Office of the Registrar. Applications received after this date will not be accepted and the student will be considered to have defaulted the examinations. Fees for supplemental examinations must accompany the application and, if the student subsequently decides not to write the examination, this fee is not refunded. Supplemental examinations must be written at the next regular supplemental period.

(e) A student may not write supplemental examinations to raise his standing in courses already passed nor will the results of supplemental examinations be considered in arriving at a student’s standing in his year’s programme.

(f) A student may write a supplemental once only in any one course.

(g) Failure to write an examination is considered a failure to pass. A student who fails to write a supplemental examination, except for a properly certified reason, will be considered to have failed the examination. If the student fails to write for medical reasons, a Physician’s certificate covering the precise period of absence must be filed in the Office of the Registrar within 1 week after the examination should have been written.

Academic Programmes

1. How to Select a Programme in Year One of the Faculty of Arts

In the Faculty of Arts a first-year student faces a more difficult decision in selecting courses than does a freshman in Science or Engineering. Whereas scientific and technical programmes tend to restrict the syllabus for the first-year student, the Faculty of Arts offers approximately twenty first-year courses from which the student must choose six.

Although one student may begin his university career with the intention of entering a four-year Honours programme, another may wish to earn a General degree, which means that he chooses a “major subject.” at the end of the first year and graduates in three years. Still another student may not have made up his mind which programme he wishes to enter nor has he determined the subject or discipline in which he will concentrate.

With these factors in mind the Faculty of Arts offers a first-year programme that will permit the student maximum flexibility in determining his programme. In most instances a student in Arts may defer these two significant decisions (the type of degree — Honours or General — and his field of concentration) until the end of his first year. At that time, if his marks are satisfactory, he is free “to major” in any of the six subjects he has studied during this year, or to go on in an Honours programme in one of these subjects.
Academic Programmes

This Calendar describes recommended Year 1 programmes for the various Honours courses, beginning on page 23. That student who definitely plans to work towards an Honours degree and who knows the field in which he wishes to major, will select the appropriate programme. The courses outlined for Honours students are also recommended for students who plan to major in that discipline.

For example, the student desiring to enter the four-year Honours programme in English and the student planning to take a three-year General Degree with an English major should both turn to page 23 of the Calendar. Here they will find the syllabus recommended for Year I.

- English 101
- A language other than English
- Philosophy 100 or equivalent
- Psychology 110
- History 100
- Science 100, or a course in Religious Knowledge

To get a brief idea of the content of each of these (or other) courses, he should turn to pages 120 - 274 where course descriptions are listed alphabetically by departments for the entire University. In some cases this programme may not meet the needs or special circumstances of the student. The chairman of the department concerned will be pleased to answer enquiries from students in this regard.

A student who has not determined in what field or subject he wishes to concentrate should study the Calendar carefully. After examining the suggested departmental programmes, he should read the descriptions of separate courses in order to have a more comprehensive idea of what the content of any programme would include. He should consult his School Guidance Officer, the chairman of any University department, or the Registrar, by letter or in person for additional clarification or information.

2. Students may choose courses from the following groups:

**Group A.** (i) English, History, Philosophy.
(ii) French, German, Greek, Italian, Latin, Russian, Spanish, a culture civilization course, Classical Civilization:

**Group B.** Anthropology, Economics, Geography, Political Science, Psychology, Sociology;

**Group C.** Mathematics, Courses offered by the Faculty of Science*, Religious Knowledge, Music, Ukrainian.

* Where prerequisites can be met.
Year One. (Common to both Honours Courses and General Courses)
The student must select six courses from the above groups.

- Two courses from Group A
- Two courses from Group B
- Two other courses.

Notes:

(i) “Courses” refers to courses which extend for one full academic year; two half-year courses (half-year courses are marked with ° in the course description section) are the equivalent of one full course. The Department of Political Science does offer a few courses which are full courses but extend over one term only.

(ii) A First Year Student who has indicated his intention of entering an Honours Course may postpone one of the required subjects from Group A or Group B until a later year.

(iii) In Year I a student must normally complete the introductory course in the department in which he will major in his later years.

(iv) A student who, in the opinion of the Chairman of his major department, is deficient in English may be required to take a non-credit course in remedial English.

(v) Students entering the General or Honours Mathematics programme will normally take Mathematics 130, 131, 132, in Year I; their programmes will be adjusted to permit this selection.

3. Each student’s programme must be approved on registration day by a faculty advisor from the Faculty of Arts.

4a. Once the student has completed his registration, he may not change his programme, add courses or drop courses, without obtaining permission from the Dean, the Instructor of the course to which he is changing and/or the department chairman of the student’s major. Such changes must be recorded on the official forms available at the Office of the Registrar. Changes in courses are permitted for a period of three weeks from the date of beginning of lectures. The only changes permitted after this period will be dropping of a course previously designated as an extra, or where a student wishes to reduce his programme from honours to general.

b. Extra subjects must be so designated at Registration. They will not be used in computing the year’s over-all average and they do not carry supplemental privileges. An extra subject may not be used as a substitute for a regular subject.

On registration day a professor from each department is available to the student for consultation and assistance in selecting the Year I programme. It is of great assistance if the student has given careful thought to his programme before registration day.

If a student has any further questions about these matters he should write the Registrar or the Dean of the Faculty of Arts.
The General Course

Year I (For Year I programme, refer to pages 18 to 20)

At the end of Year I, each student in the General Course must choose one of the following subjects as his major field of study.

Anthropology  Greek  Psychology
Economics    History  Russian
English      Latin    Sociology
French       Mathematics  Spanish
Geography    Philosophy
German       Political Science

Year II (General)

Each student in Year II must choose at least five courses in consultation with his department chairman:

(a) two further courses in his major subject (see notes);
(b) three other courses (see notes).

Year III (General)

Each student in Year III must choose at least five courses in consultation with his department chairman:

(a) two further courses in his major subject;
(b) three other courses.

Notes:

1. The programme of every student must include either
(a) a minimum of eight courses beyond the 100 level, or
(b) courses from no more than seven subject fields.

2. Before graduation each student must take:
   —a minimum of four courses, not all in one subject, from Group A
   —a minimum of two courses from Group A(i)
   —a minimum of one course from Group A(ii). This requirement may be met by a foreign culture civilization course or by a language other than English at the 100 level.

3. "Courses" refers to courses which extend for one full academic year; two half year courses (half-year courses are marked with * in the course description section) are the equivalent of one full course. The Department of Political Science does offer a few courses which are full courses but extend over one term only.
Honours Courses

1. In Year I a student must normally complete the introductory course in the subject in which he will major in later years.

2. Before graduation each student must take:
   — a minimum of four courses, not all in one subject, from Group A
   — a minimum of two courses from Group A(i)
   — a minimum of one course from Group A(ii). This requirement may be met by a foreign culture civilization course or by a language other than English at the 100 level.

3. Students are requested to refer to the detailed programmes following this page for other departmental requirements.

4. "Courses" refers to courses which extend for one full academic year; two half-year courses (half-year courses are marked with * in the course description section) are the equivalent of one full course. The Department of Political Science does offer a few courses which are full courses but extend over one term only.
Honours Economics

Prerequisite: It is desirable, but not mandatory, that students planning to enter Honours Economics should offer three Grade XIII papers in Mathematics.

Year I

Recommended Programme: Hours
Economics 100 3
Political Science 110 3
English 101 3
History 100, or Philosophy 100 or equivalent 3
A language other than English 3
One Elective ○ 3

Year II

Economics 200 3
Economics 230 3
Economics 255 or Economics 240 3
History 100, or Philosophy 100 or equivalent (whichever not elected in Year I) 3
One Elective ○○ 3

Year III

Economics 300 3
Three of Economics 330, 340, 365, 370, 380, 390 9
One Elective ○○ 3

Year IV

Economics 400 3
Economics 440 3
Economics 490 3
Two of Economics 450, 460, 470, 480, a 300 course not previously elected 6

○ It is strongly recommended that students elect Mathematics 130 (Calculus)

○○ If Mathematics 233 (Probability and Statistics) is chosen as the elective in Year II a second elective must be chosen in place of Economics 300 (Statistics) in Year III.

Honours English

Year I

Recommended Programme: Hours
English 101 3
One of French 100, German 100, Latin 100 3-4
Philosophy 100 or equivalent 3
Psychology 110 3
History 100 3
Science 100 or a course in Religious Knowledge 3-4
Year II

English 251, 261, 270, 280  11
Classical Civilization 260  3
One other supporting course  3

Year III

English 350, 360, 370, 380  11
Two supporting courses  6

Year IV

English 300, 451, 460, 470, 495  15
One supporting course  3
Comprehensive Examination

° English 475 (English Linguistics) may be chosen as one of the supporting courses.

Honours English and French

Year I

Recommended Programme:  Hours
English 101  3
French 160  3
History 100, or Philosophy 100 or equivalent  3
One of History 100, Philosophy 100, or equivalent,
a course in German, Latin, or Spanish  3
Psychology 110, or Political Science 100  3
Science 100 or a course in Religious Knowledge  3-4

Year II

English 251 and two other English courses
(see Note 1)  7-9
French 250, 260  6
One other course (see Note 2)  2-3

Year III

Two English courses (see Note 1)  4-6
French 350, 360, 370  7
One other course  3

Year IV

English 480 and one other English course
(see Note 1)  6-7
French 450, 460, 470, 480  8
Senior Honours Essay  3
Comprehensive Examination

Note 1: Before graduation students must complete the following English courses: English 101, 251, 270 or 280, 360, 350 or 370, 380 or 451, 300 (or 330j) or 460, and 480.

Note 2: Students planning to enter O.C.E. must choose English 261.
### Honours English and German

**Year I**  
*Recommended Programme:*  
- English 101  
- German 100  
- History 100, or Philosophy 100 or equivalent  
- Psychology 110 or another social science  
- Two other courses  

<table>
<thead>
<tr>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>5-7</td>
</tr>
</tbody>
</table>

**Year II**  
- English 251 and *two* other English courses  
  (see Note 1)  
- German 250 (or, on approval, 270), 260  
- One other course (see Note 2)  

<table>
<thead>
<tr>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-9</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>2-3</td>
</tr>
</tbody>
</table>

**Year III**  
- *Two* English courses (see Note 1)  
- German 350, 360, 370, 380  
- One other course  

<table>
<thead>
<tr>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-6</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

**Year IV**  
- English 480 and *one* other English course  
  (see Note 1)  
- German 450, 460, 470  
- Senior Honours Essay  
- Comprehensive Examination  

<table>
<thead>
<tr>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-7</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

**Note 1:** Before graduation students must complete the following English courses: English 101, 251, 270 or 280, 360, 350 or 370, 380 or 451, 300 (or 330J) or 460 and 480.

**Note 2:** Students planning to enter O.C.E. must choose English 261.

### Honours English and History

**Year I**  
*Recommended Programme:*  
- English 101  
- History 100 or 110  
- *One of* French 100, German 100, Latin 100  
- *Three of* Economics 100, Geography 100, Science 100, and a course in Religious Knowledge  

<table>
<thead>
<tr>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>3-4</td>
</tr>
<tr>
<td>9-10</td>
</tr>
</tbody>
</table>

**Year II**  
- English 251 and *two* other English courses  
  (see Note 1)  
- *Two* History courses (see Note 2)  
- *One of* Philosophy 100 or equivalent, Psychology 110, an advanced literature course  

<table>
<thead>
<tr>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-9</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

**Year III**  
- *Two* English courses (see Note 1)  
- *Three* History courses (see Note 2)  
- *One* other course (see Note 3)  

<table>
<thead>
<tr>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-6</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

25
Year IV

English 480 and one other English course
(see Note 1) 6-7
Two of History 470-479 4
One other History course (see Note 2) 2-3
Senior Honours Essay 3
Comprehensive Examination

Note 1: Before graduation students must complete the following English courses: English 101, 251, 270 or 280, 360, 350 or 370, 380 or 451, 300 (or 330J) or 460 and 480.

Note 2: The six courses in History beyond the first year will normally be selected from History 250, 255, 260, 295, 350, 361, 362, 370, 380.

Note 3: Students planning to enter O.C.E. must choose English 261.

Honours English and Latin

Year I

Recommended Programme:                Hours
English 101                               3
Latin 100                                 3
History 100, or Philosophy 100 or equivalent 3
Two courses in the social sciences         6
One further course                        3

Year II

English 251 and two other English courses (see Note 1) 7-9
Latin 250, 260                              4
Classical Civilization 250                  3

Year III

Two English courses (see Note 1) 4-6
Latin 350, 360, 370                         7
Classical Civilization 260                   3
One other course (see Note 2)               3

Year IV

English 480 and one other English course (see Note 1) 6-7
Latin 450, 460, 470                         7
Senior Honours Essay                        3
Comprehensive Examination

Note 1: Before graduation students must complete the following English courses: English 101, 251, 270 or 280, 360, 350 or 370, 380 or 451, 300 (or 330J) or 460 and 480.

Note 2: Students planning to enter O.C.E. must choose English 261.
### Honours English and Philosophy

**Year I**

- **Recommended Programme:**
  - English 101: 3
  - *One of* French 100, German 100, Latin 100, Greek 100: 3-4
  - *One of* Philosophy 221/2 or 280/1: 3
  - Psychology 110 or Political Science 100: 3
  - *One of* History 100 or a foreign language course: 3-4
  - Science 100: 4

### Year II

- English 251 and *two* other English courses:
  - (see Note 1) 7-9
- *One of* Philosophy 221/2 or 280/1: 3
- Philosophy 282/3 and *one* other Philosophy course: 6
- *One other* course: 3

### Year III

- *Two* English courses (see Note 1): 4-6
- Philosophy 299, 331, and *one* other Philosophy course: 7
- *One other* course: 3

### Year IV

- English 480 and *one* other English course (see Note 1): 6-7
- *Three* Philosophy courses: 6
- Senior Honours Essay: 3
- Comprehensive Examination: 3

**Note 1:** Before graduation students must complete the following English courses: English 101, 251, 270 or 280, 360, 350 or 370, 380 or 451, 300 (or 330J) or 460., and 480.

**Note 2:** Students who decide on their Honours programme on entry into Year II should take both Philosophy 221/2 and 280/1 during that year, and should consult the Department concerning rearrangement of their courses.

### Honours English and Russian

**Year I**

- **Recommended Programme:**
  - English 101: 3
  - Russian 1-50 or 100: 3-5
  - History 100, or Philosophy 100 or equivalent: 3
  - Psychology 110 or another social science: 3
  - Two other courses: 5-7

**Year II**

- English 251 and *two* other English courses:
  - (see Note 1) 7-9
- Two Russian courses (see Note 2): 6
- *One other* course (see Note 3): 2-3
Honours English and Spanish

Year I

<table>
<thead>
<tr>
<th>Recommended Programme:</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>English 101</td>
<td>3</td>
</tr>
<tr>
<td>French 100</td>
<td>4</td>
</tr>
<tr>
<td>Spanish 100</td>
<td>4</td>
</tr>
<tr>
<td>History 100, or Philosophy 100 or equivalent</td>
<td>3</td>
</tr>
<tr>
<td>Psychology 110 or Political Science 100</td>
<td>3</td>
</tr>
<tr>
<td>Science 100, a course in Religious Knowledge,</td>
<td>3-4</td>
</tr>
<tr>
<td>or a second social science</td>
<td></td>
</tr>
</tbody>
</table>

Year II

| English 251 and two other English courses     | 7-9   |
| (see Note 1)                                 |       |
| Spanish 250, 260                             | 6     |
| One other course (see Note 2)                | 3     |

Year III

| Two English courses (see Note 1)             | 4-6   |
| Spanish 350, 360, 370                        | 7     |
| One other course                            | 3     |

Year IV

| English 480 and one other English course     | 6-7   |
| (see Note 1)                                |       |
| Spanish 450, 460, 470, 480                  | 8     |
| Senior Honours Essay                        | 3     |
| Comprehensive Examination                   |       |

Note 1: Before graduation students must complete the following English courses: English 101, 251, 270 or 280, 360, 350 or 370, 380 or 451, 300 (or 330J) or 460., and 480.

Note 2: Students planning to enter O.C.E. must choose English 261.
### Honours French and German

#### Year I

**Recommended Programme:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>French 160</td>
<td>4</td>
</tr>
<tr>
<td>German 100</td>
<td>3</td>
</tr>
<tr>
<td><em>Two of</em> History, English, Philosophy</td>
<td>6</td>
</tr>
<tr>
<td>One course in the social sciences</td>
<td>3</td>
</tr>
<tr>
<td>One elective (see Note 1)</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Year II

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>French 250, 260</td>
<td>6</td>
</tr>
<tr>
<td>German 260, and one of 250, 270</td>
<td>6</td>
</tr>
<tr>
<td>Two electives</td>
<td>6</td>
</tr>
</tbody>
</table>

#### Year III

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>French 350, 360, 370</td>
<td>7</td>
</tr>
<tr>
<td>German 350, and two of 360, 370, 380</td>
<td>7</td>
</tr>
<tr>
<td>One elective</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Year IV

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>French 450, 460, 470, 480</td>
<td>8</td>
</tr>
<tr>
<td>German 450, 460, 470</td>
<td>7</td>
</tr>
<tr>
<td>One elective (see Note 2)</td>
<td>3</td>
</tr>
<tr>
<td>Comprehensive Examination</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Each student will normally complete a minimum of at least one course from each of English, History and Philosophy.

1. The student may take the two required Social Sciences in the first year.

2. Required if the student would not otherwise have fulfilled the required minimum number of courses.
### Honours French and Latin

**Year I**

**Recommended Programme:**
- Latin 100  
  - Hours: 3
- French 160  
  - Hours: 4
- Two courses in the social sciences  
  - Hours: 6
- English 101 or History 100  
  - Hours: 3
- One elective  
  - Hours: 3

**Year II**

- Latin 250, 260  
  - Hours: 4
- French 250, 260  
  - Hours: 6
- Philosophy 100 or equivalent  
  - Hours: 3
- One elective  
  - Hours: 3

**Year III**

- Latin 350, 360, 370  
  - Hours: 7
- French 350, 360, 370  
  - Hours: 7
- One elective  
  - Hours: 3

**Year IV**

- Latin 450, 460, 470  
  - Hours: 7
- French 450, 460, 470, 480  
  - Hours: 8

### Honours French and Political Science

**Year I**

**Recommended Programme:**
- Political Science 110  
  - Hours: 3
- French 160  
  - Hours: 4
- History 100  
  - Hours: 3
- Economics 100  
  - Hours: 3
- English 101 or Philosophy 100 or equivalent  
  - Hours: 3
- Elective  
  - Hours: 3

**Year II**

- Political Science 270  
  - Hours: 3
- Political Science 280  
  - Hours: 3
- French 250  
  - Hours: 3
- French 370  
  - Hours: 3
- History 260  
  - Hours: 3
- *Elective  
  - Hours: 3

**Year III**

- Two approved Political Science courses  
  - Hours: 6
- French 350  
  - Hours: 2
- French 360  
  - Hours: 3
- History 380  
  - Hours: 3
- *Elective  
  - Hours: 3

**Year IV**

- Two approved Political Science courses at the 300 or 400 level  
  - Hours: 6
- French 450  
  - Hours: 2
- French 480  
  - Hours: 2
- *Two Electives  
  - Hours: 6

*Electives may be drawn from additional courses in Political Science or French as well as from other departments. Electives must be approved by the departments of French and Political Science.
Honours French and Russian

Prerequisite: Students entering Honours French and Russian are strongly advised to offer Grade XIII Latin or German, or Russian, where possible, as well as French.

Year I  
**Recommended Programme:**  
<table>
<thead>
<tr>
<th>Subject</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>French 160</td>
<td>4</td>
</tr>
<tr>
<td>Russian 1-50 or 100</td>
<td>3</td>
</tr>
<tr>
<td>Two of History, English, Philosophy</td>
<td>6</td>
</tr>
<tr>
<td>One course in the social sciences</td>
<td>3</td>
</tr>
<tr>
<td>One elective (see Note 1)</td>
<td>3</td>
</tr>
</tbody>
</table>

Year II  
<table>
<thead>
<tr>
<th>Subject</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>French 250, 260</td>
<td>6</td>
</tr>
<tr>
<td>Russian 260, or 100 and one of 250, 370</td>
<td>6</td>
</tr>
<tr>
<td>Two electives</td>
<td>6</td>
</tr>
</tbody>
</table>

Year III  
<table>
<thead>
<tr>
<th>Subject</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>French 350, 360, 370</td>
<td>7</td>
</tr>
<tr>
<td>Russian 350, and two of 360, 370, 470</td>
<td>8</td>
</tr>
<tr>
<td>One elective</td>
<td>3</td>
</tr>
</tbody>
</table>

Year IV  
<table>
<thead>
<tr>
<th>Subject</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>French 450, 460, 470, 480</td>
<td>8</td>
</tr>
<tr>
<td>Russian 450, 460, 480</td>
<td>7</td>
</tr>
<tr>
<td>One elective (see Note 2)</td>
<td>3</td>
</tr>
</tbody>
</table>

Comprehensive Examination

Note: Each student will normally complete a minimum of at least one course from each of English, History and Philosophy.

1. The student may take the two required Social Sciences in the first year.

2. Required if the student would not otherwise have fulfilled the required minimum number of courses.

Honours French and Spanish

Prerequisite: Students registering in Honours French and Spanish must present satisfactory standing in Grade XIII English, French and Latin. Those who begin Spanish in the University will take Spanish 1-50 in the first year, and Spanish 100, 250 and 260 in the second year.

Year I  
**Recommended Programme:**  
<table>
<thead>
<tr>
<th>Subject</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>French 160</td>
<td>4</td>
</tr>
<tr>
<td>Spanish 100</td>
<td>4</td>
</tr>
<tr>
<td>Latin 100 or Italian 12J</td>
<td>3</td>
</tr>
<tr>
<td>One course in the social sciences</td>
<td>3</td>
</tr>
<tr>
<td>Two electives</td>
<td>6</td>
</tr>
</tbody>
</table>
Year II
French 250, 260  6
Spanish 250, 260  6
History 260  3
Italian 50J (for those who took 12J) or one elective  3

Year III
French 350, 360, 370  7
Spanish 350, 360, 370  7
English 380  3

Year IV
French 450, 460, 470, 480  8
Spanish 450, 460, 470, 480  8

Note: Students taking Honours courses involving French and/or Spanish are required to read, independently, a number of books dealing with the history and culture of France and/or Spain and Spanish America, and will be examined on the assumption that the reading has been done.

Honours Geography

(Teaching Option)

<table>
<thead>
<tr>
<th>Year</th>
<th>Courses</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Geography 100</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Earth Science 130</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>A language other than English</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Three courses chosen after consultation with the Department</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>II</td>
<td>Geography 210, 220, 260*, 275°</td>
<td>2-3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Three courses chosen after consultation with the Department</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>III</td>
<td>Geography 300°, 301°, 375, 380</td>
<td>2-3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Three courses chosen after consultation with the Department</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>IV</td>
<td>Geography 341 or 420, 421-9, 480, 490</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>One course chosen after consultation with the Department</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

Notes:
1. This programme is designed to permit students to enter Secondary School Teaching or to continue to graduate work in Geography.
2. Geography 260°, 275°, 300°, 301° are half year courses. The two half courses listed in one year occur in the same timetable slot.
3. In all the Geography courses after Year I, some reading assignments will be given in the student's second language.
4. Students are encouraged to obtain summer employment that will provide experience useful to a geographer.
5. All students must participate in a one-week field camp in each of the last two years. In Year III the field camp will be part of Geography 375; in Year IV, Geography 480.
Honours Geography

(Urban, Regional and Resource Planning Option)

<table>
<thead>
<tr>
<th>Year</th>
<th>Courses</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Lectures</td>
</tr>
<tr>
<td>I</td>
<td>Geography 100</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Earth Science 130</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>A language other than English</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Three courses chosen after consultation with the Department</td>
<td>9</td>
</tr>
<tr>
<td>II</td>
<td>Geography 220, 250, 260*, 275*</td>
<td>2-3</td>
</tr>
<tr>
<td></td>
<td>Three courses chosen after consultation with the Department</td>
<td>9</td>
</tr>
<tr>
<td>III</td>
<td>Geography 355, 356, 375, 380</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Two courses chosen after consultation with the Department</td>
<td>6</td>
</tr>
<tr>
<td>IV</td>
<td>Geography 456, 480, 490</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Two courses chosen after consultation with the Department</td>
<td>6</td>
</tr>
</tbody>
</table>

Notes:

1. This programme is designed for students who intend to do graduate work in Geography and/or Planning, or who intend to go directly into research work with planning agencies, government or business.

2. Geography 260* and 275* are half year courses. The two half courses listed occur in the same timetable slot.

3. In all the Geography courses after Year I, some reading assignments will be given in the student's second language.

4. Students are encouraged to spend at least one summer working for an agency involved in planning research or other work related to planning.

5. All students must participate in a one-week field camp in each of the last two years. In Year III the field camp will be a part of Geography 375; in Year IV, Geography 480.

6. It is recommended that a series of three courses be chosen from one of the following: Economics, Sociology, Political Science.
### Honours German and Russian

#### Year I

**Recommended Programme:**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>German 100</td>
<td>3</td>
</tr>
<tr>
<td>Russian 1-50 or 100</td>
<td>5-3</td>
</tr>
<tr>
<td><em>Two of History, English, Philosophy</em></td>
<td>6</td>
</tr>
<tr>
<td>One course in the social sciences</td>
<td>3</td>
</tr>
<tr>
<td>One elective (see Note 1)</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Year II

<table>
<thead>
<tr>
<th>Subject</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>German 260 and one of 250, 270</td>
<td>6</td>
</tr>
<tr>
<td>Russian 260 or 100 and one of 250, 270</td>
<td>6</td>
</tr>
<tr>
<td>Two electives</td>
<td>6</td>
</tr>
</tbody>
</table>

#### Year III

<table>
<thead>
<tr>
<th>Subject</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>German 350, two of 360, 370, 380</td>
<td>8</td>
</tr>
<tr>
<td>Russian 350, 360 or 260 and one of 370, 470</td>
<td>8</td>
</tr>
<tr>
<td>One elective</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Year IV

<table>
<thead>
<tr>
<th>Subject</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>German 450, 460, 470</td>
<td>7</td>
</tr>
<tr>
<td>Russian 450, 460, 470, 480</td>
<td>9</td>
</tr>
<tr>
<td>One elective (see Note 2)</td>
<td>3</td>
</tr>
<tr>
<td>Comprehensive examination</td>
<td>9</td>
</tr>
</tbody>
</table>

**Note:** Each student will normally complete a minimum of at least one course from each of English, History and Philosophy.

1. The student may take the two required Social Sciences in the first year.
2. Required if the student would not otherwise have fulfilled the required minimum number of courses.

### Honours History

#### Year I

**Recommended Programme:**

Any first-year programme that fulfills the general requirements (see page 20) is acceptable. A History course should be offered. Courses in English, a language other than English, Economics, Geography and Political Science are recommended.

#### Year II

<table>
<thead>
<tr>
<th>Subject</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Two of History</em> 250, 255, 260</td>
<td>6</td>
</tr>
<tr>
<td>One other History course</td>
<td>3</td>
</tr>
<tr>
<td>Three other courses (see Note 1)</td>
<td>9</td>
</tr>
</tbody>
</table>

#### Year III

<table>
<thead>
<tr>
<th>Subject</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Three of History</em> 350, (361 or 362), 370, 380</td>
<td>9</td>
</tr>
<tr>
<td>Two other courses (see Note 1)</td>
<td>6</td>
</tr>
</tbody>
</table>

#### Year IV

<table>
<thead>
<tr>
<th>Subject</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Two of History</em> 470-479</td>
<td>4</td>
</tr>
<tr>
<td>History 499</td>
<td></td>
</tr>
<tr>
<td><em>Three of History or approved alternative senior courses</em> (see Note 2)</td>
<td>9</td>
</tr>
<tr>
<td>Comprehensive examination</td>
<td>9</td>
</tr>
</tbody>
</table>
Honours History

Notes:
1. By the end of Year III a sequence of at least two full courses should be completed in both the humanities and social sciences in addition to History.

2. Alternative senior courses may be chosen from such fields as Economics, History, Geography, Philosophy, Political Science.

3. Graduation in this course with at least Second Class standing qualifies a student for admission to the Type A course in History at O.C.E.

Honours History and Philosophy

<table>
<thead>
<tr>
<th>Year I</th>
<th>Recommended Programme:</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>One of Philosophy 221/2 or 280/1</td>
<td>2-3</td>
</tr>
<tr>
<td></td>
<td>History 100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Four other courses to fulfill the general requirements. (See page 20)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year II</th>
<th>Recommended Programme:</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>One of Philosophy 221/2 or 280/1</td>
<td>2-3</td>
</tr>
<tr>
<td></td>
<td>Philosophy 282/3 and one other Philosophy course</td>
<td>4-6</td>
</tr>
<tr>
<td></td>
<td>Three of History 250, 260, 270, (274/276) 350, 361, 362, 370, 380</td>
<td>9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year III</th>
<th>Recommended Programme:</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Philosophy 299, 325/6</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Philosophy 345 and one other half course in Philosophy</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Three of History 250, 260, 270, (274/276), 350, 361, 362, 370, 380</td>
<td>9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year IV</th>
<th>Recommended Programme:</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Three Philosophy courses</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Two of History 470 to 479</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>History 499</td>
<td></td>
</tr>
</tbody>
</table>

Students who decide on their Honours programme on entry into Year II should take both Philosophy 221/2 and 280/1 during that year, and should consult the Department concerning rearrangement of their courses.

Honours Latin

<table>
<thead>
<tr>
<th>Year I</th>
<th>Recommended Programme:</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Latin 100</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>One of English or Philosophy</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Two courses in Social Sciences</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Classical Civilization 250</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>One elective</td>
<td>3</td>
</tr>
</tbody>
</table>
### Year II
- Latin 250, 260, 360: 7
- Classical Civilization 260: 3
- Two electives: 6

### Year III
- Latin 350, 370, 380: 7
- Classical Civilization 350: 3
- Two electives: 6

### Year IV
- Latin 450, 460, 470, 480: 10
- Two electives: 6

*Note: Those intending to obtain a Type A certificate for teaching in Ontario High Schools must take a Minor in addition to their Latin programme. In Greek, as a Minor subject 9 hours are required, in French 15, in English 15, in Italian 15. The Electives provide room for these requirements.*

### Honours Mathematics

**Prerequisite:** Students entering this programme should have an overall average of 66% in the Grade XIII examinations in Mathematics (Algebra, Geometry, and Trigonometry); it is also desirable to have taken Grade XIII Chemistry and Physics. To remain in the Honours Mathematics programme, a student must obtain an over-all average of 60% in each year.

#### Year I

**Recommended Programme:**
- Mathematics 130, 131: 6
- Four other courses, one of which may be Mathematics 132

#### Year II
- Mathematics 230: 3
- Mathematics 231*: 2
- Mathematics 232*: 3
- Three electives, one of which may be chosen from Mathematics 234, 235.

*Two of: Mathematics 236, 237, 238 may be chosen in place of Mathematics 231, 237.*

#### Year III

**(Pure Mathematics Option)**
- Mathematics 330, 331, 332, 333: 10
- One or two additional Mathematics courses: 2-4
- Two electives: 6

**(Statistics and Actuarial Mathematics Option)**
- Mathematics 331, 332, 334: 11
- Two or three courses from Mathematics 330, 333, 335, 336, 338: 4-6
- Two electives: 6
Honours Mathematics

(Teaching Option)
Mathematics 330, 331, 332, 334 12
One additional Mathematics course 2
Two electives 6

(Pure Mathematics Option)
Three courses from Mathematics 425, 430, 431, 432, 433, 434 10
Two or three additional Mathematics courses 4-6
Two electives 6

(Statistics and Actuarial Mathematics Option)
Mathematics 435, 438 5
Three or four courses from Mathematics 430, 433, 436, 437, 439, 440, 446, 447 6-8
Two electives 6

(Teaching Option)
Mathematics 446 2
Four additional Mathematics courses numbered above 200 12
Two electives

Note: 1. Each student will normally include two courses in Physical Science among the elective courses of the second, third, and fourth years.

2. Students may choose their elective courses so as to have a minor field of specialization in addition to Mathematics; for example, Psychology, Economics, German, French, etc., could serve as minors. With the permission of the Dean and the Department Chairman, students may replace one of the Mathematics courses of each of the third and fourth years by a course chosen from the minor field.

Co-operative Honours Mathematics (Actuarial and Computer Options)
For a brochure outlining the Co-operative Mathematics programme in detail, please write to the Department of Mathematics or to the Registrar.

Honours Mathematics and Philosophy

Year I

<table>
<thead>
<tr>
<th>Recommended Programme</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>English 101</td>
<td>3</td>
</tr>
<tr>
<td>One of Philosophy 221/2 or 280/1</td>
<td>3</td>
</tr>
<tr>
<td>A foreign language</td>
<td>3</td>
</tr>
<tr>
<td>One course in the social sciences</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics 130, 131</td>
<td>6</td>
</tr>
</tbody>
</table>

37
Year II
Mathematics 230, 231, 232 8
One of Philosophy 221/2 or 280/1 3
One of Philosophy 240 or 340 or 282/3 3
Elective 3

Year III
Mathematics 330, 332, 233, 234 10
One of Philosophy 240 or 340 or 282/3 3
Philosophy 299 and one other Philosophy course 4

Year IV
Mathematics 331, 337, 433, 446 7
Three Philosophy courses 6
Elective (may be another Math.) 2-3

Note 1: Students who decide on their Honours programme on entry into Year II should take both Philosophy 221/2 and 280/1 during that year, and should consult the Department concerning rearrangement of their courses.
Honours Mathematics and Psychology

Prerequisite: Students entering this programme should have an overall average of 66% in the Grade XIII examinations in Mathematics (Algebra, Geometry, and Trigonometry).

<table>
<thead>
<tr>
<th>Year</th>
<th>Recommended Programme:</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year I</strong></td>
<td><strong>Mathematics 130, 131, 132</strong></td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Psychology 110</strong></td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><strong>Philosophy 100 or two of Philosophy 125, 135, 140, 150</strong></td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><strong>A language other than English</strong></td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><strong>Biology (see Note 1)</strong></td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td><strong>Year II</strong></td>
<td><strong>Mathematics 230 and 231, 232 or 237, 238</strong></td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><strong>Psychology 280, 290</strong></td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td><strong>One other course in Psychology at the 250-299 level</strong></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>Philosophy 240</strong></td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><strong>Biology or Zoology (see Note 1)</strong></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Year III</strong></td>
<td><strong>Mathematics 233, 331, 332</strong></td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>Two other courses in Psychology at the 350-399 level</strong></td>
<td>4-5</td>
<td>2-4</td>
</tr>
<tr>
<td></td>
<td><strong>Philosophy 340</strong></td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td><strong>Year IV</strong></td>
<td><strong>Mathematics 439 or 449</strong></td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><strong>Two of Mathematics 333, 334, 335, 446</strong></td>
<td>4</td>
<td>0-2</td>
</tr>
<tr>
<td></td>
<td><strong>Psychology 430, 499</strong></td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td><strong>Elective (may be another Math. or Psych.)</strong></td>
<td>2-3</td>
<td>-</td>
</tr>
</tbody>
</table>

**Note 1:** Students lacking Grade XIII Biology must take Biology 131. Biology 231 should be completed before the end of Year II.

**Note 2:** Psychology 150 may be substituted for Psychology 110, with permission of the Department.

Honours Philosophy

Programme A. (For students electing Philosophy in first year)

<table>
<thead>
<tr>
<th>Year</th>
<th>Recommended Programme:</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year I</strong></td>
<td><strong>Philosophy 221/2 and 280/1</strong></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td><strong>English or History</strong></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>One of French, German, Latin or Greek</strong></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Two electives</strong></td>
<td>6</td>
</tr>
</tbody>
</table>
Year II

Philosophy 240 or 340, 282/3, and 299 or one other Philosophy course 10
Three electives 6-9

Year III

Four Philosophy courses (including 299 if not taken in Year II) 8
Two electives 4-6

Year IV

Five Philosophy courses including Philosophy 499 10
One elective 2-3

Programme B.  (For entering at the beginning of Year II)

Year I

Philosophy 100 or two of Philosophy 125, 135, 140 or 150 3
English or History 3
One of French, German, Latin or Greek 3
Three electives 9

Year II

Philosophy 221/2, 280/1 and one other Philosophy course 9
One of Philosophy 240 or 282/3 3
Two electives 4-6

Year III

One of Philosophy 240 or 282/3 3
Three other Philosophy courses (including 299) 7
Two electives 4-6

Year IV

Five Philosophy courses (including 499) 10
One elective 2-3

Honours Philosophy and Literature

Year 1

Recommended Programme: Hours
One of Philosophy 221/2 or 280/1 3
French 160 (or German 100) 3
English 101* 3
A Social Science 3
Two of A Natural Science
  Mathematics 3
  History 3
Another language ** 3
Another Social Science 6
Honours Philosophy and Literature

Year II
One of Philosophy 221/2 or 280/1
Philosophy 282/3 and one other Philosophy course
French 250, 260 (or German 260 and one of German 250, 270)
One elective (Social Science, if requirement not met in first year)

Year III
Philosophy 299, 331 and one other Philosophy course
French 350, 360, 370 (or German 350, 360, 380)
One elective

Year IV
Three Philosophy courses
French 450, 460, 470, 480 (or German 450, 460, 470)
Senior Essay

*In certain special cases, where the student can prove a high degree of familiarity with English literature he may substitute French or German 100, whichever has not already been chosen.

**Those taking the French option should normally take Latin 100.

Note: Students who decide on their Honours programme on entry into Year II should take both Philosophy 221/2 and 280/1 during that year, and should consult the Department concerning rearrangement of their courses.

Honours Philosophy and Political Science

Year I

Recommended Programme:
One of Philosophy 221/2 or 280/1
Political Science 110
History
One of French, German, Russian, Greek, or Latin (language or civilization)
A Social Science other than Political Science
One elective

Hours
3
3
3
3
3

Year II
One of Philosophy 221/2 or 280/1
Philosophy 282/3
Philosophy 240 or alternatively 140 and another half course in Philosophy
Political Science 280
One of Political Science 281, 282; or alternatively 283 or 284, and another half course in Political Science
One elective

Hours
3
3
3
3
3
3

41
Year III

Philosophy 299 1
Philosophy 327 and another half course in Philosophy 3
Political Science 250 3
Political Science 270 3
One other full course in Political Science or equivalent in half courses 3
One elective 3

Year IV

Philosophy 325/6 3
Philosophy 499 1
Two full courses in Political Science or equivalent in half courses 6
Two electives 6

Note 1: Political Science courses other than those specified above should be selected from the following: 381, 390, 392, 393, 450-5, 490, 491; substitutions may be made with the agreement of the Department.

Note 2: Students who decide on their Honours programme on entry into Year II should take both Philosophy 221/2 and 280/1 during that year, and should consult the Department concerning rearrangement of their courses.

Honours Philosophy and Psychology

<table>
<thead>
<tr>
<th>Years</th>
<th>Recommended Programme</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year I</td>
<td>One of Philosophy 221/2 or 280/1 3</td>
<td>Psychology 110 3</td>
<td>A language other than English 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>English 101 3</td>
<td>A Social Science other than Psychology 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mathematics or a Natural Science 2-3</td>
<td>0-3</td>
</tr>
<tr>
<td>Year II</td>
<td>One of Philosophy 221/2 or 280/1 3</td>
<td>One of Philosophy 240 or 340 or 282/3 3</td>
<td>One other Philosophy course 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Psychology 211, 212, 280, 290 7</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Mathematics, a Natural Science, or a Social Science other than Psychology 3</td>
<td>(see Note 1)</td>
<td></td>
</tr>
<tr>
<td>Year III</td>
<td>One of Philosophy 240 or 340 or 282/3 3</td>
<td>Philosophy 299 and two other Philosophy courses 7</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Psychology 311, 351 and 352, or 390 2-3</td>
<td>0-2</td>
</tr>
<tr>
<td></td>
<td>Mathematics, a Natural Science, or a Social Science other than Psychology (See Note 1) 2-3</td>
<td>0-3</td>
<td></td>
</tr>
</tbody>
</table>
Honours Philosophy and Psychology

Year IV
Two Philosophy courses 4
Psychology 410, 430 5
Senior Honours Essay
(Philosophy-Psychology 499) 2-3
An elective

Note 1: Biology 131 is recommended for students who lack Grade XIII Biology, Mathematics 85 for students who lack Grade XIII Mathematics. Students may benefit from including Mathematics 130, 233, 449 and Biology 231 within their programmes. A Physics, Chemistry, Sociology, or Political Science sequence will also be acceptable.

Note 2: Students who decide on their Honours programme on entry into Year II should take both Philosophy 221/2 and 280/1 during their year, and should consult the Department concerning rearrangement of their courses.

Honours Political Science

Year I
Recommended Programme:  
Political Science 110 3
One of Economics 100, Psychology 110  
Sociology 100, Geography 100 3
One of History 100, another approved History course, Philosophy 100 or equivalent 3
One of English 101, a Foreign Language, a Foreign Culture Course 3
Two other courses to be selected in consultation with the Department 6

Year II
Three Political Science courses at the 200 level selected in consultation with the Department 9
An approved course in History, Philosophy or Economics 3
Two other courses, at least one of which must be in a subject taken in Year I 6

Year III
Four Political Science courses selected in consultation with the Department 12
Two other approved courses 6

Year IV
Four Political Science courses, at least two of which must be at the 400 level 12
One other approved course 3
## Honours Psychology

**Recommended Programme:**

<table>
<thead>
<tr>
<th>Year</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year I</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychology 150</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Philosophy 100 or two of Philosophy 125, 135, 140, 150</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Biology (see Note 1)</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>A language other than English (see Note 2)</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Mathematics (see Note 3)</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>A Social Science other than Psychology or a Natural Science other than Biology</td>
<td>2-3</td>
<td>0-2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year II</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychology 280, 290</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>One other full-year course in Psychology or the equivalent in half-year courses</td>
<td>2-3</td>
<td>0-2</td>
</tr>
<tr>
<td>Philosophy 240 or Mathematics (see Note 3)</td>
<td>2-3</td>
<td>-</td>
</tr>
<tr>
<td>A language other than English</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>A Natural Science or a Social Science other than Psychology</td>
<td>2-3</td>
<td>0-3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year III</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychology 360</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Three full-year Psychology courses or their equivalent in half-year courses</td>
<td>6-9</td>
<td>4-6</td>
</tr>
<tr>
<td>Philosophy or Mathematics (see Note 3)</td>
<td>2-3</td>
<td>-</td>
</tr>
<tr>
<td>A Natural Science or a Social Science other than Psychology</td>
<td>2-3</td>
<td>0-3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year IV</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychology 430 and 499</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Two full-year Psychology courses or their equivalent in half-year courses</td>
<td>4-6</td>
<td>2-4</td>
</tr>
<tr>
<td>A Natural Science or a Social Science other than Psychology</td>
<td>2-3</td>
<td>0-3</td>
</tr>
</tbody>
</table>

**Notes:**

1. Students without high school Biology must select Biology 131.

2. Russian is strongly recommended.

3. Students lacking Grade XIII Mathematics are urged to take Mathematics 85 in Year I. All Psychology Honour students should complete Mathematics 130 by the end of Year III. A student wishing to take both Philosophy and Mathematics in Year II, III, IV may omit one of the other recommended courses.

44
Honours Psychology

4. This is a recommended programme. Substitutions are permitted in the non-psychology courses with the consent of the Department of Psychology.

5. See also: Honours Biology and Psychology (Faculty of Science), Mathematics and Psychology, Philosophy and Psychology, Psychology and Sociology.

Honours Psychology and Sociology

<table>
<thead>
<tr>
<th>Year</th>
<th>Recommended Programme:</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Lectures</strong></td>
<td><strong>Labs.</strong></td>
</tr>
<tr>
<td>Year I</td>
<td>Psychology 110</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Sociology 100</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Philosophy 100 or equivalent</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Biology (see Note 1)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>A language other than English</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Elective (see Note 2)</td>
<td>3</td>
</tr>
<tr>
<td>Year II</td>
<td>Psychology 211, 212 and 290</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Sociology — two courses at the 200 level</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Philosophy 240</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Elective (see Note 2)</td>
<td>2-3</td>
</tr>
<tr>
<td>Year III</td>
<td>Psychology 311, 351, 352</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Sociology 320 and one other course in Sociology at the 300 level</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Two electives (see Note 2)</td>
<td>5-6</td>
</tr>
<tr>
<td>Year IV</td>
<td>Psychology 410 and 430</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Sociology 450, 465</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>One elective</td>
<td>2-3</td>
</tr>
<tr>
<td></td>
<td>Senior Honours Essay (Psychology - Sociology 499)</td>
<td>5-6</td>
</tr>
</tbody>
</table>

Notes:

1. Students lacking Grade XIII Biology must take Biology 131.

2. Students lacking Grade XIII Mathematics should elect Mathematics 85. Other Electives recommended include Mathematics 130 and 499 and Biology 231.

Note: Honours Students are required to have Mathematics 253 or if their preparation permits, Mathematics 140 and Mathematics 243.
Honours Sociology

Year I

Recommended Programme: Hours
Sociology 100 3
History 100 3
Philosophy 100 or equivalent 3
English 101 3
Psychology 110 3
A language other than English 3

Year II

Sociology 201, 210 and two other courses in Sociology 9
Economics 100 3
Two electives 6

Year III

Sociology 320, 325 and two other courses in Sociology 12
Two electives 6

Year IV

Sociology 450, 465, 470 and 499 12
One elective 3

Note: Students proposing to do post-graduate work in Sociology should be aware of the necessary grounding they should have in Mathematics in selecting electives. Other special interests of the student can be satisfied through the proper elective choices.
III

The Faculty of Engineering
The Co-operative Engineering Course

The preparation for an engineering career includes both formal academic studies at a university and intensive training in the practice of engineering. A similar pattern is to be found in preparation for careers in medicine or law, and is characteristic of any development of professional competence. The Co-operative Engineering Course at the University of Waterloo provides a completely integrated pattern of academic study and industrial experience in various phases of engineering. The degree course covers almost five calendar years, comprising eight terms each of about four months' duration of university work on the campus which are pursued alternatively with six four-month terms of organized and supervised training in engineering practice. The total time spent in study is the same as that encountered in the usual course of four "academic years."

While co-operative courses have been offered in many other countries, and the inherent advantages are well recognized, the Co-operative Programme at the University of Waterloo is unique in Canada.

The engineering curricula at the University of Waterloo provide a sound basis in Mathematics and Pure Science and in Engineering Science and Design. The first year of the course is common for all programmes, as is a substantial part of the work of the second year. Starting with the second year, students elect one of the four principal divisions of engineering. The curriculum for each of the four basic programmes combines required "core" subjects essential to the field, and "elective" subjects permitting considerable diversity in individual programmes of study. An important part of the curriculum is a series of electives in the Humanities and Social Sciences.

The co-operative course brings a student into direct contact with the engineering profession and exposes him to problems typical of those encountered in practice. Students are introduced to full-scale engineering projects and installations, far beyond the scope of any university laboratory. Arrangements for work assignments are made through the Co-ordination Department of the University, which provides a liaison between campus and industry. Through directed experience in industry, the student's educational environment is extended and his total education advanced. The co-operative experience represents much more than an opportunity to secure financial assistance, or to make an early start of a vocation. It provides the maturing prospective engineer with an opportunity for self-discipline and direction, and allows an early appreciation of the social and personal aspects of engineering through direct association with a technological environment.

Through this carefully organized and implemented programme of co-operative study and work, it is felt that graduates will be well prepared for a career which requires high standards of professional skill and learning. The increasing dependence of our society on modern technology certainly requires engineers who along with their technical ability, are prepared for individual responsibility and have a clear understanding of the relationship of their profession to industry and society.
Co-operative Graduate Programme in Engineering

The graduate co-operative programme of the Faculty of Engineering of the University of Waterloo is intended to provide means for engineers now in professional employment to undertake formal study on an intermittent basis. The development in engineering studies at the University of Waterloo arises from the nature of recent and current trends in engineering and science, in which new knowledge is displacing established material at an ever increasing pace. It reflects also the unique relationship of the University of Waterloo with Canadian industry achieved through the existing undergraduate co-operative engineering programme. Trends in the past few years have shown that it is becoming increasingly difficult for engineers in professional employment to keep abreast of advances in areas of engineering and science appropriate to their responsibilities — whether technical or administrative. It seems clear that formal study is the most effective approach for both updating courses and for more advanced work.

A feature of this programme is that the available courses include regular graduate level work and, as well, advanced level undergraduate courses that would be of interest to graduates of a few years' standing. All courses will be offered on an intramural basis.

Two basic schedules for credit courses will be available. The first, termed “full-time co-operative study” will entail resident study at Waterloo for at least four days per week in each semester. The second, “part-time co-operative study” will enable students located near the University, to follow a special programme allowing them to take individual courses as may be conveniently arranged.

There are three semesters in the calendar year at Waterloo, each lasting fifteen weeks: the fall semester running from September to December the winter semester running from January to early April, and the spring semester running from late April to early August. All individual courses offered may be completed in a single semester, and students can thus arrange study patterns in various semesters to suit their convenience. It would, for instance, be possible for a student to complete work for a Master’s degree through resident study in successive winter semesters alone.

Degree requirements of the Faculty of Graduate Studies of the University of Waterloo require, for the Master's degree, at least eight semester-courses, or some smaller number of courses with a research thesis. Up to half the course requirements can be met with advanced level undergraduate courses of acceptable character. It is anticipated that most students in the graduate co-operative programme will be interested either in courses leading to a Master's degree, or in occasional courses for “updating” with no degree credit in mind. It will also be possible to satisfy all formal course requirements for the doctorate through this programme.

Along with the formal graduate co-operative programme described above, the Faculty of Engineering also offers a programme of short courses of one-or-
two-week duration, on various specialized topics. Schedules of these are announced from time to time.

The entire programme of graduate co-operative study and the short course programme are co-ordinated and offered through the Division of Graduate Professional Studies of the Faculty of Engineering of the University of Waterloo. Further information on course content may be obtained directly from this division. Applications for admission should be directed to the Registrar of the University of Waterloo.

Research for credit towards a higher degree can be undertaken in external laboratories if the project can be effectively supervised and is acceptable to a particular Engineering department and has the approval of the appropriate Graduate Council Committee.

**Degrees**

The Degree of Bachelor of Applied Science (B.A.Sc.) is awarded by the University in the following undergraduate courses:

- Chemical Engineering
- Civil Engineering
- Electrical Engineering
- Mechanical Engineering

All programmes are of modern scientific character and, instead of a separate programme in Engineering Physics, opportunity is provided for optional additional study in Mathematics and Science in each of the four main programmes. All courses entail five years of undergraduate study on the co-operative programme.

The Degrees of Master of Applied Science (M.A.Sc.) and Doctor of Philosophy (Ph.D.) are also awarded in Engineering. Work for higher degrees may be pursued either through conventional full-time graduate study, or through the graduate co-operative programme of the Faculty of Engineering. For further details, consult the section of this calendar dealing with the Faculty of Graduate Studies, and special remarks on the graduate co-operative programme on page 49, and as well the particular courses in graduate work in the various departments as listed in Chapter VII.
Co-operative Programme

The eight terms of study and six terms of industrial employment provided in the course are arranged as shown in the diagram below:

<table>
<thead>
<tr>
<th>Stream</th>
<th>1966</th>
<th>1967</th>
<th>1968</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fall</td>
<td>Winter</td>
<td>Spring</td>
</tr>
<tr>
<td>&quot;A&quot;</td>
<td>First Term</td>
<td>Second Term</td>
<td>Work Period</td>
</tr>
<tr>
<td></td>
<td>&quot;B&quot;</td>
<td>Work Period</td>
<td>Second Term</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Work Period</td>
<td>Third Term</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Work Period</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fourth Term</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Work Period</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1969</th>
<th>1970</th>
<th>1971</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td>Spring</td>
<td>Fall</td>
</tr>
<tr>
<td>&quot;A&quot;</td>
<td>Third Term</td>
<td>Sixth Term</td>
</tr>
<tr>
<td>Work Period</td>
<td>Work Period</td>
<td>Work Period</td>
</tr>
<tr>
<td>&quot;B&quot;</td>
<td>Work Period</td>
<td>Fifth Term</td>
</tr>
<tr>
<td>Work Period</td>
<td>Work Period</td>
<td>Work Period</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sixth Term</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Work Period</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Seventh Term</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Work Period</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eighth Term</td>
</tr>
</tbody>
</table>

All Year I students enrol in September. These Year I students spend the first term together at the University, and, as indicated on the diagram, also complete the course and graduate together. Between the first and last terms, the diagram shows that each class is split into two approximately even groups for continuity of employment opportunity on the co-operative programme. Both groups, of course, have the same total time on campus and in industry; one group having a double academic term at the start of the course and the other having a double academic term at the end of the course. The division at the end of the first term of study is based upon student preferences, financial considerations of students, etc. Precise dates for the beginning and end of the various terms are shown in the academic calendar for the year.

Admission and Registration

General

Application for admission to the Faculty of Engineering should be made, as early in the year as possible, on forms provided by the Office of the Registrar. Academic certificates (not diplomas) and other supporting documents should be forwarded as soon as they become available. Admission cannot be granted until all requirements have been met and all documents submitted.

Admission to Year I

In order to qualify for admission to the first year of the Engineering programme the applicant must have completed the requirements for the Ontario
Secondary School Honours Graduation Diploma (Senior Matriculation), or its equivalent, showing an overall average of 60% in the Grade XIII papers required for admission and with a minimum overall average of 60% in the five papers in Mathematics and Science. A somewhat higher average may be required of applicants who have taken two or more years to complete the work of Grade XIII. Standing is required in the following papers:

- English (Two credits)
- Mathematics (Algebra, Geometry, Trigonometry)
- Science (Chemistry, Physics)
- One additional subject (One or two credits)

Additional papers can be selected from any of the optional subjects offered at the Grade XIII level with the qualification that no more than one of the following papers may be counted as an “additional” paper: Accountancy Practice, Secretarial Practice, Mathematics of Investment, Art or Music (Departmental Examination). The marks received in one of these papers will be included in the computation of the applicant’s average. Standing with the Royal Conservatory of Music in Grade VIII practical and Grade II theory will be considered as one ‘additional paper’ on the same terms as the above list except the marks received will not be computed in the average.

**Note 1.** Single combined papers in English and other language subjects are counted as two credits each. All other papers are counted as one credit each, (e.g. Biology, History, Geometry).

**Note 2.** The University will continue to use the results of Grade XIII final examinations as the major criterion for admission to first year in September 1966. Applicants are encouraged to submit College Entrance Examination Board (S.A.T.) Scores as supplementary data where feasible. Applicants who are unable to submit these test results are assured, however, that their admission will not be jeopardized as a result.

The following certificates, recognized as being equivalent to the Ontario Grade XIII certificate, may be accepted insofar as they meet the admission requirements of the University of Waterloo in subjects and percentages:

- Alberta: Senior Matriculation (Grade XIII)
- British Columbia: Senior Matriculation (Grade XIII)
- Manitoba: Senior Matriculation (Grade XII)
- New Brunswick: Senior Matriculation (Grade XIII)
- Newfoundland: Year I Memorial University
- Nova Scotia: Senior Matriculation (Grade XII)
- Prince Edward Island: Third Year Certificate from Prince of Wales College
- Quebec: McGill Senior Matriculation or Quebec Senior High School Leaving Certificate
Admission and Registration

Saskatchewan
Senior Matriculation (Grade XII)

England and Wales, West Indies, East and West Africa
The General Certificate of Education with passes in at least five subjects, two of which must be at Advanced Level. Advanced Level subjects must include Mathematics and either Physics or Chemistry.

Scotland
The Scottish Leaving Certificate.

United States of America
High School Graduation plus an additional year of formal study in subjects comparable to Ontario Grade XIII.

Admission to Advanced Standing
An applicant for admission to advanced standing must submit an official transcript from the University which he has attended, showing in detail the courses he has taken and his standing in each. Because of the co-operative nature of the programme, no student will be admitted above the Year III, Term A level. Any student thus admitted would be required to register in the 'A' stream and complete a minimum of three work terms.

Admission as an Adult Student
Any student of mature age who has been away from formal education for more than two years, and who does not possess the minimum requirements for admission, may apply to enter as an adult student. Each application will be considered on its merits by the Admissions Committee. Under certain circumstances, the applicant may be required to write a qualifying examination.

Admission of Students from Other Countries
Students from areas where English is not the common language must provide certified translations of academic certificates. In addition, the applicant may be required to take either "The English Proficiency Tests" prepared by the English Language Institute of the University of Michigan, or the examinations for "The Certificate of Proficiency in English" of the University of Cambridge, in order to satisfy the Admissions Committee that his knowledge of the English language is adequate to pursue his studies successfully. The expenses involved in administering the test must be borne by the applicant.

Re-Admission
The University reserves the right to refuse admission to any candidate, and to refuse re-admission if, in the opinion of competent authority, a student is not profiting from University studies.
Registration

September 14       Wednesday       Year I
September 16       Friday          Advanced Years

Once the student has completed his registration, he may not change his course, add subjects, or drop subjects, without obtaining permission from the Dean, the instructor, and processing the change, on the proper forms, through the Office of the Registrar.

Fees

All fees for the academic year are due and payable on the day of registration. Credit for scholarships or bursaries is given only on the authority of the Registrar after presentation of proof of the award.

If, for reasons acceptable to the Comptroller, the fees for the terms cannot be paid in full on the day of registration, they may be paid in two instalments, but an extra charge of $5.00 will then be added to the total fee.

The first instalment, to be paid on the day of registration, is a minimum of 60% of tuition, plus all incidental fees. The balance must be paid on or before the eighth week of term.

A charge of $2.00 per month will be made on overdue accounts. Failure to pay an overdue account before conclusion of lectures will bar a student from writing examinations or obtaining credit for previous work.
Fees

A student who finds it necessary to withdraw from attendance is required to obtain a withdrawal voucher from the Registrar. This voucher, when signed by both the Dean and the Registrar, may entitle him to a refund of a portion of his fee. No fee will be refunded unless this procedure is followed.

Refunds of tuition fees are made at the discretion of the University. Incidental fees are not refundable.

The fee schedule shown is the one in effect for the 1965-66 year and at the time of printing is still subject to review and possible change for the 1966-67 year. If a fee change is made, a notice will be issued with a new fee schedule; however, the University does not undertake or accept responsibility to so notify all recipients of this calendar. The Board of Governors reserves the right to make changes in the published schedule of fees without notice.

---

Fees per term

<table>
<thead>
<tr>
<th></th>
<th>Year One</th>
<th>Other Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuition</td>
<td>292.50</td>
<td>$342.50</td>
</tr>
<tr>
<td>Incidental*</td>
<td>24.75</td>
<td>24.75</td>
</tr>
<tr>
<td></td>
<td>$317.25</td>
<td>$367.25</td>
</tr>
</tbody>
</table>

Miscellaneous Fees

- Examination — Supplemental, each paper: $10.00
- Presiding fee (at an outside centre, each half day): 5.00
- Photograph (at first registration only): 1.00
- Late Registration: 10.00
- Transcript of record: 1.00
- Degree and Graduation - Final year only: 10.00

The Health Insurance Fee is for eight months’ protection following each registration, and therefore includes students while off campus in their work periods. The fee is adjusted for the second term when a student remains on campus for two consecutive years.

* Incidental fees include student activities, athletic, health insurance and health services. The Health Insurance Plan does not include the premiums for benefits of the Ontario Hospital Services Commission. Such coverage is the student's own responsibility.

Residence Fees

Residence fees for both men and women are:

<table>
<thead>
<tr>
<th>Type of Room</th>
<th>Single</th>
<th>Semi-private</th>
<th>Double</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per academic year</td>
<td>$800.</td>
<td>$760.</td>
<td>$700.</td>
</tr>
<tr>
<td>Per term</td>
<td>$400.</td>
<td>$380.</td>
<td>$350.</td>
</tr>
</tbody>
</table>

All students may pay residence fees on a term basis; payments are due and payable on or before the day of registration or the first day of each term.
This fee does not include the period between the end of the first term and the beginning of the second term. Students occupying residence in this period will be charged an additional $2.00 per day for their room (food, if available, will be an extra charge).

Rooms may be occupied for twenty-four hours before registration and after the final examination.

Examinations and Promotions

The Faculty constitutes the examining body for all University examinations. The arrangement of the undergraduate engineering programme is shown on page 51. The first two terms or semesters comprise the “First Year” and courses in the first year extend over the full two terms, with final examinations at the end of the second term. Beyond the first year, all courses are of single term duration, and final examinations are held at the end of each term.

The following regulations govern the conduct of examinations and the promotions policy of the Faculty of Engineering of the University.

1. All examination results are considered by the Faculty Committee on Examinations and Promotions and subsequently by the Faculty Council. After the results have been considered by these bodies, they will be issued to individual students by the Registrar.

2. Standings in individual subjects are indicated by numerical grades in the scale 0 to 100, and may be interpreted according to the following:
   - 85 - 100 Excellent
   - 75 - 84 Very Good
   - 66 - 74 Good, Above Average
   - 60 - 65 Fair, Average to Below Average
   - 50 - 59 Passing
   - Below 50 Failing

3. For promotion from the First Year an overall average of 60% is required. Students failing to secure this average will be required to repeat the year except that if, in the opinion of the Faculty Council, a student is deemed unlikely to profit from further study, re-admission will be denied.

4. For promotion in the third and subsequent terms an overall average of 60% is required in the work of the term. Students failing to secure this average normally will be required to repeat all or part of the work of the term last completed.

   Where timetables permit, repeating students may be excused from repeating individual courses in which satisfactory grades have been obtained, and permitted to register in other appropriate courses.

5. Overall average of grades or standings may be interpreted according to the following:
   - 75.0 - 100 First Class Honours
Examinations and Promotions

6. A student must obtain an average standing of 60% as defined in section 2 or 3 above to qualify for the privilege of writing supplemental examinations. Supplemental examinations will be written in the term immediately following that in which the respective final examinations were written. The results of supplemental examinations are reported and recorded but do not affect the original standing as used in determining averages for promotion. A student may not write supplemental examinations to raise the standing in subjects already passed.

7. No student will be permitted to continue in course if he fails a supplemental examination in a course which is required as a prerequisite for further study, except with the express approval of the Examinations and Promotions Committee and the Department in which he is registered. Where a necessary prerequisite subject has not been cleared, a student may either repeat the year or term, or remain out of course until the deficiency is cleared at a subsequent examination.

8. If a student has failed to clear the supplemental examination in a single subject not required as a prerequisite for further study, he may be permitted to continue in course for one year, but must clear the condition before proceeding further.

9. Failure to write an examination is considered a failure to pass. A student who defaults a final examination, except for a properly certified reason, has no supplemental examination privilege. Doctors' certificates, or other documents indicating reasons for absence from examinations must be filed in the Office of the Registrar by the last day of examinations.

10. Final examinations are automatically re-read for all subjects in which failing grades are assigned. Great care is taken not to make errors in assigning and recording grades.

11. A student may not repeat a given year more than once. Degree requirements must be fulfilled in not more than 11 terms of resident study.

12. Any student may be required to withdraw at any time, if, in the opinion of the Faculty Council, he is unlikely to profit from further study.

Academic Programmes

It is important to summarize the principles and objectives of the engineering curricula at Waterloo, as they relate to the role of the engineering graduate in a modern industrialized society. Technological advances and economic evolution produce an ever-changing environment in which it is seen that obsolescence comes to entire industries as well as to processes and product, and primary attention is necessarily focused on the capacity to innovate design in process and product. Engineers are undoubtedly amongst the most important leaders
in such a society, and the conditions noted lead to primary concern with fundamental education, versatility of mind, and the ability to maintain a position close to the frontiers of development.

Rigorous work in Mathematics and the Sciences is emphasized throughout the course, and the common work in these basic areas of Science in the first and second years is used in each departmental programme to support advanced studies in engineering analysis and synthesis. It should be noted that the first year of the engineering course provides almost the same Mathematics, Physics, and Science courses as found in the first year in the Faculty of Science.

The core programmes for each of the four major divisions of engineering provide the foundation for professional activity in any field of engineering interest. A wide variety of elective courses are available in Engineering, Science, Mathematics, the Humanities, and Social Sciences, from which optional programmes may be developed under the guidance of faculty advisors. Engineering Physics programmes, in which studies in engineering are associated with advanced study in Mathematics and Pure Science are thus available, in effect, in every major field, and supplant previous separate courses in Engineering Physics.

The optional programmes that are made available under the curricula indicated should not be construed as specialization, but are rather intended to foster independent study and maturity of learning by permitting special undergraduate activity in subject areas which hold maximum interest. Certain courses, normally taken only at the post-graduate level, may in fact be included in under-
Academic Programmes

graduate programmes where necessary prerequisites are met. It must be emphasized that professional specialization in engineering requires intensive study beyond the Bachelor's degree as well as extensive experience in practice.

It is important to realize that the separation of engineering studies into four basic curricula areas reflects primarily divisions of learning in engineering, rather than divisions by classes of industry, for instance. It is to be noted that the chemical industry, the aeronautical industry, the mining industry, the pulp and paper industry — every major industry in fact — requires engineers from all primary divisions of the profession. Undergraduate study in any of the four basic divisions provided may lead, perhaps with further study or special experience as necessary, to professional activity in consulting work, or to staff positions in any kind of industry or any government agency, in research, education, design, design development, or administrative work.

Year I — Common to all Engineering students
(For Admission Requirements see page 51)

Course Arrangement:

<table>
<thead>
<tr>
<th></th>
<th>First Term</th>
<th></th>
<th>Second Term</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lect. lab/prob., tut.</td>
<td></td>
<td>Lect. lab/prob., tut.</td>
<td></td>
</tr>
<tr>
<td>Math. 12</td>
<td>Calculus I</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Math. 21</td>
<td>Algebra and Solid Geometry</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Physics 11</td>
<td>Physics</td>
<td>3</td>
<td>3*</td>
<td>3</td>
</tr>
<tr>
<td>G.E. 23</td>
<td>Measurement</td>
<td>2</td>
<td></td>
<td>3*</td>
</tr>
<tr>
<td>Chem. 11</td>
<td>General Chemistry</td>
<td>3</td>
<td>3*</td>
<td>3</td>
</tr>
<tr>
<td>G.E. 11</td>
<td>Synthesis</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>G.E. 21</td>
<td>Graphics I</td>
<td>4*</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>G.E. 22</td>
<td>Graphics II</td>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>G.E. 24</td>
<td>Tutorial</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

One of: Economics 3
Geography 3
Political Science 3
Psychology 3
Sociology 3

Note: * signifies a course given on alternate weeks.
Detailed course descriptions commence on page 121.
All courses are of single term duration unless specifically indicated.
At the completion of the First Year, students are required to select one of the following major divisions of engineering:

- Chemical Engineering
- Civil Engineering
- Electrical Engineering
- Mechanical Engineering

Since the Faculty of Engineering is primarily oriented towards a modern scientific approach to engineering, students interested in

Engineering Physics

can register in any one of the four major engineering programmes and pursue
a suitable course of study, including elective advanced courses in Mathematics, Chemistry and Physics. Alternatively, students primarily interested in Physics should consider major study directly in that field, as offered in the Faculty of Science.

Chemical Engineering

The course offered by the Department of Chemical Engineering is intended to prepare students for professional careers in those fields of engineering where physical-chemical transformation of matter play a significant role. The academic curriculum is based on the concept that undergraduate studies, to be most effective in a scientific industrial age, must deal primarily with basic scientific and engineering principles. In the earlier years the subject matter is analytical and closely prescribed—mathematics, physics, and chemistry form the foundation. In the senior years, subjects such as transport processes, process system design, and economic analysis, enables the student to reach a more comprehensive understanding of his previous work. A certain degree of specialization is available in the final year through options oriented towards Chemistry, Chemical Engineering, Applied Mathematics, and Industrial Management. The co-operative work assignments form an introduction to the different aspects of engineering such as research, development, design, production, economic factors, etc., and provide for relating theory and practice in education. Work programmes are carefully planned and developed to enable the students to obtain maximum experience in industry.

A. Core Programme

a. Mathematics and Science Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Lect.</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math. 22</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Math. 23</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Math. 24</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Math. 31</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Math. 32</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Chem. 22</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Chem. 26</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Chem. 31</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Chem. 35</td>
<td>3</td>
<td>3*</td>
</tr>
<tr>
<td>Chem. 36</td>
<td>3</td>
<td>3*</td>
</tr>
</tbody>
</table>

b. Engineering Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Lect.</th>
<th>Lab. or Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>G.E. 32 Fluid Mechanics (Transport Processes I)</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>G.E. 61 Philosophy of Science</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>E.E. 12 Electricity and Magnetism I</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>E.E. 13 Electricity and Magnetism II</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Ch.E. 11 Chem. Process Principles I</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

60
Chemical Engineering

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ch.E. 12</td>
<td>Chem. Process Principles II</td>
<td>3</td>
</tr>
<tr>
<td>Ch.E. 16</td>
<td>Inorganic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>Ch.E. 17</td>
<td>Applied Mathematics I</td>
<td>3</td>
</tr>
<tr>
<td>Ch.E. 18</td>
<td>Engineering Statistics</td>
<td>2</td>
</tr>
<tr>
<td>Ch.E. 22</td>
<td>Transport Processes II</td>
<td>3</td>
</tr>
<tr>
<td>Ch.E. 31</td>
<td>Physical-Chemical Principles I</td>
<td>3</td>
</tr>
<tr>
<td>Ch.E. 32</td>
<td>Thermodynamics I</td>
<td>3</td>
</tr>
<tr>
<td>Ch.E. 33</td>
<td>Thermodynamics II</td>
<td>3</td>
</tr>
<tr>
<td>Ch.E. 36</td>
<td>Physical-Chemical Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>Ch.E. 41</td>
<td>Reaction Kinetics I</td>
<td>3</td>
</tr>
<tr>
<td>Ch.E. 42</td>
<td>Reaction Kinetics II</td>
<td>3</td>
</tr>
<tr>
<td>Ch.E. 51</td>
<td>Process Dynamics and Control I</td>
<td>3</td>
</tr>
<tr>
<td>Ch.E. 52</td>
<td>Process Dynamics and Control II</td>
<td>3</td>
</tr>
<tr>
<td>Ch.E. 61</td>
<td>Engineering Economics</td>
<td>3</td>
</tr>
<tr>
<td>Ch.E. 62</td>
<td>Process System Design</td>
<td>2</td>
</tr>
<tr>
<td>Ch.E. 71</td>
<td>Chemical Engineering Lab. I</td>
<td>4</td>
</tr>
<tr>
<td>Ch.E. 72</td>
<td>Chemical Engineering Lab. II</td>
<td>6</td>
</tr>
<tr>
<td>Ch.E. 91</td>
<td>Seminar</td>
<td>1</td>
</tr>
</tbody>
</table>

A minimum of 6 courses must be chosen in addition to the core courses listed above to fulfill the requirements of the Chemical Engineering programme. Two courses (six hours) should be chosen from non-technical electives in the humanities or social sciences. The equivalent of four courses are to be technical electives, and three of these are to be selected from any one of the optional groups listed below. The fourth elective can be chosen from other Chemical Engineering courses or from other science or engineering course lists according to interest, but this choice must be approved by the Department.

Optional Groups

(I) Chemical Engineering Science
- Ch.E. 34 Physical-Chemical Principles II
- Ch.E. 43 Reactor Design and Catalysis III

(II) Polymer Science
- Chem. 55 Polymer Chemistry
- Ch.E. 81 Physical Chemistry of Polymers
- Ch.E. 607 (or equivalent) - Non-Newtonian Flow

(III) Metallurgical Science
- Ch.E. 34 Physical-Chemical Principles II
- Ch.E. 43 Reactor Design and Catalysis
- Ch.E. 85 Chemical Metallurgy
(IV) Systems Option
   Math.  55  Digital Computer Programming
   One approved course from Management Sciences, or from Graduate
   Ch.E. courses in Systems and Controls

(V) Research Project
   Ch.E.  98  Research and Design Project I (3 hours)
   Ch.E.  99  Research and Design Project II (6 hours)

Academic Programmes for Each Term (1966/67)

Chemical Engineering

Year IIA.  Fall 1966 - Winter 1967
   Math.  22
   Math.  24
   E. E.  12
   Chem.  22
   Chem.  26
   Ch.E.  11
   Ch.E.  31
   Ch.E.  36

Year IIB.  Fall 1966 and Summer 1967
   Math.  31
   Math.  32
   E.E.  13
   Chem.  36
   Ch.E.  12
   Ch.E.  16

Year IIIA. Winter 1967 and Summer 1967
   Ch.E.  17
   Ch.E.  18
   Chem.  31
   G.E.  32
   Ch.E.  32
   Ch.E.  41

Year IIIB.  Fall 1966 and Winter 1967
   Chem.  35
   Ch.E.  22
   Ch.E.  33
   Ch.E.  42
   Ch.E.  71
   Tech. Elect.
Civil Engineering

Civil Engineers plan, design, and supervise the construction of such facilities as bridges, buildings, railways, highways, dams, water supply systems, and waste disposal systems. The demands of society for such facilities are so great that civil engineers in fulfilling these demands, spend well over a tenth of our total national income—more money than spent by any other engineering or professional group.

The curriculum provides a modern approach to the subject based on a thorough grounding in mathematics and natural sciences. Because of the need for a broad understanding of the principles of Engineering, students are also introduced to other engineering subjects such as thermodynamics and electricity as a preparation for Civil Engineering studies. Whereas complete professional specialization can be achieved only in postgraduate study and in engineering practice, the students can find ample opportunity to pursue advanced undergraduate study in a variety of areas. For example:

(a) **Structural Engineering**—Intended for students primarily interested in design and construction of structures; emphasis is placed on a broad foundation in mechanics and behaviour of materials.

(b) **Environmental Health Engineering**—The major attention in this option is given to studies of water and air resources supply, treatment, and disposal, industrial hygiene, radiation protection, control of communicable diseases and environmental sanitation and design of municipal facilities.

(c) **Transportation Engineering**—is intended for the student interested in the planning, design, construction and traffic operation of streets and highways. Emphasis is placed on planning and design related to traffic demands.
(d) **Geotechnical Engineering**—is designed to provide the student with an understanding of the engineering properties of soils and enable him to appreciate the methods behind the design of foundations of structures, earth retaining structures, earth dams and highway pavements.

(e) **Engineering Mechanics**—for students with a strong interest in rigorous study of mechanics and related fields, leading to an understanding of advanced structural analysis and serving as a preparation for graduate study in structural engineering, hydraulics, mechanics of solids and fluids, or properties of materials.

(f) **Hydraulic Engineering**—is intended for the student interested in the planning, design and operation of water supply and water management.

### A. Core Programme

#### a. Mathematics and Science Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math. 22</td>
<td>Calculus II</td>
<td>3</td>
</tr>
<tr>
<td>Math. 23</td>
<td>Numerical Methods</td>
<td>-2</td>
</tr>
<tr>
<td>Math. 31</td>
<td>Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>Math. 32</td>
<td>Numerical Analysis</td>
<td>2</td>
</tr>
</tbody>
</table>

#### b. Engineering Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>G.E. 12</td>
<td>Introduction to Engineering Systems</td>
<td>3</td>
</tr>
<tr>
<td>G.E. 31</td>
<td>Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>G.E. 32</td>
<td>Fluid Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>G.E. 41</td>
<td>Mechanics of Deformable Solids I</td>
<td>2</td>
</tr>
<tr>
<td>G.E. 42</td>
<td>Dynamics</td>
<td>2</td>
</tr>
<tr>
<td>G.E. 53</td>
<td>Structure and Properties of Matter I</td>
<td>2</td>
</tr>
<tr>
<td>G.E. 54</td>
<td>Structure and Properties of Matter II</td>
<td>2</td>
</tr>
<tr>
<td>F.E. 12</td>
<td>Electricity and Magnetism I</td>
<td>2</td>
</tr>
<tr>
<td>E.E. 13</td>
<td>Electricity and Magnetism II</td>
<td>2</td>
</tr>
</tbody>
</table>

#### c. Non-Technical Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>G.E. 61</td>
<td>History and Philosophy of Science</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>2 Arts Electives</td>
<td>6</td>
</tr>
</tbody>
</table>

### Civil Engineering Core

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.E. 22</td>
<td>Mechanics of Deformable Solids II</td>
<td>2</td>
</tr>
<tr>
<td>C.E. 31</td>
<td>Theory of Structures</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 32</td>
<td>Behaviour of Steel Structures</td>
<td>2</td>
</tr>
<tr>
<td>C.E. 33</td>
<td>Reinforced Concrete I</td>
<td>2</td>
</tr>
<tr>
<td>C.E. 41</td>
<td>Engineering Measurement</td>
<td>2</td>
</tr>
<tr>
<td>C.E. 51</td>
<td>Geotechnical Materials</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 52</td>
<td>Geotechnical Mechanics</td>
<td>2</td>
</tr>
<tr>
<td>C.E. 61</td>
<td>Transportation Engineering</td>
<td>2</td>
</tr>
<tr>
<td>C.E. 66</td>
<td>Engineering Statistics</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 71</td>
<td>Water Resources Engineering</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 79</td>
<td>Engineering Hydraulics</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 81</td>
<td>Law, Contracts and Specifications</td>
<td>2</td>
</tr>
</tbody>
</table>
B. Elective Courses

*One of:*

C.E. 85 Civil Engineering Design Studies II

or C.E. 86 Research Project

*The Technical Electives, five in number, are to be chosen according to the option selected. Elective courses may be chosen from the list below, or from other Engineering, Arts or Science course lists, in consultation with a Civil Engineering faculty advisor. In particular, sequence chosen from among the courses listed may be formed so as to satisfy a general civil engineering study in addition to the areas of specialization listed above.*

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>G.E. 13</td>
<td>Management Science I</td>
<td>2</td>
</tr>
<tr>
<td>G.E. 14</td>
<td>Statistics in Engineering Management</td>
<td>2</td>
</tr>
<tr>
<td>G.F. 52</td>
<td>Physical Properties of Materials</td>
<td>2</td>
</tr>
<tr>
<td>C.E. 34</td>
<td>Reinforced Concrete II</td>
<td>2</td>
</tr>
<tr>
<td>C.E. 35</td>
<td>Structural Design</td>
<td>2</td>
</tr>
<tr>
<td>C.E. 53</td>
<td>Geotechnical Processes</td>
<td>2</td>
</tr>
<tr>
<td>C.E. 54</td>
<td>Geotechnical Engineering</td>
<td>2</td>
</tr>
<tr>
<td>C.E. 55</td>
<td>Engineering Aspects of Surficial Soils</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 62</td>
<td>Highway Engineering</td>
<td>2</td>
</tr>
<tr>
<td>C.E. 63</td>
<td>Pavement Materials</td>
<td>2</td>
</tr>
<tr>
<td>C.E. 64</td>
<td>Pavement Structural Design</td>
<td>2</td>
</tr>
<tr>
<td>C.E. 72</td>
<td>Environmental Health Engineering</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 83</td>
<td>Project Management</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 609</td>
<td>Advanced Theory of Structures</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 610</td>
<td>Inelastic Behaviour of Ductile Members and Structures</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 611</td>
<td>Elementary Mechanics of Continua</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 612</td>
<td>Experimental Mechanics</td>
<td>1</td>
</tr>
<tr>
<td>C.E. 650</td>
<td>Advanced Soil Mechanics I</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 671</td>
<td>Water Resources Engineering I</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 672</td>
<td>Water Resources Engineering II</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 686</td>
<td>Engineering Hydrology</td>
<td>2</td>
</tr>
<tr>
<td>C.E. 689</td>
<td>Open Channel Hydraulics</td>
<td>2</td>
</tr>
<tr>
<td>Math. 41</td>
<td>Applied Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>Math. 42</td>
<td>Vector Methods</td>
<td>2</td>
</tr>
<tr>
<td>Math. 44</td>
<td>Complex Variable</td>
<td>2</td>
</tr>
<tr>
<td>Math. 45</td>
<td>Applied Analysis II</td>
<td>2</td>
</tr>
<tr>
<td>Math. 55</td>
<td>Digital Computer Programming</td>
<td>3</td>
</tr>
<tr>
<td>Math. 56</td>
<td>Matrix Algebra</td>
<td>3</td>
</tr>
<tr>
<td>Geog. 350</td>
<td>Urban Geography and Settlement Patterns (two terms)</td>
<td>2</td>
</tr>
<tr>
<td>Biol. 31</td>
<td>Biology for Engineers</td>
<td>2</td>
</tr>
</tbody>
</table>
Academic Programmes for Each Term (1966/67)

Civil Engineering

Year IIA.  Fall 1966 - Winter 1967
  Math.  22  
  Math.  23  
  E.E.  12  
  G.E.  41  
  G.E.  42  
  C.E.  41  
  1 Arts elective

Year IIB.  Fall 1966
  Math.  31  
  Math.  32  
  E.E.  13  
  G.E.  12  
  G.E.  53  
  G.F.  22

Year IIB.  Summer 1967
  Math.  31  
  Math.  32  
  E.E.  13  
  G.F.  53  
  C.E.  22  
  C.E.  51

Year IIIA.  Winter 1967
  G.E.  12  
  G.E.  54  
  C.E.  31  
  C.E.  52  
  C.E.  82  
  C.E.  61

Year IIIA.  Summer 1967
  G.E.  31  
  G.E.  32  
  G.E.  54  
  C.E.  31  
  C.E.  51  
  C.E.  71

Year IIIB.  Fall 1966
  C.E.  66  
  G.E.  31  
  C.E.  32  
  C.E.  41  
  C.E.  71  
  C.E.  79
Department of Design

Since January of 1965, the Department of Design has offered Graduate studies and research in Human Physical Environments, leading to the degree of Master of Applied Sciences in Environmental Design.

The programme is unique in that it brings together various academic disciplines, research and working professional designers to achieve educational balance between the laboratory and the development of theory and methodology. The graduate programme has been designed to prepare the student to work in the ever-increasing complexity of the Human Physical Environment and handle multi-factor design problems with intelligence, experience and skill.

The programme consists of Department of Design course work, electives in other University departments and “Field Laboratory” work in the Institute of Design.

The Institute of Design is a financially independent and working Institute that contributes to the development of formal academic programmes, while not acting as a teaching organization. Through the Institute of Design, the student has the opportunity of work and contact with a varied group of professional consultants and the full-time Institute staff that have backgrounds in the areas of Product Design; Psychology; Fine Arts; Films; Civil, Electrical and Mechanical Engineering; and Graphic Design.

The Master’s programme is open to candidates who can satisfy the general requirements for admission to the Faculty of Graduate Studies and the requirements of the Admission Committee of the Department of Design. While admission is generally on an individual basis, the Committee will require:
1. Evidence that the candidate’s undergraduate studies were in one of the following or related major areas:

<table>
<thead>
<tr>
<th>Architecture</th>
<th>Engineering</th>
<th>Graphics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td>Economics</td>
<td>Sociology</td>
</tr>
<tr>
<td>Geography</td>
<td>Psychology</td>
<td></td>
</tr>
<tr>
<td>Commerce</td>
<td>Industrial Design</td>
<td></td>
</tr>
</tbody>
</table>

2. Evidence of the candidate’s interest and/or experience in Environmental Design through previous course work or as practical experience.

Depending upon the student’s previous course work and experience, his course selection and thesis topic will relate to one of the following:

1. The Visual and Communication Environment (preferred background in Graphics, Psychology, Sociology).

2. Industrial Products Environment (preferred background in Industrial Design, Engineering, Physics, Chemistry, Economics, Industrial Administration).

The Master’s Programme generally requires two years to complete and consists of the following:

1. Two one-semester courses from Department of Design Group A subjects (see courses offered).

2. One one-semester course from Department of Design Group B subjects (see courses offered).

3. Two one-semester courses from another University Department as approved by the Department of Design.

4. Additional course work or special studies as required by Department of Design, based on the individual candidate’s experience.

5. A thesis which contains the design of a physical object or system and makes an original contribution to the general fields of design methodology and/or theory.

**The Diploma Programme**

The Department of Design also offers a Diploma programme, leading to a Diploma in Environmental Design. The programme is designed for the individual who is more interested in the technical and feasibility aspects of design than the methodology and theory, yet wishes to study design within the University environment.

All Diploma programmes will be related to the Design of Human Physical Environments; and depending upon the student’s background and experience, his course selection and project will relate to one of the following:

1. The Visual and Communication Environment

2. The Industrial Products Environment

Admission to the programme is on an individual basis through the Senate Admissions Committee for Diploma Programmes and the Department of Design.
In general, the committee will require:

1. Evidence from prior education or experience that the student can meet the course requirements.

2. Evidence from prior education or experience that the student has an interest and some skill in Environmental Design or a related design area.

The Diploma programme generally requires two years to complete and consists of the following:

1. A minimum of six courses (four in the Department of Design and two in another University Department as approved or advised by the Department of Design).

2. Additional course work or special studies as required by the Department of Design, based on the individual student's experience.

3. A design project consisting of a physical object or system that demonstrates physical and economic feasibility.

Electrical Engineering

Electrical Engineering encompasses a wide variety of specialized topics as evidenced by the 29 distinct professional groups in the Institute of Electrical and Electronics Engineers, one of the largest professional organizations in North America. Listed in alphabetical order, the professional groups range from Aeronautical and Navigational Electronics to Vehicular Communications, which still does not include the different areas of power engineering. Such areas as Electronic Computers and Automatic Control Systems, which have helped considerably for the advent of the Space Age, come within the purview of Electrical Engineering.

It has come clearly impossible for any EE curriculum to address itself to narrow specializations centered around technologies, for there are too many of them.

Consistent with modern trends in Electrical Engineering education, Waterloo has endeavoured to stress some of the basic disciplines underlying the various branches of Electrical Engineering. Some such disciplines are:

(a) System Theory;
(b) Field Theory;
(c) Communication Theory;
(d) Analogue and Digital Computations.

The courses on Electro-Mechanics, Network Theory, Electronic Circuits, Control Systems, etc., come under group (a). Transmission Lines, Micro-Wave Circuits, aspects of design, etc., come under group (b); Group (c) includes those areas for which a knowledge of probability and statistics is essential. Group (d), although a discipline in its own entity, is interspersed throughout the other areas.
### A. Core Programme

#### a. Mathematics and Science Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Code</th>
<th>Title</th>
<th>Lect.</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math. 22</td>
<td>22</td>
<td>Calculus II</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Math. 23</td>
<td>23</td>
<td>Numerical Methods</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Math. 24</td>
<td>24</td>
<td>Mathematics Problems</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Math. 31</td>
<td>31</td>
<td>Differential Equations</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Math. 32</td>
<td>32</td>
<td>Numerical Analysis</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Math. 33</td>
<td>33</td>
<td>Differential Calculus</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Math. 34</td>
<td>34</td>
<td>Integral Calculus</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Math. 44</td>
<td>44</td>
<td>Complex Variables</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>E.E. 12</td>
<td>12</td>
<td>Electricity and Magnetism I</td>
<td>2</td>
<td>3*</td>
</tr>
<tr>
<td>E.E. 13</td>
<td>13</td>
<td>Electricity and Magnetism II</td>
<td>2</td>
<td>3*</td>
</tr>
<tr>
<td>Phys. 15</td>
<td>15</td>
<td>Modern Physics</td>
<td>3</td>
<td>-</td>
</tr>
</tbody>
</table>

#### b. Engineering Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Code</th>
<th>Title</th>
<th>Lect.</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>G.E. 12</td>
<td>12</td>
<td>Introduction to Engineering Systems</td>
<td>3</td>
<td>3*</td>
</tr>
<tr>
<td>G.E. 31</td>
<td>31</td>
<td>Thermodynamics</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>G.E. 41</td>
<td>41</td>
<td>Mechanics of Deformable Solids</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>G.E. 42</td>
<td>42</td>
<td>Dynamics</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>G.E. 51</td>
<td>51</td>
<td>Micro-Structure of Materials</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>G.E. 52</td>
<td>52</td>
<td>Physical Properties of Materials</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>E.E. 23</td>
<td>23</td>
<td>Analogue Computation</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>F.F. 42</td>
<td>42</td>
<td>Network Theory II</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>E.E. 51</td>
<td>51</td>
<td>Electronics I</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>E.E. 52</td>
<td>52</td>
<td>Electronics II</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>E.E. 61</td>
<td>61</td>
<td>Electromechanics I</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>E.E. 62</td>
<td>62</td>
<td>Electromechanics II</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>E.E. 71</td>
<td>71</td>
<td>Transmission Lines and Wave Guides</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>E.E. 72</td>
<td>72</td>
<td>Electromagnetic Fields</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>E.E. 81</td>
<td>81</td>
<td>Control Systems I</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>E.E. 82</td>
<td>82</td>
<td>Control Systems II</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>E.E. 91</td>
<td>91</td>
<td>Electrical Laboratory I</td>
<td>-</td>
<td>3*</td>
</tr>
<tr>
<td>E.E. 93</td>
<td>93</td>
<td>Electrical Laboratory III</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 94</td>
<td>94</td>
<td>Electrical Laboratory IV</td>
<td>-</td>
<td>4½</td>
</tr>
<tr>
<td>E.E. 95</td>
<td>95</td>
<td>Electrical Laboratory V</td>
<td>-</td>
<td>4½</td>
</tr>
<tr>
<td>E.E. 96</td>
<td>96</td>
<td>Electrical Laboratory VI</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>E.E. 99</td>
<td>99</td>
<td>Seminar</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

#### c. Non-Technical Courses (two required)

<table>
<thead>
<tr>
<th>Course</th>
<th>Code</th>
<th>Title</th>
<th>Lect.</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>G.E. 61</td>
<td>61</td>
<td>History and Philosophy of Science, Arts Elective</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

### B. Elective Courses (five to be chosen)

<table>
<thead>
<tr>
<th>Course</th>
<th>Code</th>
<th>Title</th>
<th>Lect.</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.E. 24</td>
<td>24</td>
<td>Logic and Switching</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>E.E. 44</td>
<td>44</td>
<td>Pulse and Switching Circuits</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>E.E. 45</td>
<td>45</td>
<td>Network Synthesis</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
<td>Credits</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>------------------------------------</td>
<td>---------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>E.E. 55</td>
<td>Solid State Electronics</td>
<td>2</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>E.E. 64</td>
<td>Advanced Electromechanics</td>
<td>3</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>E.E. 65</td>
<td>Power Systems Analysis</td>
<td>3</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>E.E. 74</td>
<td>Microwave Circuit Theory</td>
<td>3</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>E.E. 75</td>
<td>Dielectrics and Magnetics</td>
<td>2</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>E.E. 83</td>
<td>Communication Theory</td>
<td>3</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Math. 51</td>
<td>Probability and Statics</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Math. 55</td>
<td>Digital Computer Programming</td>
<td>3</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Math. 56</td>
<td>Matrix Algebra</td>
<td>3</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>G.E. 32</td>
<td>Fluid Mechanics</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

### Academic Programmes for Each Term (1966/67)

#### Electrical Engineering

**Year IIA. Fall 1966 - Winter 1967**

- Math. 22
- Math. 23
- Math. 24
- G.E. 41
- G.E. 42
- E.E. 12
- E.E. 91

**Year IIB. Fall 1966 - Summer 1967**

- Phys. 15
- Math. 31
- Math. 32
- G.E. 12
- G.E. 31
- E.E. 13

**Year IIIA. Winter 1967 - Summer 1967**

- Math. 33
- Math. 34
- G.E. 51
- E.E. 42
- E.E. 51
- E.E. 61

**Year IIIB. Fall 1966 - Winter 1967**

- G.E. 52
- E.E. 52
- E.E. 62
- E.E. 71
- Math. 44
Year IVA. Fall 1966 - Summer 1967

E.E. 23
E.E. 72
E.E. 81
Electives (2)
Math. 51
Math. 55
Math. 56
E.E. 24
E.E. 44
E.E. 55
G.E. 32

Year IVB. Winter 1967

E.E. 82
E.E. 96
E.E. 99
Electives (3)
E.E. 45
E.E. 64
E.E. 65
E.E. 74
E.E. 75
E.E. 83
Math. 51

Mechanical Engineering

The scope of mechanical engineering is so wide and its services so universally needed as a basic part of all kinds of engineering work that the mechanical engineer is in demand in a variety of industries throughout Canada. He is required in the field of power generation where he would deal with steam, diesel or other internal combustion engines, and with hydraulic or gas turbines; in the field of heating, ventilating and refrigeration: in the design and manufacture of material handling equipment, automobiles, locomotives, aircraft, rockets, marine vessels, furnaces, boilers, pressure vessels, heat exchangers, motors, generators and machine tools. He is employed in industries such as steel production, mining, transportation, communications, oil refining, chemicals manufacture, paper, sugar, textiles, the government, and construction. In the last few years additional demands have been imposed by the requirement that Mechanical Engineers understand and lead in the development of new methods of energy conversion and other technologies of the space age. The undergraduate programme in Mechanical Engineering is designed to provide the student with a firm grasp of basic fundamentals in the mathematical, physical, chemical, and engineering sciences, and also provides an opportunity (on a limited scale)
for specialization in the later years. The degree of B.A.Sc. in Mechanical Engineering carries exemption from parts I and II of the Institution of Mechanical Engineers (London) Examination.

Organization of the Mechanical Engineering undergraduate programme is founded on a core of subjects that must be taken by all students. The first year is common with the other branches of engineering. The second year provides elementary courses in Mechanical Engineering and certain branches of Civil and Electrical Engineering together with further development in mathematics and physics. Opportunities for specialization occur during the third and fourth years, there being a choice of elective subjects available to permit pursuit of individual interests. A coherent set of electives in a particular technical area is termed an Option. Examples of such Options are the following:

(a) **Thermo-Fluid Mechanics Option** — is to accommodate students chiefly interested in the interrelated fields of thermodynamics and fluid flow including aerodynamics and gas dynamics. Emphasis is placed on the mathematical and physical aspects of the subject in order to develop a sound engineering-scientific perspective and capability.

(b) **Engineering Mechanics Option** — is intended primarily for those interested in research and development careers in engineering. The courses are oriented for the student to obtain depth of understanding in the basic sciences (mathematics, physics, and chemistry) and the engineering sciences (particularly with respect to the mechanics of solids) and to gain insight and skill in the application of these sciences to engineering problems.

(c) **Mechanical and Structural Design Option** — is intended for the student with a strong interest in design. The over-all system approach to design is followed. Since mechanical design often extends into the field of structures, particularly when the unit being designed is large, structural engineering courses are suggested. Similarly of value are courses in heat transfer and fluid flow.

(d) **Manufacturing Sciences Option** — is designed to provide the student with an understanding of industry from the viewpoint of its organization, its processes, and the application of mathematics to its operation. It is suggested for those students primarily interested in the industrial aspects of mechanical engineering.

(e) **Engineering Materials Option** — is organized to provide an understanding of those phenomena which influence the mechanical and physical properties of engineering materials. The curriculum is designed to provide sufficient depth in the science of materials to permit further study and research in specialized fields such as physical metallurgy, ceramics, or nuclear materials, and at the same time to provide a fundamental understanding of the structure and behaviour of materials as processed, fabricated and used in industry.
A. Core Programme

a. Mathematics and Science Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Lect.</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math. 22</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Math. 23</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Math. 31</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Math. 32</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Math. 41</td>
<td>3</td>
<td>-</td>
</tr>
</tbody>
</table>

b. Engineering Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Lect.</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>G.E. 12 Introduction to Engineering Systems</td>
<td>3</td>
<td>3*</td>
</tr>
<tr>
<td>G.E. 31 Thermodynamics</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>G.E. 32 Fluid Mechanics</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>G.E. 41 Mechanics of Deformable Solids I</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>G.E. 42 Dynamics</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>G.E. 53 Structure and Properties of Matter I</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>G.E. 54 Structure and Properties of Matter II</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 12 Electricity and Magnetism I</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>E.E. 13 Electricity and Magnetism II</td>
<td>2</td>
<td>3*</td>
</tr>
<tr>
<td>E.E. 32 Electronics</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 81 Control Systems</td>
<td>3</td>
<td>3*</td>
</tr>
<tr>
<td>M.E. 13 Kinematics</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>M.E. 21 Mechanics of Machinery</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>M.E. 53 Heat Transfer I</td>
<td>3</td>
<td>3*</td>
</tr>
<tr>
<td>M.E. 81 Seminar</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>M.E. 82 Mechanical Engineering Projects</td>
<td>-</td>
<td>9</td>
</tr>
<tr>
<td>C.E. 22 Mechanics of Deformable Solids II</td>
<td>2</td>
<td>-</td>
</tr>
</tbody>
</table>

c. Non-Technical Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Lect.</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.E. 61 History and Philosophy of Science</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Two Arts Electives</td>
<td>6</td>
<td>-</td>
</tr>
</tbody>
</table>

B. Elective Courses

Seven elective courses are required in addition to the core courses listed above to fulfill the requirements of the Mechanical Engineering programme. Some of these are prerequisites for other, higher level elective subjects, and should therefore be chosen on the basis of a decision on the part of the student to enter one or other of the options. The subjects offered in the various options are listed below. Higher level electives are offered depending on the availability of faculty. It is not necessary (or even desirable) to choose all electives from a single option. Furthermore, electives may be chosen from the offerings of other Engineering Departments. Mathematics or indeed any other Arts or Science Department, provided only that the timetables are compatible.

a. Thermodynamics — Fluid Mechanics Option

Prerequisites:
M.F. 54 Thermodynamics II
M.E. 62 Fluid Dynamics
Higher level electives:
M.E. 35 Nuclear Engineering
M.E. 55 Statistical Thermodynamics
M.E. 56 Heat Transfer II
M.E. 63 Turbomachines I
M.E. 65 Gas Dynamics I
M.E. 66 Turbulent Flow I
M.E. 631 Fluid Power Control Systems
M.E. 655 Combustion
M.E. 666 Wave phenomena in Fluids
Suggested electives from other options or departments:
Math. 54 Differential Equations of Mathematical Physics
C.E. 79 Engineering Hydraulics
C.E. 611 Elementary Mechanics of Continua

b. Engineering Mechanics Option
Prerequisites:
M.E. 24 Advanced Dynamics
M.E. 62 Fluid Dynamics
Higher level electives:
M.E. 23 Analysis and Synthesis of Machines
M.E. 25 Mechanical Vibrations
M.E. 625 Experimental Mechanics
Suggested electives from other options or departments:
M.E. 22 Design of Machines
Math. 54 Differential Equations of Mathematical Physics
M.E. 56 Heat Transfer II
M.E. 65 Gas Dynamics
M.E. 66 Turbulent Flow I
M.E. 43 Technology of Manufacture I
C.E. 611 Elementary Mechanics of Continua

c. Mechanical and Structural Design Option
Prerequisites:
M.E. 22 Design of Machinery
M.E. 73 Human Factors Engineering
Suggested electives from other options:
M.E. 41 Technology of Manufacture
M.E. 38 Manufacturing Properties of Materials
M.E. 23 Analysis and Synthesis of Machines
M.E. 25 Mechanical Vibrations
M.E. 56 Heat Transfer II
M.E. 62 Fluid Dynamics
E.E. 61 Electro mechanics I
E.E. 62 Electro mechanics II
E.E. 64 Advanced Electro mechanics
C.E. 35 Structural Design
C.E. 609 Advanced Theory of Structures
C.E. 611 Elementary Mechanics of Continua
d. Manufacturing Sciences Option

Electives:
- M.E. 41 Manufacturing Science I
- M.E. 42 Manufacturing Science III
- M.E. 43 Manufacturing Science IV
- M.E. 44 Manufacturing Science V
- M.E. 647 Manufacturing Science VII
- M.E. 49 Metrology
- M.E. 645 Machinery of Manufacture

Suggested electives from other options or departments:
- M.S. 13 Management Science I
- M.S. 14 Management Science II
- M.S. 83 Project Management
- M.E. 73 Human Factors Engineering
- M.E. 631 Fluid Power Control Systems
- Soc. 339 Industrial Sociology
- Math. 55 Digital Computer Programming
- Ch.E. 55 Polymer Chemistry
- Ch.E. 81 Physical Chemistry of Polymers
- M.E. 37 Ceramics
- D. 406 Advanced Design
- M.E. 31 Physical Metallurgy I
- M.F. 32 Physical Metallurgy II

e. Engineering Materials Option

Mechanical Engineering Electives:
- M.E. 31 Physical Metallurgy I
- M.E. 32 Physical Metallurgy II
- M.E. 34 Impurities and Imperfections in Solids
- M.E. 35 Nuclear Engineering
- M.E. 37 Ceramics
- M.F. 38 Materials in Nuclear Technology
- M.E. 641 Theory of Metals
- M.E. 642 Behaviour of Materials
- M.E. 646 Radiation Effects in Engineering Materials

Suggested electives from other options and departments:
- M.E. 41 Technology of Manufacture I
- M.E. 73 Human Factors Engineering
- M.E. 643 Technology of Manufacture II
- C.E. 611 Elementary Mechanics of Continua
- E.E. 55 Solid State Electronics
- Chem. 25 Polymer Chemistry and Physics

Mechanical Engineering

Year II A. Fall 1966 and Winter 1967

- Math. 22
- Math. 23
- E.E. 12
Mechanical Engineering

G.E.  41
M.E.  13
G.E.  42

Year IIB.  Summer 1967 and Fall 1966
  Math.  31
  E.E.  13
  G.E.  31
  G.E.  12
  G.E.  53

Year IIIA.  Winter 1967 and Summer 1967
  G.E.  54
  G.E.  32
  M.E.  21
  C.E.  22
  E.E.  32

Year IIB.  Fall 1966 and Winter 1967
  Math.  41
  M.E.  53
  G.E.  61
  2 Technical electives
  Arts elective

Year IVA.  Fall 1966 and Summer 1967
  Math.  32
  M.E.  81
  M.E.  82
  E.E.  81
  2 Technical electives

Year IVB.  Winter 1967
  M.E.  81
  M.E.  82
  3 Technical electives
  Arts elective

Note: For Graduate Programme in Design see page 67.
      For Graduate Programmes in Management and Systems Engineering,
      page 227).
IV

The Faculty of Science
The Faculty of Science

The University issued its first calendar for the Faculty of Science in 1959, and enrolled its first Science students that autumn. By the autumn of 1965 there were 810 full-time undergraduate and 88 graduate students, and a full-time teaching staff of 60. In each year since its inception the Faculty has introduced new programmes and extended its facilities.

The Department of Chemistry offers a course in Co-operative Applied Chemistry at the honours level leading to the Degree of Bachelor of Science beginning in the Fall of 1966. The curriculum differs from that of Honours Chemistry in that it is designed to relate the fundamental concepts of pure Chemistry to modern technological problems. The first year is common to both Co-operative Applied Physics and Co-operative Applied Chemistry. In years two and three a student is required to take one subject in each of four areas in which limited specialization is permitted in the fourth year. These areas include Analytical Chemistry, Polymer Chemistry, Materials Science, and Biochemistry. Since the course has been designed in large part to prepare the graduate for a career in industry, the curriculum is not intended to permit either transfer to Honours Chemistry beyond the second year or unconditional acceptance for advanced study in pure research upon graduation.

The first year of Applied Chemistry will commence in the autumn of 1966 with the following years being added in sequence; no students can be admitted to advanced years at this time. The admission and promotion requirements are those of the Faculty of Science for honours courses.

There are four teaching departments in the Faculty of Science: Biology, Chemistry, Earth Sciences, and Physics. Extensive instruction is also given by members of the University's Department of Mathematics. Astronomy is taught in the Physics Department; Biochemistry is offered in the Chemistry Department; Botany, Microbiology and Zoology and certain courses embracing these fields together (e.g. Genetics, Cell Biology and Ecology) are taught in the Department of Biology. All the departments except Earth Sciences offer post-graduate courses and research facilities and these are listed in Section VII of this Calendar - Course Descriptions. General regulations governing post-graduate studies are set forth in Section V. The majority of the graduates in Honours courses in Science undertake some post-graduate study.

All Science students are enrolled on a full-time basis. All courses in this Faculty except Co-operative Applied Physics and Co-operative Applied Chemistry are offered in two terms throughout a conventional academic year. The Applied Physics and Applied Chemistry courses are given exclusively on a co-operative basis with alternating terms of academic and industrial work in the same manner as the courses in the Faculty of Engineering (see chart on page 51).

The Dean and department chairmen will be pleased to receive inquiries about the programmes in this Faculty. A student contemplating post-graduate study should direct his correspondence to the chairman of the department in which he proposes to specialize.
Degrees

The degree of Bachelor of Science (B.Sc.) is awarded by the University on the successful completion of any of the academic programmes listed below. The ordinary or pass-level B.Sc. will be awarded on completion of the General Course in either the three or four-year programme. The honours degree, B.Sc. (Honours), will be awarded on completion of any of the honours courses shown under Academic Programmes.

Admission and Registration

General

Application for admission to the Faculty of Science should be made as early in the year as possible, on forms provided by the Office of the Registrar. Academic certificates (not diplomas) and other supporting documents should be forwarded as soon as they become available.

Admission to the faculty cannot be granted until all requirements have been met and all documents submitted.

Admission to Year I

In order to qualify for admission to the first year of the Science programme the applicant must have completed the requirements for the Ontario Secondary School Honour Graduation Diploma (Senior Matriculation), or its equivalent, showing an overall average of 60% in the Grade XIII papers required for admission and with a minimum overall average of 60% in the five papers in Mathematics and Science. A somewhat higher average may be required of applicants who have taken two or more years to complete the work of Grade XIII. Standing is required in the following papers:

- English (Two credits)
- Mathematics (Algebra, Geometry, Trigonometry)
- Science (Chemistry, Physics)
- One additional subject (One or two credits).

Students intending to take an Honours course in Mathematics, Physics, or Chemistry and Physics should have minimum of 66% in the five papers required in Mathematics and Science.

Additional papers can be selected from any of the optional subjects offered at the Grade XIII level with the qualification that no more than one of the following papers may be counted as an “additional” paper: Accountancy Practice, Secretarial Practice, Mathematics of Investment, Art or Music (Departmental Examination). The marks received in one of these papers will be included in the computation of the applicant's average. Standing with the Royal Conservatory of Music in Grade VIII practical and Grade II theory will be considered as one 'additional paper' on the same terms as the above list except the marks received will not be computed in the average.
Note 1. Single combined papers in English and other language subjects are counted as two credits each. All other papers are counted as one credit each, (e.g. Biology, History, Geometry).

Note 2. The University will continue to use the results of Grade XIII final examinations as the major criterion for admission to first year in September 1966. Applicants are encouraged to submit College Entrance Examination Board (S.A.T.) Scores as supplementary data where feasible. Applicants who are unable to submit these test results are assured, however, that their admission will not be jeopardized as a result.

The following certificates, recognized as being equivalent to the Ontario Grade XIII certificate, may be accepted insofar as they meet the admission requirements of the University of Waterloo in subjects and percentages:

Alberta
Senior Matriculation (Grade XII)
British Columbia
Senior Matriculation (Grade XIII)
Manitoba
Senior Matriculation (Grade XII)
New Brunswick
Senior Matriculation (Grade XIII)
Newfoundland
Year I Memorial University
Nova Scotia
Senior Matriculation (Grade XII)
Prince Edward Island
Third Year Certificate from Prince of Wales College
Quebec
McGill Senior Matriculation or Quebec
Senior High School Leaving Certificate
Saskatchewan
Senior Matriculation (Grade XII)
England and Wales, West Indies,
The General Certificate of Education
East and West Africa
with passes in at least five subjects, two
of which must be at the advanced level
in subjects appropriate to the candidate's
intended field of study.
Scotland
The Scottish Leaving Certificate.
United States of America
High School Graduation plus an additional
year of formal study in subjects
comparable to Ontario Grade XIII.

Admission to Advanced Standing
An applicant for admission to advanced standing must submit an official transcript from the University which he has attended, showing in detail the courses he has taken and his standing in each.

Admission as an Adult Student
Any student of mature age who has been away from formal education for more than two years, and who does not possess the minimum requirements for
Admission and Registration

admission, may apply to enter as an adult student. Each application will be considered on its merits by the Admissions Committee. Under certain circumstances, the applicant may be required to write a qualifying examination.

Admission of Students from Other Countries

Students from areas where English is not the common language must provide certified translations of academic certificates. In addition, the applicant may be required to take either "The English Proficiency Tests" prepared by the English Language Institution of the University of Michigan, or the examinations for "The Certificate of Proficiency in English" of the University of Cambridge, in order to satisfy the Admissions Committee that his knowledge of the English language is adequate to pursue his studies successfully. The expenses involved in administering the test must be borne by the applicant.

Re-Admission

The University reserves the right to refuse admission to any candidate, and to refuse re-admission if, in the opinion of competent authority, a student is not profiting from University studies.

Registration

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Programme</th>
</tr>
</thead>
<tbody>
<tr>
<td>September 14</td>
<td>Wednesday</td>
<td>Year I Co-operative Programmes</td>
</tr>
<tr>
<td>September 14</td>
<td>Wednesday</td>
<td>All Years Regular Programmes</td>
</tr>
<tr>
<td>September 16</td>
<td>Friday</td>
<td>Advanced Years Co-operative Programmes</td>
</tr>
</tbody>
</table>

Once the student has completed his registration, he may not change his course, add subjects, or drop subjects, without obtaining permission from the Dean, the instructor, and processing the change, on the proper forms, through the Office of the Registrar. Changes in courses are permitted for a period of three weeks from the date of beginning of lectures.

Fees

All fees for the academic session are due and payable on the day of registration. Credit for scholarships or bursaries will be given only on the authority of the Registrar after presentation of proof of the award.

If for reasons acceptable to the Comptroller, the fees for the year cannot be paid in full on the day of registration, they may be paid in two instalments but an extra charge of $5.00 will then be added to the total fee. The first instalment, to be paid on the day of registration, is a minimum of 60% of the tuition fees plus all incidental fees. The balance must be paid in full on the first day of the second term (or before the eighth week of term for co-operative students).

A charge of $2.00 per month will be made on overdue accounts. Failure to pay an overdue account before conclusion of lectures will bar a student from writing examinations or obtaining credit for previous work.
A student who finds it necessary to withdraw from attendance is required to obtain a withdrawal voucher from the Registrar. This voucher, when signed by both the Dean and the Registrar, may entitle him to a refund of a portion of his fees. No fees will be refunded unless this procedure is followed.

Refunds of tuition fees are made at the discretion of the University.

Incidental fees are not refundable.

The fee schedule shown is one in effect for the 1965-66 year and at the time of printing is still subject to review and possible change for the 1966-67 year. If a fee change is made, a notice will be issued with a new fee schedule; however, the University does not undertake or accept responsibility to so notify all recipients of this calendar. The Board of Governors reserves the right to make changes in the published schedule of fees without notice.

### Sessional Fees

<table>
<thead>
<tr>
<th>Item</th>
<th>Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuition</td>
<td>$510.50</td>
</tr>
<tr>
<td>Incidental</td>
<td>46.00</td>
</tr>
</tbody>
</table>

**Total** $556.50

### Co-operative Programmes in Science

**Fees per term**

<table>
<thead>
<tr>
<th>Year One</th>
<th>Other Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuition</td>
<td>$292.50</td>
</tr>
<tr>
<td>Incidental</td>
<td>24.75</td>
</tr>
</tbody>
</table>

**Total** $317.25 $342.25
Fees

Part-Time Students
Fee per course (limit, 2 courses per session) $100.00

Miscellaneous Fees
Examination—Supplemental, each paper $10.00
Presiding fee (at an outside centre, each half day) 5.00
Photograph (at first registration only) 1.00
Late Registration 10.00
Transcript of record 10.00
Degree and Graduation - Final year only 10.00

Incidental fees include student activities, athletics, health insurance and health services. The Health Insurance Plan does not include the premiums for benefits of the Ontario Hospital Services Commission. Such coverage is the student’s own responsibility.

For Co-operative students in Science the Health Insurance Fee is for eight months’ protection following each registration, and therefore includes students while off campus in their work periods. The fee is adjusted for the second term when a student remains on campus for two consecutive terms.

Residence Fees
Residence fees for both men and women are:

<table>
<thead>
<tr>
<th>Type of Room</th>
<th>Single</th>
<th>Semi private</th>
<th>Double</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per academic year</td>
<td>$800</td>
<td>$760</td>
<td>$700</td>
</tr>
<tr>
<td>Per term</td>
<td>$400</td>
<td>$380</td>
<td>$350</td>
</tr>
</tbody>
</table>

All students may pay residence fees on a term basis; payments are due and payable on or before the day of registration or the first day of each term. This fee does not include the period between the end of the first term and the beginning of the second term. Students occupying residence in this period will be charged an additional $2.00 per day for their room. (Food, if available, will be an extra charge).

Rooms may be occupied for twenty-four hours before registration and after the final examination.

Examinations and Promotions

The Faculty constitutes the examining body for all University examinations. Final examinations for all years are held in April-May, and cover the whole work of each course. Supplemental examinations are held in July. The time normally allowed for each examination is three hours.

In addition to final examinations, each student in Year 1 is required to write mid-year tests. These tests are compulsory, and the results obtained are used in determining standing.
The following regulations govern the practice of the Faculty of Science in regard to standings, promotions, and supplemental examinations.

1. All examination results are considered by the Faculty Committee on Standings and Promotions and subsequently by the Faculty Council. After the results have been considered by these bodies, they will be issued to individual students by the Registrar.

2. Standings in individual subjects will be granted by letter grade as follows:

<table>
<thead>
<tr>
<th>Range of Marks</th>
<th>Letter Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>75 - 100</td>
<td>A</td>
</tr>
<tr>
<td>66 - 74</td>
<td>B</td>
</tr>
<tr>
<td>60 - 65</td>
<td>C</td>
</tr>
<tr>
<td>50 - 59</td>
<td>D</td>
</tr>
<tr>
<td>Below 50, supplemental allowed</td>
<td>S</td>
</tr>
<tr>
<td>Below 50, no supplemental allowed</td>
<td>F</td>
</tr>
</tbody>
</table>

(In this and subsequent sections the term "subject" will apply to individual courses, e.g. Chemistry 131, and the term "course" will apply to groups of subjects, e.g. the Chemistry and Biology Course).

3. Standing in an individual subject is determined by combining the marks assigned for term work with those obtained on written examinations. The ratio in which these marks are combined is at the discretion of the individual departments. To pass in a subject, a candidate must obtain 50% in his examination and a minimum of 50% in the combined term mark and examination mark. A student whose term work is deficient in a subject may, at the discretion of the department concerned and the Dean, be barred from writing the final examination in that subject.

4. Promotion to the next higher year or to graduation will be based on passing the complete year's work: credit will not be granted in individual subjects where a candidate has not passed his year.

5. To pass his year clear in an Honours course, a student must pass in all subjects and obtain an overall average of 60%.

6. To pass his year clear in the General course, a student must pass in all subjects and obtain an overall average of 50% and an average of 60% in the subjects of his major field. By this regulation, promotion may be withheld when a student has passed in all subjects but failed to achieve the required standing in his major subjects.

7. An overall standing in each year will be assigned based on the average of the results of the final examination in the course. This standing will be a class of honours in Honours courses or a letter grade in the General course. It will not be altered by marks obtained in supplemental examinations. Standings for the year will be granted as follows:
Examinations and Promotions

<table>
<thead>
<tr>
<th>Range of Average Mark</th>
<th>Honours Course</th>
<th>General Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>75 - 100</td>
<td>First Class Honours</td>
<td>A</td>
</tr>
<tr>
<td>66 - 74</td>
<td>Second Class Honours</td>
<td>B</td>
</tr>
<tr>
<td>60 - 65</td>
<td>Third Year Honours</td>
<td>C</td>
</tr>
<tr>
<td>50 - 59</td>
<td></td>
<td>D</td>
</tr>
</tbody>
</table>

8. A student who fails more than two subjects at the annual examination fails his year. He is not eligible for supplemental examinations. In cases where the Faculty Council considers that a student will not profit by further study, he will be notified with his examination results that he must withdraw from the Faculty of Science. Other failed students may repeat the year.

9. A student repeating a course must repeat all subjects in class unless exemption has been granted by the Dean and the Faculty Council.

10. Failure to write an examination is considered a failure to pass. A student who defaults a final examination, except for a properly certified reason, has no supplemental examination privileges and must repeat the work in class. If a student fails to write for medical reasons, a doctor’s certificate covering the precise period of absence must be filed in the Office of the Registrar before the end of the examination period.

11. All examinations which receive a failing grade are automatically re-read.

12. To be eligible for supplemental examination a student:
   (a) must have attended lectures in the course in which he proposes to write,
   (b) must not have failed more than two full courses,
   (c) must not have defaulted the final examination except for a properly certified reason.

13. A student who fails to obtain 40% in the final examination may be granted supplemental privileges only at the discretion of the Committee on Standings and Promotions.

14. Supplemental examinations will be held in July. Applications for supplemental examinations must be filed by June 24, on forms provided by the Office of the Registrar. Fees for supplemental examinations must accompany the application. If the student subsequently decides not to write the examination, the fee is not refunded.

15. A student who has failed to obtain a clear pass after the supplemental examinations will have his case reviewed by the Committee on Standings and Promotions. If he has failed a supplemental examination in a non-prerequisite subject, he may be granted a pass standing conditioned in this subject, otherwise he must repeat the year.

16. A student who has been promoted with a condition in a subject from the previous year, must clear that condition before being promoted further. In special cases, and on petition to the Faculty Council, a student may be permitted to substitute another subject for one in which he is conditioned.

17. A student may not write supplemental examinations to raise his standing in subjects already passed, nor will the results of supplemental examinations be considered in arriving at a student’s standing in his course.
Academic Programmes

First Year

(For all students whether Honours or General except Co-operative Applied Physics (see page 89) and Co-operative Applied Chemistry (see page 89.)

<table>
<thead>
<tr>
<th>Subject</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>English 130</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 131</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics 130</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Physics 131</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>or Physics 100</td>
<td>3</td>
<td>3*</td>
</tr>
</tbody>
</table>

One of:

<table>
<thead>
<tr>
<th>Subject</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 131</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Biology 131</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 132</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

One of:

<table>
<thead>
<tr>
<th>Subject</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 131 or 132</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Earth Sciences 130</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics 131</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Mathematics 132</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Psychology 110</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Psychology 150</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

*indicates a laboratory taken in alternate weeks.

In addition to the first four subjects in the above listing which are required of all students, two others must be selected at the time of registration. The choice of these two will be dictated by the field of further study which student intends to pursue. The following table lists the departmental requirements for each major honours programme in the Faculty.

<table>
<thead>
<tr>
<th>Major Field of Study</th>
<th>Required in First Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td>Mathematics 131</td>
</tr>
<tr>
<td>Physics</td>
<td>Mathematics 131</td>
</tr>
<tr>
<td>Physics &amp; Chemistry</td>
<td>Mathematics 131</td>
</tr>
<tr>
<td>Chemistry</td>
<td>Mathematics 131</td>
</tr>
<tr>
<td>Chemistry &amp; Biology</td>
<td>Mathematics 131, Biology 131</td>
</tr>
<tr>
<td>Biology</td>
<td>Biology 131</td>
</tr>
<tr>
<td>Biology &amp; Psychology</td>
<td>Biology 131, Psychology 150</td>
</tr>
<tr>
<td>Earth Sciences</td>
<td>Earth Sciences 130 and Biology 131</td>
</tr>
</tbody>
</table>

Note 1. The Ontario Department of Education has strongly recommended that all students who are preparing to teach science in high school should take at least one year of Biology.
Note 2. Earth Science 130 is a recommended subject for students in the second year of the General Course with a major in Biology.

Note 3. For those students who plan to take the Honours programme in Biology and Psychology, Psychology 150 is required rather than Psychology 110.

Note 4. Earth Sciences 130 and Biology 131 should be selected by those planning to major in Earth Sciences. Another Science or Mathematics subject may be chosen in place of Biology 131 by students who have achieved a good standing in post-1964 Grade XIII Biology or equivalent.

Note 5. Physics 100 is the first part of a two-year terminal Physics course designed for students whose major department after Year I will be Biology or Earth Sciences.

In the second and higher years the student will select a major field of study from one of the following departments: Biology, Chemistry, Earth Sciences, Mathematics or Physics. He must have attained C Standing in this field in his first year before he may choose it for major study. He must attain C Standing in this field in subsequent years for promotion, and in the final year for graduation.

First Year Co-operative Programmes
(For students planning to choose either Co-operative Applied Chemistry or Co-operative Applied Physics.)

<table>
<thead>
<tr>
<th>Year 1A</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 101</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics 131</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics 130</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics 131</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics 132</td>
<td></td>
<td></td>
</tr>
<tr>
<td>English 15</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>General Chemistry</td>
<td>3 3</td>
</tr>
<tr>
<td></td>
<td>Mechanics, Wave Motion &amp; Heat</td>
<td>3 3</td>
</tr>
<tr>
<td></td>
<td>Calculus</td>
<td>3 0</td>
</tr>
<tr>
<td></td>
<td>Algebra and Solid Geometry</td>
<td>2 1</td>
</tr>
<tr>
<td></td>
<td>Numerical Procedures</td>
<td>1 2</td>
</tr>
<tr>
<td></td>
<td>English Literature</td>
<td>3 0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 1B</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 101</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics 131</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics 130</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics 131</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics 132</td>
<td></td>
<td></td>
</tr>
<tr>
<td>English 15</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>General Chemistry</td>
<td>3 3</td>
</tr>
<tr>
<td></td>
<td>Mechanics, Wave Motion &amp; Heat</td>
<td>3 3</td>
</tr>
<tr>
<td></td>
<td>Calculus</td>
<td>3 0</td>
</tr>
<tr>
<td></td>
<td>Algebra and Solid Geometry</td>
<td>2 1</td>
</tr>
<tr>
<td></td>
<td>Numerical Procedures</td>
<td>1 2</td>
</tr>
<tr>
<td></td>
<td>English Literature</td>
<td>3 0</td>
</tr>
</tbody>
</table>

General Courses

The General Course is available in a four-year programme in certain departments as well as in a three-year programme in all departments. Graduates of the four-year programme who have taken appropriate options will be eligible for certain categories of industrial and government employment for which the three-year programme will not fit them; likewise they can meet the subject requirements for admission to Type-A courses at Ontario College of Education.
with specialization in a single subject. Where the four-year programme is available, a student may graduate with the General B.Sc. after either three or four years; the graduation diploma will indicate whether the three or four-year course has been completed. A student who has graduated from the three-year course may apply to register for the four-year course; upon successful completion of the latter, a new graduation diploma will be issued in exchange for the original, but the student will not graduate a second time.

Graduates of the three-year course who have taken the required subjects are qualified to apply for admission to medical schools in Ontario. Students who have passed the first year of the course with appropriate choice of subjects are qualified to apply for admission to a dental school. Graduates are also eligible for admission to the Type B course at Ontario College of Education or for various industrial positions such as senior laboratory technicians, technical sales representatives, and so forth.

The curriculum after Year I is arranged as follows:

### Three Year Course

<table>
<thead>
<tr>
<th>Year</th>
<th>Major Field</th>
<th>Minor Fields</th>
<th>Arts Elective</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>2 subjects</td>
<td>2 subjects</td>
<td>1 subject</td>
<td>5 subjects</td>
</tr>
<tr>
<td>III</td>
<td>2 subjects</td>
<td>2 subjects</td>
<td>1 subject</td>
<td>5 subjects</td>
</tr>
</tbody>
</table>

### Four Year Course

<table>
<thead>
<tr>
<th>Year</th>
<th>Major Field</th>
<th>Minor Fields</th>
<th>Arts Elective</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>2 subjects</td>
<td>2 subjects</td>
<td>1 subject</td>
<td>5 subjects</td>
</tr>
<tr>
<td>III</td>
<td>2 or 3</td>
<td>1 or 2</td>
<td>1 subject</td>
<td>5 subjects</td>
</tr>
<tr>
<td>IV</td>
<td>2 or 3</td>
<td>1 or 2</td>
<td>1 subject</td>
<td>5 subjects</td>
</tr>
</tbody>
</table>

*Where two minor fields are required or selected they must be in different departments. Minor fields must be subjects for which the student is qualified, offered by a majoring department in the Science Faculty.*

The selection of subjects in upper years will be restricted partly by limitations imposed by the timetable, and partly by the necessity in many subjects of having completed prerequisites. Each student's programme must therefore be approved by the Chairman of the Department of his major field.

The following programmes are those recommended by the department for major study in their fields. The university will make every effort to ensure that the timetable accommodates these programmes. Other combinations of subjects may be taken provided they fit the student's timetable and are approved by his departmental chairman.

### Extra Subjects

The following regulations apply to both General and Honours programmes. An extra subject may be taken, but it must be in addition to the programme specified by the calendar or by the departmental chairman. It must be designated as an extra on the Registration Form (e.g. Chem. 337x). If dropped during the first term it will not appear on the student's record; if dropped in
General Courses

the second term, but before the final examinations, it will appear on the
transcript as "Incomplete." The mark in the extra subject will not be averaged
with those from the required courses for overall standing.

There will not be supplemental privileges with extra subjects.

Biology Major

Year I
Including Biology 131 or 132

Year II
Two of: Biology 233, 234, 235
Chemistry 236
Physics 200
Arts Elective

Three-year course

Year III
Two of: Biology 333, 334, 335, 337
Chemistry 337
Earth Sciences 130
Arts or Science Elective

Four-year course

Year III
Two of: Biology 333, 334, 335, 337
Chemistry 337
Earth Sciences 130
Arts or Science Elective

Year IV
Three Biology courses acceptable to Biology Department
Chemistry 437
Arts or Science Elective

Chemistry Major

Year I
Including Mathematics 131

Year II
Chemistry 236, 242
One of: Mathematics 236 (required
for four-year course),
Physics 237
One of: Physics 242, Biology 233, 234,
235†
Arts Elective
Three-year course

Year III
Chemistry 325  
One of: Chemistry 241, 337  
One of: Physics 235, Biology 231  
One of: Mathematics 233, Earth Science 130  
Arts Elective

Four-year course

Year III
Chemistry 241, 325  
Physics 235, or 242 (if not taken previously)  
One of: Biology 231  
Mathematics 233  
Chemistry 336 or 337  
Arts Elective

*Chemistry 336 must be taken in Year III or Year IV.
*Biology 235 preferred. Biology 233, 234 may be taken if timetable permits.

Earth Sciences Major

Year I
Including Earth Science 130 and Biology 131†  
† Another course from the option list may be selected by students who have achieved a good standing in post-1964 Grade XIII Biology or equivalent.

Year II
Two of: Earth Sciences 230, 235, (232 and 238)  
Two of: Chemistry 242, Physics 200, Biology 231, Mathematics 243  
One of: Sociology 100, Psychology 110, Economics 100.

Three-year course

Year III
Two of: Earth Sciences 330, 335, 337, 340  
Two of: Chemistry 241, Biology 234, Physics 237  
One of: History 100, Political Science 100, Philosophy 100.

Four-year course

Year III
Two or three of: Earth Sciences 330, 335, 337, 340  
One or two of: Chemistry 241, Biology 234, Physics 237  
One of: History 100, Political Science 100, Philosophy 100.

Year IV
Two or three of: Earth Sciences 338, 430, 431, 439, 440.  
One or two of: Biology 233, 333, a Science option not previously elected.  
One Arts elective not previously elected.
General Courses

Mathematics Major

Year I
Including Mathematics 131

Year II
Mathematics 236
One of: Mathematics 132, 230, 233, 235, 330
One of: Physics 235, 237, 242
One of: Biology 131, Chemistry 231, Earth Science 130
Arts Elective

Physics Major

Year I
Including Mathematics 131

Year II
Physics 235, 242
One of: Mathematics 132, 236, 237
One of: Chemistry 231
Arts Elective

Three-year course

Year III
Physics 339
One of: Physics 237, 332, 338
One of: Mathematics 230, 233
One of: Chemistry 231, 325
Arts Elective

Four-year course

Year III
Physics 339 or 334
One or two of: Physics 237, 332, 335, 338
One or two of: Mathematics 230 or 233; Chemistry 231 or 325
Arts Elective

Year IV
Two or three of: Physics 237, 331, 332, 335, 336, 338, 439, or 434 (if 334 was taken in Year III)
One or two of: Science options not previously elected, or other courses in Mathematics, Chemistry, or Biology acceptable to the Physics Department
Arts Elective

Honours Courses

The normal route to attain professional standing in science is to take an Honours course in the appropriate field or combination of fields. The Honours courses are of four years' duration; they are rather specialized in content, and
the syllabus in each is rather rigidly prescribed. Those graduating with at least second-class honours standing are granted preferred treatment for postgraduate study in Canadian Universities. Graduates of certain Honours courses are eligible for admission to Type A (specialist) courses for prospective high school teachers at the Ontario College of Education.

*The following Honours programmes are available.*

**Honours Biology**

*(For Year I, see page 88)*

<table>
<thead>
<tr>
<th>Year II</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 233</td>
<td>Vertebrate Zoology</td>
<td>2</td>
</tr>
<tr>
<td>Biology 234</td>
<td>Comparative Plant Morphology</td>
<td>2</td>
</tr>
<tr>
<td>Biology 235</td>
<td>Fundamentals of Microbiology</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 236</td>
<td>Organic Chemistry I</td>
<td>2</td>
</tr>
<tr>
<td>Physics 200</td>
<td>General Physics II</td>
<td>3</td>
</tr>
<tr>
<td>Arts or Science Elective</td>
<td></td>
<td>as specified</td>
</tr>
</tbody>
</table>

**Year III**

| Biology 333 | Invertebrate Zoology | 2 | 3 |
| Biology 334 | Taxonomy and Evolution | 2 | 3 |
| Biology 335 | Microbiology I | 2 | 3 |
| Biology 337 | General Physiology | 2 | 3 |
| Chemistry 337 | Biochemistry I | 2 | 3 |
| Arts or Science Elective | | as specified |

**Year IV**

Either

five of the courses offered in Biology at the 400 level

Or

four of the courses offered in Biology at the 400 level plus one Science elective.

**Honours Biology and Chemistry**

*(For Year I, see page 88)*

<table>
<thead>
<tr>
<th>Year II</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 231</td>
<td>Chemical Bonding and Structure</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 232</td>
<td>Analytical Chemistry</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 236</td>
<td>Organic Chemistry I</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 236</td>
<td>Differential Equations</td>
<td>2</td>
</tr>
</tbody>
</table>

Two of:

| Biology 233 | Vertebrate Zoology | 2 | 3 |
| Biology 234 | Comparative Plant Morphology | 2 | 3 |
| Biology 235 | General Microbiology | 2 | 3 |
### Honours Biology and Chemistry

<table>
<thead>
<tr>
<th>Year III</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 325</td>
<td>General Physical Chemistry</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 336</td>
<td>Organic Chemistry II</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 337</td>
<td>Biochemistry I</td>
<td>2</td>
</tr>
<tr>
<td>Physics 242</td>
<td>Electricity and Magnetism</td>
<td>2</td>
</tr>
<tr>
<td><strong>Two of:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biology 333</td>
<td>Invertebrate Zoology</td>
<td>2</td>
</tr>
<tr>
<td>Biology 334</td>
<td>Taxonomy and Evolution</td>
<td>2</td>
</tr>
<tr>
<td>Biology 335</td>
<td>Microbiology I</td>
<td>2</td>
</tr>
<tr>
<td>Biology 337</td>
<td>General Physiology</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year IV</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 331</td>
<td>Inorganic Chemistry I</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 437</td>
<td>Biochemistry II</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 233</td>
<td>Probability and Statistics</td>
<td>2</td>
</tr>
<tr>
<td><strong>Three of:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any 400-level courses offered in Biology</td>
<td>as specified</td>
<td></td>
</tr>
</tbody>
</table>

### Honours Biology and Psychology

*(For Year I, see page 88)*

<table>
<thead>
<tr>
<th>Year II</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 231</td>
<td>Genetics and Evolution</td>
<td>3</td>
</tr>
<tr>
<td>Biology 233</td>
<td>Vertebrate Zoology</td>
<td>2</td>
</tr>
<tr>
<td>Psychology 251</td>
<td>Comparative Psychology (half course)</td>
<td>2</td>
</tr>
<tr>
<td>Psychology 252</td>
<td>Physiological Psychology (half course)</td>
<td>2</td>
</tr>
<tr>
<td>Psychology 360</td>
<td>Sensation and Perception</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 236</td>
<td>Organic Chemistry I</td>
<td>2</td>
</tr>
<tr>
<td>German or Russian</td>
<td>A course at an appropriate level</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year III</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 333</td>
<td>Invertebrate Zoology</td>
<td>2</td>
</tr>
<tr>
<td>Biology 337</td>
<td>General Physiology</td>
<td>2</td>
</tr>
<tr>
<td>Psychology 370</td>
<td>Animal Learning</td>
<td>2</td>
</tr>
<tr>
<td>Psychology 380</td>
<td>Advanced Physiological Psychology</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 233</td>
<td>Probability and Statistics</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 337</td>
<td>Biochemistry I</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year IV</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 431</td>
<td>Ecology</td>
<td>2</td>
</tr>
<tr>
<td>Biology 434</td>
<td>Genetics</td>
<td>2</td>
</tr>
<tr>
<td>Biology 436</td>
<td>Neurophysiology</td>
<td>2</td>
</tr>
<tr>
<td>Psychology 449</td>
<td>Senior Honours Essay</td>
<td>5</td>
</tr>
<tr>
<td><strong>or</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biology 499</td>
<td>Senior Honours Project</td>
<td>as required</td>
</tr>
<tr>
<td>Psychology 430</td>
<td>Problems in Contemporary Psychology</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 449</td>
<td>Experimental Design</td>
<td>2</td>
</tr>
<tr>
<td><strong>or</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 437</td>
<td>Biochemistry</td>
<td>2</td>
</tr>
</tbody>
</table>
## Honours Chemistry

*(For Year I, see page 88)*

<table>
<thead>
<tr>
<th>Year II</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 231</td>
<td>Chemical Bonding and Structure</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 232</td>
<td>Analytical Chemistry</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 235</td>
<td>Physical Chemistry I</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 236</td>
<td>Organic Chemistry I</td>
<td>2</td>
</tr>
<tr>
<td>Physics 242</td>
<td>Electricity and Magnetism</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 236</td>
<td>Differential Equations</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year III</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 331</td>
<td>Inorganic Chemistry I</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 335</td>
<td>Physical Chemistry II</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 336</td>
<td>Organic Chemistry II</td>
<td>2</td>
</tr>
<tr>
<td>Physics 235</td>
<td>Optics</td>
<td>2</td>
</tr>
</tbody>
</table>

*One of:*

| Physics 332 | Electronics | 2 | 3* |
| Chemistry 337 | Biochemistry I | 2 | 0 |
| Mathematics 233 | Probability and Statistics | 2 | 1 |

<table>
<thead>
<tr>
<th>Year IV</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 431</td>
<td>Inorganic Chemistry II</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 435</td>
<td>Physical Chemistry III</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 436</td>
<td>Organic Chemistry III</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 439</td>
<td>Advanced Laboratory</td>
<td>0</td>
</tr>
<tr>
<td>Arts Elective</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Honours Chemistry

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 337</td>
<td>Biochemistry I</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 440</td>
<td>Polymer Chemistry</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Physics 332</td>
<td>If not chosen above</td>
<td>2</td>
<td>3*</td>
</tr>
<tr>
<td>Mathematics 233</td>
<td>If not chosen above</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Mathematics 450</td>
<td>Applied Analysis</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 437</td>
<td>Biochemistry II</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

* indicates a laboratory taken in alternate weeks

### Co-operative Applied Chemistry (Honours)

*(For Year I, see page 89)*

#### Year IIA

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 202</td>
<td>Analytical Chemistry</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Chemistry 206</td>
<td>Introductory Organic Chemistry</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics 236A</td>
<td>Differential Equations</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Physics 243</td>
<td>Electricity and Magnetism</td>
<td>3</td>
<td>3*</td>
</tr>
<tr>
<td>Chemistry 209</td>
<td>Technical Literature</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

#### Year IIB

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 200</td>
<td>Radiochemistry</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 201</td>
<td>Introductory Inorganic Chemistry</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 205</td>
<td>Introductory Physical Chemistry</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics 51</td>
<td>Probability &amp; Statistics</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Physics 236</td>
<td>Physical Optics</td>
<td>3</td>
<td>3*</td>
</tr>
</tbody>
</table>

#### Year IIIA

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 301</td>
<td>Applied Inorganic Chemistry</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 306</td>
<td>Applied Organic Chemistry</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 308</td>
<td>Instrumental Measurements I</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Physics 341A</td>
<td>Electronics</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Arts Elective</td>
<td></td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Year IIIB

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 303</td>
<td>Introductory Polymer Chemistry</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 305</td>
<td>Applied Physical Chemistry</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 307</td>
<td>Introductory Biochemistry</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 318</td>
<td>Instrumental Measurements II</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Arts Elective</td>
<td></td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Year IVA

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 400</td>
<td>Electrochemistry and Corrosion</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 402</td>
<td>Modern Organic Analysis</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics 55</td>
<td>Digital Computer Programming</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Arts Elective</td>
<td></td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>
Honours Chemistry and Physics

(For Year I, see page 88)

Year II
Chemistry 231  Chemical Bonding and Structure  2  0
Chemistry 232  Analytical Chemistry  2  6
Chemistry 235  Physical Chemistry I  2  1
Mathematics 237  Differential and Integral Calculus  3  0
Mathematics 238  Principles of Computer Science  2  0
Physics 232  Electricity and Magnetism  2  3°
Physics 235  Optics  2  3°

Year III
Chemistry 236  Organic Chemistry I  2  3
Chemistry 335  Physical Chemistry II  2  6
Mathematics 233  Probability and Statistics  2  1
Physics 331  Classical Mechanics I  3  0
Physics 334  Atomic and Nuclear Physics I  3  0
Physics 336  Physical Mathematics I  2  0
one Arts Elective
as specified

Year IV
Chemistry 331  Inorganic Chemistry I  2  0
Chemistry 336  Organic Chemistry II  2  3
Physics 332  Electronics  2  0
Physics 333  Intermediate Laboratory  0  6
Physics 434  Atomic and Nuclear Physics II  2  0
Honours Chemistry and Physics

**Option A (Chemistry)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 435</td>
<td>Physical Chemistry III</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 439</td>
<td>Advanced Laboratory</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

One of:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 337</td>
<td>Biochemistry I</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 440</td>
<td>Polymer Chemistry</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>One Arts Elective</td>
<td></td>
<td>as specified</td>
<td></td>
</tr>
</tbody>
</table>

**Option B (Physics)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 435</td>
<td>Solid State Physics</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>One Arts or Science Elective</td>
<td></td>
<td>as specified</td>
<td></td>
</tr>
</tbody>
</table>

* Indicates a laboratory taken in alternate weeks.

Honours Mathematics

(With Science Minor)

The course shown below is the Mathematics and Physics programme. Analogous courses are permitted in which Chemistry or Biology is the minor subject.

*(For Year I, see page 88)*

**Year II**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 230</td>
<td>Algebra I</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 231†</td>
<td>Differential Calculus</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 232†</td>
<td>Integral Calculus</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 233</td>
<td>Probability and Statistics</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Physics 232</td>
<td>Electricity and Magnetism</td>
<td>2</td>
<td>3*</td>
</tr>
<tr>
<td>Physics 235</td>
<td>Optics</td>
<td>2</td>
<td>3*</td>
</tr>
</tbody>
</table>

One of:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 234</td>
<td>Mechanics</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 235</td>
<td>Actuarial Mathematics</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>One other Arts or Science Course</td>
<td></td>
<td>as specified</td>
<td></td>
</tr>
</tbody>
</table>

† Two of Mathematics 236, 237, 238 may be chosen instead of Mathematics 231, 232.

**Year III (Pure Mathematics Option)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 330</td>
<td>Euclidean and Projective Geometry</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 331</td>
<td>Algebra II</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 332</td>
<td>Theory of Functions</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 333</td>
<td>Differential Equations</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

One or two Additional Mathematics Courses as specified

One Science Elective as specified

One Non-Science Elective as specified
### (Statistics Option)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 331</td>
<td>Algebra II</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 332</td>
<td>Theory of Functions</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 335</td>
<td>Finite Differences</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 338</td>
<td>Mathematical Statistics</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

**Two of:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 330</td>
<td>Euclidean and Projective Geometry</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 333</td>
<td>Differential Equations</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 334</td>
<td>Numerical Methods</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>One Science Elective</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One Arts Elective</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### (Applied Mathematics Option)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 331</td>
<td>Algebra II</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 332</td>
<td>Theory of Functions</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 333</td>
<td>Differential Equations</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 334</td>
<td>Numerical Methods</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 337</td>
<td>Advanced Mechanics</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 339</td>
<td>Electromagnetism I</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>One Science Elective</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One Non-Science Elective</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Indicates a laboratory taken in alternate weeks.*

### (Teaching Option)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 330</td>
<td>Euclidean and Projective Geometry</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 331</td>
<td>Algebra II</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 332</td>
<td>Theory of Functions</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 334</td>
<td>Numerical Methods</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>One additional Mathematics Course</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One Science Elective</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One Non-Science Elective</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Year IV (Pure Mathematics Option)

*Three or four of:*

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 426</td>
<td>Point Set Topology</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 430</td>
<td>Finite Projective Geometries</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 431</td>
<td>Algebra III</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 432</td>
<td>Functions of a Complex Variable</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 433</td>
<td>Theory of Integration</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 434</td>
<td>Differential Equations of</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Mathematics 448</td>
<td>Mathematical Physics</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

*Two or three Additional Mathematics Courses* |  as specified |
| One Science Elective |  as specified |
| One Non-Science Elective |  as specified |
### Honours Mathematics

#### (Statistics Option)

<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 435 Laboratory</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics 438 Estimation and Hypothesis Testing</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 439 Theory of Experimental Design</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

**Two or Three Courses from:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 430 Finite Projective Geometries</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 433 Theory of Integration</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 440 Advanced Probability</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 446 History of Mathematics</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 447 Statistical Mechanics</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

One Science Elective
One Non-Science Elective

#### (Applied Mathematics Option)

<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 432 Functions of a Complex Variable</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 434 Differential Equations of Mathematical Physics</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

**Three or Four Courses from:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 441 Quantum Theory</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 442 Theory of Relativity</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 443 Electromagnetism II</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 444 Elasticity</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 445 Hydrodynamics</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 446 History of Mathematics</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 447 Statistical Mechanics</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

One Science Elective
One Non-Science Elective

#### (Teaching Option)

<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 446 History of Mathematics</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Four additional Mathematics courses numbered above 200

One Science Elective
One Non-Science Elective

Elective courses both in and outside Mathematics should not be selected by the student before consultation with the Chairman of the Department of Mathematics.

**Science electives for the third or fourth years:** Biology 131 or 231, Earth Science 130, Physics 338 or 339, or any Mathematics subject not previously taken.

**Non-science electives for the third and fourth years:** English 230, or 235, German 1-50, History 200, Psychology 110, Russian 1-50, Science 400.

Other electives may be chosen subject to the restrictions of the student's timetable and the consent of the departmental chairman.
Note 1: Students completing this course may qualify for the High School Assistant’s Certificate, Type “A”, in Mathematics.

Note 2: Students wishing to qualify for High School Assistant’s Certificate, Type “A”, in Mathematics and Physics must choose courses in Physics for their Science electives in Years III and IV.

Honours Physics

(Mathematics and Physics programme)

(For Year I, see page 88)

<table>
<thead>
<tr>
<th>Year II</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 230</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Algebra I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics 237</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Differential and Integral Calculus</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 238</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Principles of Computer Science</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 233</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Probability and Statistics</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Physics 232</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity and Magnetism</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Physics 235</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optics</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Physics 237</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Astronomy I</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year III</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 331</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classical Mechanics I</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Physics 332</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electronics</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Physics 333</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermediate Laboratory</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Physics 334</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atomic and Nuclear Physics I</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Physics 335</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermodynamics, Kinetic Theory of Gases, Statistical Mechanics</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>one Arts or Science Elective</td>
<td>as specified</td>
<td></td>
</tr>
<tr>
<td>plus Option A†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics 336</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Mathematics I</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>or Option B†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science Elective</td>
<td>as specified</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year IV</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 433</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advanced Laboratory</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Physics 434</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atomic and Nuclear Physics II</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Physics 435</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solid State Physics (half course)</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Physics 441</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electromagnetic Theory</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>plus Option A†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics 431</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classical Mechanics II</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Physics 436</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Mathematics II</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

Two of:

| Physics 432              |          |       |
| Physics of Solid State Devices (half course) | 3 | 0 |
| Physics 437              |          |       |
| Topics in Theoretical Physics (half course) | 3 | 0 |
Honours Physics

Lectures Labs.

Mathematics A suitable course as specified
Science A suitable course as specified
Arts A suitable course as specified

or Option B†

Physics 336 Physical Mathematics I 2 0
Science 400 History and Philosophy of Science 2 0
Chemistry A suitable course as specified
Arts or Science Elective as specified

† Either option provides a suitable terminal Honours course in Physics, but Option A is recommended for those intending to do graduate work and Option B for those preparing to teach in high schools.

The choice of electives must be made to fit the student’s timetable and must be approved by the Chairman of the Department of Physics. The following are recommended subjects for this purpose.

Science electives for the third or fourth year: Chemistry 236 or 325; Earth Science 130; Mathematics 330, 338, or 440; Physics 337, 338, 416, 438; Science 400.

Non-science electives for the third or fourth year: English 235; German 1-50; History 200; Philosophy 100; Russian 1-50.

Co-operative Applied Physics

(Honours)

(For Year I, see page 89)

Year IIA

Physics 232 Electricity and Magnetism 2 0
Physics 235 Optics 2 0
Physics 233 Laboratory 0 6
Mathematics 236 Differential Equations 2 0
Mathematics 237 Differential and Integral Calculus 3 0
Mathematics 51 Probability and Statistics 2 3
One Elective † 3 0

Year IIB

Physics 232 Electricity and Magnetism 2 0
Physics 235 Optics 2 0
Physics 245 Structure of Solids 3 0
Physics 233 Laboratory 0 6
Mathematics 236 Differential Equations 2 0
Mathematics 237 Differential and Integral Calculus 3 0
Physics 341A Electronics I 3 3

103
### Year IIIA

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 331</td>
<td>Classical Mechanics I</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Physics 335</td>
<td>Thermodynamics and Statistical Mechanics</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Physics 340</td>
<td>Quantum Physics I</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Physics 333</td>
<td>Laboratory</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Physics 336</td>
<td>Physical Mathematics I</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Physics 341B</td>
<td>Electronics II</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>One Elective</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Year IIIB

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 334</td>
<td>Nuclear Physics</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Physics 331</td>
<td>Classical Mechanics I</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Physics 335</td>
<td>Thermodynamics and Statistical Mechanics</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Physics 333</td>
<td>Laboratory</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Physics 336</td>
<td>Physical Mathematics I</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>One Elective</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Year IVA

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 435</td>
<td>Solid State Physics</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Physics 441</td>
<td>Electromagnetic Theory</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Physics 433</td>
<td>Senior Laboratory</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Mathematics 334</td>
<td>Numerical Analysis</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Physics 436</td>
<td>Physical Mathematics II</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>One Elective</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### One of:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 442</td>
<td>Metal Physics</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Electrical Eng. 83</td>
<td>Information Theory</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

### Year IVB

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 440</td>
<td>Quantum Physics II</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Physics 441</td>
<td>Electromagnetic Theory</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Physics 433</td>
<td>Senior Laboratory</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Mathematics 334</td>
<td>Numerical Analysis</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Physics 436</td>
<td>Physical Mathematics II</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>One Elective</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### One of:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 432</td>
<td>Device Physics</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Physics 443</td>
<td>Hydrodynamics</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Physics 437</td>
<td>Topics in Theoretical Physics</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

† At least two electives must be humanities or social sciences
The Faculty of Graduate Studies
Degrees

Courses leading to the degree of Master of Arts (M.A.) are offered by the departments of French, Geography, German, History, Mathematics, Russian, Philosophy and Psychology.

Courses leading to the degree of Master of Science (M.Sc.) are offered by the departments of Biology, Chemistry, Mathematics, and Physics.

Courses leading to the degree of Master of Applied Science (M.A.Sc.) are offered by the departments of Chemical Engineering, Civil Engineering, Electrical Engineering, Mechanical Engineering, and Design; and by the Faculty of Engineering in Management and Systems Engineering.

Courses leading to the degree of Master of Philosophy (M.Phil) are at present offered by the following Arts departments: German, History, Mathematics, and Philosophy. The Master of Philosophy degree (M.Phil.) is offered only by the Arts Faculty.

Graduate courses in Applied Psychology are offered by the Psychology Department.

Courses leading to the degree of Doctor of Philosophy (Ph.D.) are offered by the departments of Biology, Chemical Engineering, Chemistry, Civil Engineering, Electrical Engineering, German, Mathematics, Mechanical Engineering, Philosophy, Physics, Psychology, and Russian.
Degrees

Other departments are planning to offer graduate programmes in the near future. Detailed information concerning specific courses may be obtained from the Dean of the Faculty.

Co-operative Graduate Programme in Engineering — see page 49

Requirements for the Master's Degree

Each candidate for the Master's Degree shall have his programme approved by the Committee on Programmes for the Master's Degree.

Four full courses, acceptable for graduate credit, or two such courses and a thesis, are required for the Master's Degree. The subject of the thesis research must be approved by the head of the department concerned. Four copies of the candidate's thesis shall be submitted to the Dean of Graduate Studies to be read and judged by at least two members of the University Faculty.

In the case of a student proceeding to the Master's Degree without writing a thesis, it is recommended that one of the four courses of graduate work be obtained outside his own special field of study and preferably outside his own department. These are minimal requirements and any additional departmental regulations are specifically listed along with the course offerings of the department concerned. Students must obtain an average of at least 66% in the set of courses which they present in fulfillment of course requirements for the degree.

The minimum time of registration for the Master's Degree is one academic year from an honours Bachelor's Degree or equivalent. If a candidate is employed in other work that requires more than approximately fifteen hours per week, he will not be able to complete the requirements in the minimum time. The requirements for the degree must be completed within a total period of four consecutive academic years.

In exceptional circumstances, extensions may be made beyond the maximum time allowance upon petition to the Graduate Council at least four months prior to the normal date for completion of degree requirements.

Requirements for the Master of Philosophy Degree

The Master of Philosophy degree is especially designed as a scholarly degree intermediate between the M.A. and Ph.D. degrees.

The normal pattern in proceeding to the M.Phil. Degree is B.A., M.Phil., whereas to the Ph.D. degree it is B.A., M.A., Ph.D. The candidate must have an adequate knowledge of at least one language other than English as specified by his department. Seven full courses, acceptable for graduate credit, plus an M.Phil. thesis are required for the M.Phil. degree. Candidates entering after a Master's Degree will have their Master's courses subtracted from this total. Students must obtain an average of at least 66% in the set of courses which they present in fulfillment of course requirements for the degree.

Each candidate shall have his programme of study approved by a committee and will be responsible to a thesis supervisor who shall be appointed from the Faculty of Graduate Studies.
The candidate shall present a thesis embodying the results of study conducted by himself on an approved topic. If, however, the candidate has written a Master's thesis of sufficiently high calibre, the department may permit him to satisfy the degree requirements for the M.Phil. without writing a thesis.

Four copies of the candidate's thesis shall be submitted to the Dean of Graduate Studies to be read and judged by two members of the University Faculty. The candidate shall defend his thesis in an oral examination before a Committee appointed by the Faculty of Graduate Studies.

The minimum period of registration for the M.Phil. degree is two academic years from an Honour Bachelor's Degree or its equivalent or one year from a Master's degree or its equivalent. If a candidate is employed in other work which requires more than approximately fifteen hours per week, he will not be allowed to complete the requirements in the minimum time. A candidate who does not complete the requirements in the minimum time must pass a comprehensive examination, as determined by his department, in order to be eligible for the degree. The requirements for the degree must be completed within a total period of six consecutive academic years from the Honours degree level. In exceptional circumstances, extensions may be made beyond the maximum time allowance upon petition to the Graduate Council at least four months prior to the normal date for completion of degree requirements.

A student may transfer from the M.Phil. programme to the Ph.D. programme in the same field, in exceptional circumstances, by petitioning to the Graduate Faculty Council through his department. If the petition should be granted, the Council will specify the requirements which he must fulfill in order to receive the Ph.D. degree.

A student who has become a candidate for the Ph.D. degree and wishes to transfer to the M.Phil. programme in the same field of study must petition the Graduate Council through his department for permission to make this change in his programme. If the petition should be granted, the Graduate Council will specify the requirements which he must fulfill in order to receive the M.Phil. degree. A student who has not passed the Ph.D. comprehensive exams must pass the M.Phil. comprehensive before he can become eligible to receive the M.Phil. degree.

Admission

In addition to fulfilling the general requirements of the Faculty of Graduate Studies, an applicant for the M.Phil. programme must possess either an Honour Bachelor's degree or the equivalent, or a Master's degree or its equivalent.

Requirements for the Ph.D. Degree

The candidate should have an adequate knowledge of at least one language other than English, as specified by the department with which he is enrolled. However, with the permission of his department and the concurrence of the Dean of Graduate Studies, a candidate may substitute for the foreign language requirements an approved full year course in a department other than his major one.
The candidate shall sit for comprehensive examinations, as determined by the department in which he is enrolled. The amount of course work which the candidate shall take will be determined by the department, but will normally not be more than four courses beyond the Master's level. Students must obtain an average of at least 66% in the set of courses which they present in fulfillment of course requirements for the degree.

Each candidate shall have his programme of study approved by a Committee, and will be responsible to a thesis supervisor who shall be appointed from the Faculty of Graduate Studies.

The candidate shall present a thesis embodying the results of original research conducted by himself on an approved topic. Four copies of the candidate's thesis shall be submitted to the Dean of Graduate Studies to be read and judged by two members of the University Faculty and an outside examiner, who will be appointed by the Dean of Graduate Studies.

The candidate shall defend his thesis in an oral examination before a Committee appointed by the Faculty of Graduate Studies.

The minimum period of registration for the Doctor's Degree is three academic years from an Honours Bachelor's Degree, or, alternatively, two academic years from a Master's Degree or equivalent. If a candidate is employed in other work that requires more than approximately fifteen hours per week, he will not be allowed to complete the requirements in the minimum time. The requirements for the degree must be completed within a total period of six consecutive academic years from the Bachelor's level or five consecutive academic years from the Master's level. At the discretion of the individual department, the maximum time limit may be extended to five consecutive academic years from completion of the minimum residence requirements. Ph.D. candidates must remain enrolled in the University until the acceptance of the thesis.

In exceptional circumstances, extension may be made beyond the maximum time allowance upon petition to the Graduate Council at least four months prior to the normal date for completion of degree requirements.

Admission and Registration

General

Application for admission to the Faculty of Graduate Studies should be made as early in the year as possible on forms provided by the Office of the Registrar. Academic transcripts and other supporting documents should be forwarded as soon as they become available.

Admission to the Faculty cannot be granted until all requirements have been met and all documents submitted.
Admission

Applicants for Graduate Study must be admitted by the Admissions Committee for the Faculty of Graduate Studies.

Only students who are graduates of approved universities and colleges are eligible for admission to Graduate Studies. In addition, the department of the University of Waterloo in which the applicant intends to pursue graduate studies must approve his application and his proposed programme.

Students who, in the opinion of the Committee on Programmes for the Master's Degree, have insufficient background to permit them to complete the requirements for the degree in one academic year, will be required to take a programme extending over at least two academic years.

The candidacy of each applicant for a Doctoral Degree must be approved by the Admissions Committee regardless of the institution at which the candidate has completed his previous work.

At the discretion of the Admissions Committee, an applicant may be required to write a set of qualifying examinations.

Admission of Students from Other Countries

Students from other countries where English is not the common language must provide certified translations of academic transcripts. In addition, the applicant may be required to take either “The English Proficiency Tests” prepared by the English Language Institute of the University of Michigan, or the examination for “The Certificate of Proficiency in English” of the University of Cambridge, in order to satisfy the Admissions Committee that his knowledge of the English language is adequate to pursue his studies successfully. The expenses involved in administering the test must be borne by the applicant.

Re-Admission

The University reserves the right to refuse admission to any candidate, and to refuse re-admission if, in the opinion of competent authority, a student is not progressing satisfactorily.

Registration

All students are required to register at the commencement of each session at the time and place designated by the Registrar.

Fees

All fees for the academic year are due and payable on the day of registration. Credit for scholarships or bursaries will be given only on the authority of the Registrar after presentation of proof of the award.

If, for reasons acceptable to the Comptroller, the fees for the year cannot be paid in full on the day of registration, they may be paid in two instalments,
but an extra charge of $5.00 will then be added to the total fee. The first instal-
ment, to be paid on the day of registration, is a minimum of 60% of the total
fees. The balance must be paid in full on the first day of the second term.
A charge of $2.00 per month will be made on overdue accounts. Failure to
pay an overdue account before conclusion of lectures may bar a student from
writing examinations or obtaining credit for previous work.

A student who finds it necessary to withdraw from attendance is required to
obtain a withdrawal voucher from the Registrar. The voucher, when signed by
the Registrar, may entitle him to a refund of a portion of his fees. No fee
will be refunded unless this procedure is followed.

Refunds of tuition fees are made at the discretion of the University.
Incidental fees are not refundable.

The fee schedule shown is one in effect for the 1965-66 year and at the
time of printing is still subject to review and possible change for the 1966-67
year. If a fee change is made, a notice will be issued with a new fee schedule;
however, the University does not undertake or accept responsibility to so notify
all recipients of this calendar. The Board of Governors reserves the right to
make changes in the published schedule of fees without notice.

Fees

Regular full-time graduate students:
—per year of required resident study $375.00
—per term of required resident study 187.50
—additional resident graduate study
  per year 50.00
  per term 25.00
—additional non-resident graduate study per year
  or portion thereof 20.00

Qualifying full-time graduate students:
—per academic year of resident study $510.00

Regular part-time graduate students:
—per each specified registration $135.00
—per each subsequent registration 50.00

Specified registration for regular part-time graduate students:

<table>
<thead>
<tr>
<th>Degree</th>
<th>Minimum Fee</th>
<th>$135.00 Payable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master's</td>
<td>$540.00</td>
<td>4 times</td>
</tr>
<tr>
<td>Ph.D. (from Master's)</td>
<td>810.00</td>
<td>6 times</td>
</tr>
<tr>
<td>Ph.D. (from Bachelor's)</td>
<td>1,350.00</td>
<td>10 times</td>
</tr>
</tbody>
</table>

Special part-time graduate students:
—per full course $100.00
—per half course or course for one term 50.00
Definitions:

Regular full-time graduate student:
A student possessing an Honours Bachelor's Degree or equivalent who is classified as a regular student by the Admissions Committee for the Faculty of Graduate Studies.

Qualifying full-time graduate student:
A student, normally not possessing an Honours degree, who is classified as a qualifying student by the Admissions Committee for the Faculty of Graduate Studies.

Regular part-time graduate student:
A graduate student enrolled for not more than one course at any registration. Course in this context represents a full course for students registered on a year basis, and a half course for students registered on a term basis.

Special part-time graduate student:
A student possessing a university degree taking not more than one graduate course but not proceeding to a degree or diploma.

Incidental and Miscellaneous Fees:
- Health services (compulsory for full-time students) $4.00
- Health insurance (optional 12 month coverage) 10.00
- Student Activities 18.00
- Photograph (at first registration only) 1.00
- Late registration 10.00
- Transcript of record 1.00
- Degree 20.00

Notes: (1) Two or more courses: full-time fee.
(2) Graduate students from other universities who spend a resident period at Waterloo but are not candidates for a Waterloo degree will pay fees as per regular graduate students.
(3) Classification of graduate students is made by the Admissions Committee for the Faculty of Graduate Studies.

Residence Fees
Residence fees for both men and women are:

<table>
<thead>
<tr>
<th>Type of Room</th>
<th>Single</th>
<th>Semi-private</th>
<th>Double</th>
</tr>
</thead>
<tbody>
<tr>
<td>per academic year</td>
<td>$800.</td>
<td>$760.</td>
<td>$700.</td>
</tr>
<tr>
<td>per term</td>
<td>$400.</td>
<td>$380.</td>
<td>$350.</td>
</tr>
</tbody>
</table>

All students may pay residence fees on a term basis; payments are due and payable on or before the day of registration or the first day of each term.
Fees

This fee does not include the period between the end of the first term and the beginning of the second term. Students occupying residence in this period will be charged an additional $2.00 per day for their room, (food, if available, will be an extra charge).

Rooms may be occupied for twenty-four hours before registration and after the final examination.

Examinations

Letter grades will be used to designate standing in individual subjects.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>75 - 100%</td>
</tr>
<tr>
<td>B</td>
<td>66 - 74%</td>
</tr>
<tr>
<td>C</td>
<td>60 - 65%</td>
</tr>
<tr>
<td>F</td>
<td>less than 60% (failure)</td>
</tr>
</tbody>
</table>

Students must obtain an average of at least 66% in the set of courses which they present in fulfillment of course requirements for any graduate degree.
VI

The Department of Physical and Health Education
Department of Physical and Health Education

The programme has been designed to provide professional training for University graduates planning to enter one of the many fields of physical education, health and recreation. Graduation from the one year programme with first or second class honours has been approved by the Department of Education of Ontario as acceptable preparation for admission to the Ontario College of Education course leading to the High School Assistant's certificate, Type “A”, in Physical Education.

One advantage of the one year post-degree programme is that it enables the student interested in teaching at the Secondary School level to develop two areas of specialty, an academic discipline and professional physical education. An innovation in physical education degree programmes is the inclusion of a skill school to be held the first week of classes. The skill school will include lectures and the beginning of skills training.

The programme is offered in the standard academic year, from September to May, and follows the same schedule of dates as the Faculties of Arts and Science.

The Physical Education programme is supervised by the Senate Committee on Physical Education.

Admission

To qualify for admission to the Bachelor of Physical Education Programme, the applicant must present the following:

1. A Bachelor's degree from a recognized University or College.

2. High School Participation Record — showing intramural, interscholastic and recreational participation; athletic and honour awards won during High School attendance.

3. University Participation Record — showing intramural, interscholastic and recreational participation; athletic and honour awards won during University or College attendance.

4. Two references from active physical education personnel.

5. A recent medical certificate.

It is recommended that a student include some courses in Psychology and Biology in his undergraduate programme in order to provide background for courses he will be taking during the Bachelor of Physical Education Programme.
Fees

All fees for the academic year are due and payable on the day of registration. Credit for scholarships or bursaries will be given only on the authority of the Registrar after presentation of proof of the award.

If, for reasons acceptable to the Comptroller, the fees for the year cannot be paid in full on the day of registration, they may be paid in two instalments, but an extra charge of $5.00 will then be added to the total fee. The first instalment, to be paid on the day of registration, is a minimum of 60% of the tuition fees plus all incidental fees. The balance must be paid on the first day of the second term.

A charge of $2.00 per month will be made on overdue accounts. Failure to pay an overdue account before conclusion of lectures will bar a student from writing examinations or obtaining credit for previous work.

A student who finds it necessary to withdraw from attendance is required to obtain a withdrawal voucher from the Registrar. The voucher, when signed by both the Department Head and the Registrar, may entitle him to a refund of a portion of his fees. No fees will be refunded unless this procedure is followed. Refunds of tuition fees are made at the discretion of the University.

Incidental fees are not refundable.

The fee schedule shown is one in effect for the 1965-66 year and at the time of printing is still subject to review and possible change for the 1966-67 year. If a fee change is made, a notice will be issued with a new fee schedule; however, the University does not undertake or accept responsibility to so notify all recipients of this calendar. The Board of Governors reserves the right to make changes in the published schedule of fees without notice.

Sessional Fees:

<table>
<thead>
<tr>
<th>Item</th>
<th>Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuition</td>
<td>$510.50</td>
</tr>
<tr>
<td>Incidental*</td>
<td>94.50</td>
</tr>
<tr>
<td></td>
<td><strong>$605.00</strong></td>
</tr>
<tr>
<td>Examination — Supplemental, each paper</td>
<td>10.00</td>
</tr>
<tr>
<td>— Presiding fee (at outside centre, each half day)</td>
<td>5.00</td>
</tr>
<tr>
<td>Photograph (at first registration only)</td>
<td>1.00</td>
</tr>
<tr>
<td>Late Registration</td>
<td>10.00</td>
</tr>
<tr>
<td>Transcript of Record</td>
<td>1.00</td>
</tr>
<tr>
<td>Degree and Graduation</td>
<td>10.00</td>
</tr>
</tbody>
</table>

* Incidental fees include student activities, athletics, health insurance, health services, skill school, and uniform. The Health Insurance Plan does not include the premiums or benefits of the Ontario Hospital Service Commission. Such coverage is the student's own responsibility.
Residence Fees

Residence fees for both men and women are:

<table>
<thead>
<tr>
<th>Type of Room</th>
<th>Single (per academic year)</th>
<th>Semi-private (per academic year)</th>
<th>Double (per academic year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>$800</td>
<td>$760</td>
<td>$700</td>
</tr>
<tr>
<td>Semi-private</td>
<td>$400</td>
<td>$380</td>
<td>$350</td>
</tr>
</tbody>
</table>

All students may pay residence fees on a term basis; payments are due and payable on or before the day of registration or the first day of each term.

This fee does not include the period between the end of the first term and the beginning of the second term. Students occupying residence in this period will be charged an additional $2.00 per day for their room, (food, if available, will be an extra charge).

Rooms may be occupied for twenty-four hours before registration and after the final examination.

Examinations

Final written examinations will be held in April and May. Oral examinations may be required at the discretion of individual instructors. The normal time for written examinations is two hours.

Letter grades signify the following standings in individual subjects:

- A: 75 - 100%
- B: 66 - 74%
- C: 60 - 65%
- D: 50 - 59%
- F: less than 50% (Failure, no supplemental allowed)
- S: less than 50% (Supplemental allowed)

Physical Education Programme

(a) First Term:

- PE 400 History of Principles of Physical Education
- PE 405 Historical Foundations in Dance (women)
- PE 410 Coaching Foundations
- PE 425 Public Health and Preventive Medicine
- PE 440 Human Anatomy
- PE 445 Care and Prevention of Athletic Injuries
- PE 460 Measurement and Evaluation
- PE 480 Skills

(b) Second Term:

- PE 420 Administration of Physical and Health Education Programmes
- PE 441 Kinesiology
- PE 450 Correctives and Adapted Physical Education
- PE 455 Physiology of Physical Activity
- PE 465 Research Project
- Psych 620 Educational Psychology
- PE 480 Skills
VII

Course Descriptions
Notes on Numbering of Courses

1. Courses offered to students in the Faculties of Arts and Science numbered:
   - 1 - 49 are at the beginning level
   - 50 - 99 are at the Ontario Grade XIII level
   - 100 - 500 are at the undergraduate level
   - Courses marked with an asterisk are half courses.

Courses offered to students in the Faculty of Engineering numbered:
- 10 - 99 are at the undergraduate level

Courses offered to students in the Faculty of Graduate Studies numbered:
- below 600 are senior undergraduate courses which may be taken for Graduate credit
- 600 and above are at the graduate level.

2. All courses listed are full courses (two terms) unless otherwise indicated.

3. A symbol following a course number indicates that the course is offered by one of the associated church colleges:
   G — Conrad Grebel
   I — St. Jerome’s College
   R — Renison College
   P — St. Paul’s College

Department of Biology

H. B. N. Hynes, Ph.D., D.Sc., (London), A.R.C.S.,

Professor and Chairman of Department

D. Parkinson. B.Sc. (London), Ph.D. (Nottingham) — — — Professor

H. R. N. Eydt, M.Sc., Ph.D. (McMaster) — — Associate Professor

C. H. Fernando, B.Sc. (Ceylon), D.Phil. (Oxford), F.R.E.S. — Associate Professor

W. E. Inniss, M.S.A. (Toronto), Ph.D. (Michigan State) — Associate Professor

W. B. Kendrick, B.Sc., Ph.D. (Liverpool) — — Associate Professor

P. E. Morrison, M.Sc. (Western), Ph.D. (McMaster) — Associate Professor

G. Power, B.Sc. (Durham), Ph.D. (McGill) — — Associate Professor

J. C. H. Carter, B.A. (Toronto), M.Sc. (McGill), Ph.D. (McGill) — Assistant Professor

E. B. Dumbroff, B.S. (Georgia), M. Forestry (Georgia), Ph.D. (Georgia) — Assistant Professor

H. C. Duthie, B.Sc., Ph.D. (Wales) — — — Assistant Professor

J. J. Pasternak, M.A. (Toronto), Ph.D. (Indiana) — Assistant Professor
Undergraduate Course Descriptions

131 - Introduction to Biology: The nature of life, the structure and function of protoplasm and cells. Cellular processes and cooperation. The structure and functioning of flowering plants and mammals. A survey of the types of animal illustrating evolutionary sequence. The role of microorganisms in nature. 2 lectures, 3 hours laboratory.

132 - Principles of Biology: A first-year course for students who have achieved a good standing in post-1965 Grade XIII Biology or equivalent. Selected topics in elementary biology. 2 lectures, 3 hours laboratory.

231 - Genetics and Evolution: The principles, methods and application of genetics. The implications of genetics in the modern evolutionary theory. 3 lectures. (Primarily for students in the General programme and to those from other departments)

233 - Vertebrate Zoology: The evolution of the vertebrate body as exemplified by both living and fossil members of the group. Laboratory dissections form an integral part of the course. Prerequisite: Biology 131 or 132 2 lectures, 3 hours laboratory.

234 - Comparative Plant Morphology: The anatomy, morphology and taxonomy of the plant kingdom with life histories of typical examples. Emphasis on morphogenetic and evolutionary aspects. Prerequisite: Biology 131 or 132 2 lectures, 3 hours laboratory.

235 - General Microbiology: Introduction to fundamental theories, principles and methods of general microbiology. Structure, systematics, growth and functions of microorganisms. 2 lectures, 3 hours laboratory.

333 - Invertebrate Zoology: A survey of the major invertebrate phyla with emphasis on the anatomy, taxonomy, and ecology of selected representatives. Prerequisite: Biology 131 or 132 2 lectures, 3 hours laboratory.


335 - Microbiology I: Detailed study of microorganisms. The cultural, morphological, structural and biochemical characteristics of bacteria. Pre-requisite: Biology 235. 2 lectures, 3 hours laboratory.
337 - General Physiology: A survey of fundamental life processes in animals and plants including energy production, biosynthesis, growth, development, absorption and transfer, and environmental effects. 
Prerequisite: Chemistry 236.
2 lectures, 3 hours laboratory.

Prerequisites: Biology 233, 234 and 333.
2 lectures, 3 hours laboratory.

432 - Microbial Ecology: Roles of microorganisms in natural and special environments, with emphasis on the methods for studying the nature and functions of microbial populations.
Prerequisites: Biology 235, Chemistry 337.
2 lectures, 3 hours laboratory.

Prerequisite: Biology 333.
2 lectures, 3 hours laboratory.

434 - Genetics: A survey of genetics with particular emphasis on biochemical genetics and the physical basis of inheritance.
Prerequisite: Biology 337 or 335.
2 lectures, 3 hours laboratory.

2 lectures, 3 hours laboratory.
Prerequisites: Biology 235, Chemistry 337.

436 - Neurophysiology: Selected topics and techniques in neurophysiology.
Prerequisite: Biology 337.
2 lectures, 3 hours laboratory.

437 - Vascular Plants: A survey of the higher plants with emphasis on morphological change and evolutionary advance.
Prerequisite: Biology 234.
2 lectures, 3 hours laboratory.

438 - Non-vascular plants: A survey of the lower plants with emphasis on variation and evolutionary advance in the algae and fungi.
Prerequisite: Biology 234.
2 lectures, 3 hours laboratory.
439 - Experimental Biology: Design, execution and interpretation of experiments. The basis of this course will be a year-long project.

Pre-requisites: Biology 337, Chemistry 337.
2 lectures, 3 hours laboratory.

441 - Plant Physiology: A detailed study of water relations, mineral nutrition, metabolism and growth and development in plants.
Prerequisites: Biology 337, Chemistry 337.
2 lectures, 3 hours laboratory.

442 - Animal Physiology: A study of digestion, metabolism, excretion, hormone action, circulation, muscle contraction, nerve conduction and the physiology of major organ systems in animals.
Prerequisites: Biology 337, Chemistry 337.
2 lectures, 3 hours laboratory.

443 - Microbiology II: Properties of pathogenic microorganisms mechanisms of infection and immunity, development of resistance, antigenantibody reactions.
Prerequisite: Biology 235.
2 lectures, 3 hours laboratory.

449 - Senior Honour Project: Each student will work under the direction of a member of the department on an experimental study. The results of this will be presented in thesis form and this will be critically examined by members of this and, where pertinent, other departments.

Graduate and Research Programmes

There are at present several major areas of study in the department in which graduate students may specialize. These include biochemical microbiology, soil microbiology, freshwater algology, palaeobotany of the Pleistocene, ecology of freshwater invertebrates, invertebrate physiology, fisheries and water pollution. It is hoped that others will have been added by the time this calendar is published.

Fields in which research is in progress in the department are as follows:
The transport mechanisms across the cellular membranes of bacteria and of the mode of action of chemical inhibitors of microorganisms.
The nature and activity of the microbial populations of forest soils.
Fungi in the root region of crop plants with special reference to root development and nutrient uptake.
The ecology of the algae in lakes and streams, the dynamics of their growth and the mechanisms of their distribution and flotation.
The ecology of peat bogs together with their palynology and the plant composition of the peat.

The invertebrate fauna of running water and the fate of organic matter in streams.

Reproduction in invertebrates with special reference to the physiological inter-relationships of nutrition, food reserves, hormones and maturation of the gonads.

Biology of salmonid fishes and fluviatile forage fishes.

602. **Fisheries Biology.** A lecture and seminar course dealing with the basic techniques of fisheries biology and reviewing the significant literature in the field.

603. **Paleobotany.** A course dealing with the evolution of the plant kingdom with emphasis upon the Fern-Pteridosperm complex and microfossils in the Pleistocene. Aspects of Phylogeny and Paleobotany are studied.

604. **Advanced Plant Ecology and Plant Geography.** Methods of quantitative plant ecology, plant distribution and plant sociology.

605. **Limnology.** An advanced discussion of the fresh water environments and current limnological literature.

606. **Algology.** A systematic account of the Algae with emphasis on the ecology of the more important limnetic forms.

607. **Advanced Microbiology.** A discussion of selected topics in Microbiology.
608. Advanced Genetics. Discussion of selected topics in modern genetics.

609. Parasitology. Parasitism in the animal kingdom. Classification, ecology, physiology, immunology and vectors. Discussion of selected topics.

610. Taxonomy. Philosophy of taxonomy. Phenetic and phylogenetic approaches. Special and general classifications. New sources of taxonomic information (chemistry, serology, etc.)


613. Mycology. Selected topics in fungal systematics and plant pathology.


667. Molecular Biology. Selected topics of interest to biologists, biochemists and biophysicists will be presented at the advanced level with the aim of evaluating recent work and development in each area. Each will be developed from basic concepts and interrelationships emphasized. Topics will include the structure of proteins and their properties in solution, transport through biological membranes, cell morphology and physiology, structure and function of selected organelles, biosynthesis of macromolecules, and the chemistry of enzyme action. This graduate course is to be presented by members of the Biology, Chemistry and Physics departments and is intended to cover those areas common to these disciplines (identical to Chemistry 667 and Physics 667).

D. C. T. Pei, B.Eng. (McGill), M.Sc. (Queen's)  
Ph.D. (McGill)  -  -  -  -  Associate Professor

K. Enns, B.A.Sc., LL.B., M.A.Sc. (Toronto)  
Ph.D. (Toronto)  -  -  -  -  Associate Professor

C. E. Gall, B.A.Sc. (Toronto), M.A.Sc. (Queen's)  
I. I. Byerley, B.A.Sc., M.A.Sc. (Toronto)  
Ph.D. (British Columbia)  -  -  -  -  Assistant Professor

T. Z. Fahidy, B.Sc., M.Sc. (Queen's), Ph.D. (Illinois)  
J. D. Ford, B.Eng. (McGill) M.A.Sc. (Toronto)  -  -  Assistant Professor

R. Y. M. Huang, B.Sc. (National Taiwan University),  
M.A.Sc. (Toronto) Ph.D. (Toronto)  -  -  Assistant Professor

R. Hudgins, B.A.Sc., M.A.Sc. (Toronto)  
Ph.D. (Princeton)  -  -  -  -  Assistant Professor

E. Rhodes, B.Sc., Ph.D. (Manchester)  -  -  Assistant Professor

P. M. Reilly, B.A.Sc. (Toronto), D.I.C. (Imperial College) Ph.D. (London)  -  -  -  Adjunct Professor

Undergraduate Programmes. Details of the undergraduate programme in Chemical Engineering are to be found on page 60.

Undergraduate Course Descriptions

11. Chemical Process Principles I. Practice in applied stoichiometry. Mass and energy balances. The simple unit operations such as evaporation, drying, etc.  
Prerequisite: Chem. 11.  
3 lectures, 2 hours problems, one term.

12. Chemical Process Principles II. Equilibrium between phases; the equilibrium stage concept. Cascades of stages with and without reflux; examples of their analysis when used to separate components by distillation, extraction, absorption and leaching.  
Small solids; their description in quantitative terms; separation by differences of size and density. Thickening.  
3 lectures, 2 hours problems, alternative weeks.

Prerequisite: Chem. II.  
3 lectures, one term.

3 lectures, one term.

22. Transport Processes II. Introduction to heat transfer. Steady and transient heat conduction. Laminar and turbulent convection, the laminar boundary layer, momentum-heat transfer analogies. Heat transfer with change of phase. Radiant heat transfer. Prerequisite: G.E. 32. 3 lectures, one term.

23. Transport Processes III. Diffusion and mass transfer by molecular and turbulent action. Interrelationship of momentum, energy and mass transport phenomena. The performance of apparatus for carrying out diffusional operations. Prerequisite: Ch.E. 22. 3 lectures, one term.

31. Physical-Chemical Principles I. Gases, first law of thermodynamics, thermochemistry, second law of thermodynamics, one component systems, solutions, properties of dilute solutions, phase equilibria and the phase rule, kinetic theory and macromolecules. 3 lectures, one term.
Prerequisites: ChE 11, ChE 31.
3 lectures, 2 hours problems alternate weeks, one term.

Prerequisite: ChE 32.
3 lectures, one term.

Prerequisite: ChE 33.
3 lectures, one term.

36. Physical-Chemical Laboratory. A laboratory to demonstrate physical chemical principles and techniques of physical measurement. Concurrently with ChE 31.
3 hours laboratory, one term.

41. Reaction Kinetics I. Introduction to kinetics and mechanism of elementary chemical processes in homogenous systems; reversible, consecutive and simultaneous reactions, interpretation of kinetic data, homogeneous catalysis, chain reactions.
Prerequisites: ChE 12, ChE 31.
3 lectures, one term.

42. Reaction Kinetics II. Use of material balances: design of isothermal flow, stirred tank and batch reactors by analytical, graphical and numerical techniques; non isothermal design for simple cases.
Prerequisite: ChE 41.
3 lectures, one term.

43. Reaction Kinetics III. Kinetics of heterogeneous and catalytic reactions; design and scale up of heterogeneous reactors.
Prerequisite: ChE 42.
3 lectures, one term.

51. Process Dynamics and Control I. The differential equations of common processes are derived and linearized. The dynamic behaviour is analyzed when uncontrolled and when standard process controllers provide feedback control. Optimal controller settings are established for stable operation.
Prerequisite: Math 41, ChE 22.
3 lectures, one term.
54. Chemical Engineering Analysis. The application of certain mathematical techniques to the analysis of chemical engineering systems. The general areas are: operational calculus, vector-matrix system representation, numerical analysis, elementary statistical system dynamics and optimization techniques. Prerequisite: Permission of the instructor.
3 lectures, one term.

52. Process Dynamics and Control II. Open and closed loop behaviour of complex processes is considered. Modern approaches to process control are introduced.
3 lectures, one term.

3 lectures, one term.

62. Process System Design. The undergraduate curriculum is co-ordinated and brought together to accomplish the basic objective of the process engineer, the design of an integrated chemical process.
Prerequisites: All Chemical Engineering required courses.
2 lectures, 3 hours problems, one term.

71. Chemical Engineering Laboratory I. Experiments in the application of physical and chemical principles to engineering analysis, phase equilibrium, fluid flow and heat transfer.
Prerequisites: ChE 12, ChE 21.
4 hours laboratory, one term.

72. Chemical Engineering Laboratory II. Experimental studies with pilot plant equipment in the representative unit operations: evaporation, distillation, absorption, extraction, drying, humidification and reactors.
Prerequisites: ChE 13, ChE 71.
6 hours laboratory, one term.

73. Chemical Engineering Laboratory III. Chemical reactors, process dynamics steady-state and transient behaviour, and applications of digital and analog computers.
Prerequisites: ChE 72, ChE 41, ChE 51.
6 hours laboratory, one term.

Prerequisite: Chem. 55.
3 lectures, one term.
85. Chemical Metallurgy. Introduction to metallurgical processes, ore dressing, calcining, roasting, leaching, reduction, precipitation and refining. Discussion and application of physico-chemical principles as related to pyrometallurgical and hydrometallurgical reactions. Technology of base metal production. 3 lectures, one term.

91. Seminar. Study and presentation of material in recent literature. 1 hour, one term.

98. Research and Design Project I. 3 lectures, one term.

99. Research and Design Project II. Prerequisite: ChE 98. 6 hours, one term.

Graduate Course Descriptions

The Department of Chemical Engineering offers courses of study leading to the degrees of Master of Applied Science and Doctor of Philosophy. The Master of Applied Science programme may be followed in either one of two directions: a “professional” option, which requires course work and an engineering report; and a “research” option, which requires less course work, and the completion of a research project. The first of these is intended to give a fuller understanding of fundamentals and greater mastery of the application of these principles to the solution of complex realistic problems. The second option offers training in fundamentals and in research methods, and is excellent preparation for those wishing to proceed to the Ph.D. degree, or for those whose primary interest is a career in research.

In addition to specialized graduate courses for research students, the Department offers a number of courses each year designed to be particularly suitable for the professional option in the M.A.Sc. programme. Graduate course requirements are measured in “units.” A course lasting one semester may be considered to be one unit. Normally, four units per semester are considered a full load, but if more than six hours/week of other work is also being done, a student may be required to carry fewer units.

Either option in the M.A.Sc. programme may also be carried out on a part-time or full-time co-operative basis. The professional option is particularly designed to meet the needs of a co-operative programme.

The Master’s Degree Programme

The professional option requires a total of eight units of course work, in addition to the submission of an acceptable engineering report. Normally, at least five units of work will be chosen from courses offered by the Chemical Engineering Department specifically for students in this option. Other courses may be chosen either from outside Departments or from other Chemical
Department of Chemical Engineering

Engineering courses. The engineering report will have a nominal value of one to two units, and represents evidence that the student is capable of obtaining and presenting a satisfactory solution to an original engineering problem of some complexity.

The research option requires a total of four units of course work at the graduate level, in addition to the submission of a thesis reporting the results of original research. The courses to be taken will be selected in consultation with the student's research advisor.

The minimum period for a full-time student to complete either option is 8 months, and the average time required will be one calendar year.

The PhD. Programme

The Ph.D. degree is awarded primarily for the successful performance of original research of high calibre. The general requirements are described in the section dealing with the Faculty of Graduate Studies, and particular requirements are available from the Department of Chemical Engineering on request. The courses to be taken by a student in the Ph.D. programme will be determined by his Committee, and will normally consist of about four to eight units of work, in addition to the research thesis.

A student in the Ph.D. programme is not accepted as a candidate for the Ph.D. degree by this Department until he has presented and successfully defended to his Committee a proposal for research.

Research Activities

Graduate research may be pursued in a number of areas including heat and mass transfer, reaction kinetics, catalysis and reactor design, thermodynamics, fluid dynamics, computational methods, and process dynamics and control. Examples of specific types of research projects currently underway are:

1. Heat and mass transfer from suspended particles, gas-particle dynamics, radiation to liquid films, transport coefficients of small particles.
2. Behaviour of dense gas-solid mixtures.
3. Diffusion coefficients of liquids and gases, effect of variable diffusion coefficients in mass transfer.
4. Application of monomolecular films to evaporation retardation.
5. Catalysis in solution, rate determining steps in heterogeneous catalysis, surface diffusion and port diffusion in catalysts, mechanism for pyrolysis of hydrocarbons.
6. Chemical process systems theory, computational methods, stability problems in reacting systems, control of chemical reactors.
7. Absorption and reaction in Cocurrent Flow Heterogeneous Systems.
9. Hydrometallurgy, high temperature high pressure solution kinetics.

Details of Graduate Courses

All courses are one term, and except for those listed under “Special Topics,” are given every year.

The following three courses are intended primarily for the professional M.A.Sc. Option.

600. Applications of Transport Theory I. The use of the rate equations in design and in the analysis and performance of flow systems, heat transfer equipment and mass transfer operations. Particular attention is given to non-ideal and multi-component systems.

601. Applications of Transport Theory II. A continuation of Chemical Engineering 600, with transfer problems in reacting systems also considered. Prerequisite: Chem. Eng. 600.


697. Engineering Report. Every professional student is expected to complete the solution of and prepare a report on a major problem in process design or evaluation. Problems may be suggested by the student or by the staff. The following courses are suitable for all graduate students.


641. Chemical Re却ors for Homogeneous Systems. Structure and preparation of solid catalysts, physical properties, nature of active surfaces and activated adsorption, selection of catalysts, heat and mass transfer in packed and fluidized bed reactors, design and heterogeneous catalytic and non-catalytic reactors.

650. Process Dynamics and Optimization. A general course of wide scope at an advanced level, covering mathematical analysis of complex systems, measurement of dynamic behaviour, optimization methods, control of processes. Prerequisite: Chemical Engineering 51 and 52 or the equivalent.

The courses below are intended mainly for students pursuing a research project, but are open to those in the professional course with the consent of the instructor and of his faculty advisor. The courses described below are of a broader scope than those listed as Special Topics in Groups A, B or C.
Not all the courses listed as Special Topics will be given in any one year (3 semesters) but several from each of groups A, B and C will be offered each year.

Prerequisite: Chemical Engineering 672 or the equivalent.

672. Advanced Mathematics in Chemical Engineering I. Review of fundamental concepts and methods of advanced mathematical analysis with applications in Chemical Engineering. Cartesian tensors and vector formulations of the equations of change. Review of matrix methods and applications to chemical engineering problems.


681. Polymer Synthesis and Characterization. A laboratory and lecture course to familiarize graduate students having research interests in polymer science with various laboratory techniques in polymer research.

686. Topics in Hydrometallurgy.

Special Topics

Group A — (Topics in Transport Theory)

605. Particle - Fluid Dynamics
606. Turbulence Theory
607. Non-Newtonian Flow
608. Compressible Flow
615. Radiant Heat Transfer
616. Heat Transfer in Two Phase Systems
625. Gas-Liquid Mass Transfer Processes
626. Dissolution and Crystallization
627. Ionic Transport Processes

Group B — (Topics in Thermodynamics and Chemical Kinetics)

635. Topics in Chemical Thermodynamics
645. Physical Processes in Heterogeneous Catalysis
646. Kinetics of Consecutive and Chain Reactions
647. Kinetics of Biological Systems
648. Residence Time Distributions, Reactor Flow Models and Reactor Stability

Group C — (Topics in Control Theory and Applied Mathematics)
655. Analysis of Non-linear Processes
656. Control of Complex Processes (including simulation theory)
657. Optimization Problems in Chemical Processes
658. Applied Statistics in Chemical Engineering
659. Stochastic Processes
660. Advanced Techniques of Analysis
698. Research Thesis for the Master's Degree
699. Research Thesis for the Doctoral Degree

Department of Chemistry

H. G. McLeod, M.A., Ph.D. (Toronto)  
Professor and Chairman of Department

Professor

W. A. E. McBryde, M.A. (Toronto), Ph.D. (Virginia)  
Professor and Dean of the Faculty of Science

T. Viswanatha, M.Sc., Ph.D. (Mysore)  
Professor

G. F. Atkinson, M.A., Ph.D. (Toronto)  
Professor

D. A. Brisbin (Mrs.) B.Sc. (Alberta), Ph.D. (Toronto)  
Professor

J. B. Capindale, M.A., D.Phil (Oxford)  
Professor

W. L. Elsdon, M.Sc. (Western), Ph.D. (McGill)  
Professor

R. M. Guest, M.A. (Western), Ph.D. (McGill)  
Professor

D. E. Irish, B.Sc. (Western), M.Sc. (McMaster), Ph.D. (Chicago)  
Professor

D. Mackay, B.Sc., Ph.D. (Aberdeen)  
Professor

A. D. Maynes, M.Sc., Ph.D. (Toronto)  
Professor

J. R. Mills, M.A. (Toronto), Ph.D. (Illinois)  
Professor

J. B. Moffat, B.A., Ph.D. (Toronto)  
Professor

H. D. Sharma, M.Sc. (Delhi), Ph.D. (California)  
Professor

R. G. Woolford, M.Sc. (Western), Ph.D. (Illinois)  
Professor
R. J. Friesen, M.Sc. (Manitoba) - - - Assistant Professor
T. E. Gough, B.Sc., Ph.D. (Leicester) - - Assistant Professor
G. E. Toogood, B.Sc., Ph.D. (Nottingham) - Assistant Professor
A. Balasubramanian, M.Sc. (Madras), Ph.D. (Indian Institute of Science - I. I. Sc.) - - - Lecturer
W. J. Byars, H.N.C. (Dundee Technical College) - Senior Demonstrator
R. W. Cumming, B.Sc. (Manitoba), M.Sc. (Minnesota) - - - Senior Demonstrator
M. C. Michael (Miss), B.Sc. (Waterloo) - Senior Demonstrator

Undergraduate Course Descriptions

Details of the undergraduate programmes offered by the Faculty of Science are to be found on page 88.

3 lectures, two terms. Laboratory: A term 3 hours alternate weeks.
B term 3 hours alternate weeks.

21. Inorganic Chemistry. Systematic inorganic chemistry based on the periodic classification, with emphasis on the relationship between properties and structure.
3 lectures, one term.

1 lecture, 3 hours laboratory, one term.

25. Polymer Chemistry and Physics. The organic and physical chemistry of elementary polymerization reactions. A study of the physical properties of polymeric materials as related to molecular structure. An introduction to polymer technology.
Prerequisite: Chem. 11 and Phys. 15.
3 lectures, one term.

26. Organic Chemistry I. The basic chemistry of the important classes of aliphatic and aromatic compounds.

3 lectures, one term.
Prerequisite: ChE 32, Chemistry 22.
3 lectures, 3 hours laboratory alternate weeks, one term.

36. Organic Chemistry II. An introduction to the important classes of heterocyclic compounds and natural products. A laboratory course on preparative organic chemistry and organic techniques accompanies the lectures.
Prerequisite: Chemistry 26.
3 lectures, 3 hours laboratory, one term.

37. Biochemistry. Carbohydrates, lipids, proteins, hormones, nucleic acids, and vitamins. Metabolism of these groups of compounds. Physico-chemical aspects of biochemistry.
Prerequisite: Chemistry 36.
3 lectures, one term.

3 lectures, one term.

45. Surface Phenomena. A study of absorption, wetting, foams, electrical surface phenomena, and principles of heterogeneous catalysis.
3 lectures, one term.

46. Organic Chemistry III. Selected topics in organic chemistry of interest and importance to Chemical Engineering students.
3 lectures, one term.

55. Polymer Physics and Chemistry. The Chemistry and physics of natural and synthetic polymers, covering the following topics: condensation and addition polymers and their reaction kinetics; properties of polymers, their measurement and relation to structure; isotactic polymers, copolymers, and polymer reactions.
3 lectures, one term.

101. General Chemistry. An elementary study of the states of matter, changes of state and the solution laws; stoichiometry; oxidation-reduction, chemical equilibria; descriptive chemistry of the common elements.
3 hours lectures, 3 hours laboratory for two terms.

131. General Chemistry. Elementary study of the states of matter, changes of state, solution laws; atomic structure and bonding; stoichiometry of equations, oxidation-reduction, chemical equilibria; descriptive chemistry of the commoner elements in terms of the periodic table.
3 lectures, 3 hours laboratory.

200. Radiochemistry. Stability rules for atomic nuclei; modes of decay of radioisotopes; radiations and their detection methods; nuclear reactions
Department of Chemistry

applied to activation analysis; radiation induced chemical reactions; use of radioisotopes in science and industry as tracers and radiation sources.
2 hours lectures, 3 hours laboratory, one term.

201. Introductory Inorganic Chemistry. Descriptive chemistry of the elements and their compounds based on the periodic table with special reference to metallurgical and other industrial processes. The laboratory will illustrate various methods of preparation of metals, non-metals and their compounds.
3 hours lectures, 3 hours laboratory, one term.

3 hours lectures, 9 hours laboratory, one term.

3 hours lectures, 3 hours laboratory, one term.

206. Introductory Organic Chemistry. Basic Chemistry and structure of the important classes of aliphatic and aromatic compounds.
3 hours lectures, 3 hours laboratory, one term.

209. Technical Literature. Use of library; instruction and practice in searching technical literature; preparation of literature reviews, special topic assignments.
2 hours laboratory, one term.

231. Chemical Bonding and Structure: Classical and wave theories of the electronic structure of atoms developed and applied to the rationalisation of the periodic table and the problems of chemical bonding. The formation and properties of the covalent bond; bonding in ionic and metallic solids; methods for the establishment of the shapes of molecules.
2 hours lectures, 3 hours laboratory. (Laboratories to be taken only by Honours Chemistry students).

232. Analytical Chemistry. Theory and practice of quantitative inorganic analysis. Representative classical and instrumental techniques will be carried out and studied with relation to the chemical phenomena which make them possible and to the general principles which they exemplify. A knowledge of ionic equilibria will be assumed and extended.
2 lectures, 6 hours laboratory.

235. Physical Chemistry I. A study of the thermodynamics of ideal systems, the chemical kinetics of simple systems, and a short introduction to the phase rule.
2 lectures, 1 hour problems.
236. **Organic Chemistry I.** The properties, preparations, reactions, and basic structural theory of the common classes of aliphatic and aromatic compounds. A laboratory course on preparative organic chemistry accompanies the lectures. 2 lectures, 3 hours laboratory.

241. **Principles and Application of Chemical Bonding:** Classical and wave theories of the electronic structure of atoms developed and applied to the rationalisation of the periodic table and the problems of chemical bonding. Application to the inorganic chemistry of the elements. 2 hours lectures, 1 hour problems.

242. **Chemical Analysis.** The determination of inorganic chemical species by volumetric, gravimetric and selected instrumental procedures. The role of analysis as a service function will be stressed. 2 lectures, 6 hours laboratory.

301. **Applied Inorganic Chemistry.** The physical principles of bonding and structure developed and applied to such industrial processes and materials as extractive metallurgy, synthesis of industrial chemicals; ceramics and alloys. 3 hours lectures, 3 hours laboratory, one term.

303. **Introductory Polymer Chemistry.** The chemistry of natural and synthetic polymers, covering condensation and addition polymers, and their elementary reaction kinetics; properties of polymers, their measurement and relation to structure; isotactic polymers, copolymers and polymer reactions. 3 hours lectures, 3 hours laboratory, one term.

305. **Applied Physical Chemistry.** The application of reversible thermodynamics to chemical reactions. Kinetics of complex homogeneous and heterogeneous reactions. Chemical reactors. Phase equilibria applied to distillation and crystallization. 3 hours lectures, 3 hours laboratory, one term.

306. **Applied Organic Chemistry.** Petroleum chemistry; the production of important industrial chemicals; synthesis of dyestuffs pharmaceuticals, pesticides and surfactants. 3 hours lectures, 3 hours laboratory, one term.

307. **Introductory Biochemistry.** Carbohydrates; proteins; nucleic acids; lipids; metabolism of these compounds. 3 hours lectures, 3 hours laboratory, one term.

308. **Instrumental Measurements I.** Introduction to the use of instruments to obtain accurate measurements of physical and chemical properties of materials. 1 hour lecture, 3 hours laboratory, one term.

318. **Instrumental Measurements II.** Extension of Chemistry 308 to dynamic measurements following the course of a chemical reaction or monitoring a continuous process. 1 hour lecture, 3 hours laboratory, one term.
325. **Physical Chemistry.** An introduction to the study of matter from the macroscopic and molecular point of view. Classical kinetic theory of gases, thermodynamics, electrochemistry, kinetics, molecular structure, surface phenomena, phase equilibria and macromolecules. A knowledge of Calculus is assumed.

2 lectures, 3 hours laboratory.

331. **Inorganic Chemistry I:** Systematic inorganic chemistry of the non-transition elements based on the principles established in Chemistry 231; introduction to nuclear-and radio-chemistry. The laboratory illustrates methods of synthesis and characterization of typical inorganic compounds.

2 hours lectures, 3 hours laboratory (except for Honours Chemistry and Physics students).

335. **Physical Chemistry II.** The thermodynamics of systems of variable composition including real gases and binary solutions of non-electrolytes. Electrochemistry and the thermodynamics of electrolytic solutions.

2 lectures, 6 hours laboratory.

336. **Organic Chemistry II:** Correlation between electronic structure and chemical properties and reactivity; stereochemistry; synthetic methods, especially enolate and related condensations, and cyclo-addition reactions; carbohydrate and peptide chemistry.

2 hours lectures, 3 hours laboratory.

337. **Biochemistry I.** Carbohydrates, lipids, proteins, hormones, nucleic acids, and vitamins. Metabolism of these groups of compounds. Physico-chemical aspects of biochemistry.

Prerequisite: Chem. 236 or equivalent.

2 lectures. (For General students and Honours Biology. 3 hours laboratory).

400. **Electrochemistry and Corrosion.** Electrolytic conductance and transport; thermodynamics of electrolytic solutions; electrode potentials; the measurement of pH; metallic corrosion.

3 hours lectures, 3 hours laboratory alternate weeks, one term.

402. **Modern Organic Analysis.** Application of wet chemical and instrumental methods in current use to the identification, determination and characterization of organic materials.

2 hours lectures, 3 hours laboratory, one term.

403. **Physical Chemistry of Polymers.** Polymerization kinetics including condensation polymers, free radical, ionic and stereoregular addition polymers, and copolymers; structure of polymers molecules; degradation; solution properties of crystalline and amorphous polymers; molecular weight distributions.

3 hours lectures, 3 hours laboratory, one term.

407. **Applied Biochemistry.** Vitamins and hormones; chemistry, production, and mechanism of action of drugs; industrial applications of enzymes and other biological materials.

3 lecture hours, 3 hours laboratory, one term.
408. Instrumentation I. Introductory systems approach to chemical instruments. Input transducers, electronic and electromechanical modules, readout devices. Optimum operation of instruments. Control systems. 1 hour lecture, 3 hours laboratory, one term.

412. Analysis of Materials. Techniques of separation determination and characterization of complex materials including ores, resistant alloys, ceramics, synthetic polymers, food and drug products and pesticides. 2 hours lectures, 3 hours laboratory, one term.

413. Properties of Polymers. Behaviour of polymers: types of mechanic behaviour, flow and relaxation mechanism, birefringence, orientation and recovery; glass transitions; crystallisation and properties of crystalline polymers; introduction to theory of high elasticity. 3 hours lectures, 3 hours laboratory, one term.

418. Instrumentation II. The laboratory time will be divided between analytical study of instrument modules, and synthesis of an instrument system to meet a typical industrial need. 1 hour lecture, 3 hours laboratory, one term.

431. Inorganic Chemistry II: Systematic inorganic chemistry of the transition elements; introduction to selected topics including ligand field theory; magnetoochemistry; interpretation of electronic spectra. 2 hours lectures.

435. Physical Chemistry III. Introduction to quantum chemistry and statistical thermodynamics. Applications to kinetics, surface chemistry, and spectroscopy. 2 lectures, 1 hour problems.

436. Organic Chemistry III. The use of spectroscopic techniques in organic chemistry; analysis of reaction mechanisms; free radical chemistry; a brief introduction to natural product chemistry. 2 hours lectures.

437. Biochemistry II. Selected topics and techniques in modern biochemistry; energy transfer, transport across membranes, comparative aspects of metabolism, mechanism and kinetics of enzyme activity, structural macromolecules, 2 lectures, 3 hours laboratory.

439. Advanced Laboratory. An introduction to research methods and techniques. The student will elect to concentrate this study in one of the following fields of chemistry, viz. analytical, inorganic, organic, physical or biochemistry. Honours Chemistry Students, 6 hours laboratory. Honours Chemistry and Physics Students, 3 hours laboratory.

445. Polymer Chemistry. The chemistry and physics of natural and synthetic polymers, covering the following topics: condensation and addition polymers and their reaction kinetics; properties of polymers, their measurements and relation to structure; isotactic polymers, copolymers, and polymer reactions. 2 lectures.
Graduate Programme in Chemistry

For both the M.Sc. and Ph.D. programmes, a student is expected to combine a thesis embodying the results of some original research with course work. A major field of study should be chosen from the following areas: analytical, inorganic, organic (including biochemistry) and physical chemistry. Course work will be appropriate to the area selected and a research director should be chosen from members of the department who are presently engaged in various fields ofendeavour as listed.

Major Areas of Research

Analytical Chemistry - chemical instrumentation based on analog modules; continuous analysis by spectrophotometric or electroanalytical techniques; complex ion systems useful in analysis; application of physical methods e.g., ion exchange, solvent extraction, to separation of metallic constituents in aqueous solutions.

Inorganic Chemistry - studies on inorganic complexes in solution, magnetic susceptibility measurements of metallic complexes; crystal structure of salt hydrates; solutions of metals in molten salts and other non-aqueous media; the chemistry of the lanthanides in non-aqueous solvents.

Organic Chemistry - synthesis of organic substances by electrochemical techniques; abnormal Kolbe reaction of halogenocarboxylic acids; free radical chemistry in general and especially the synthesis and decomposition of peroxy- and azo-compounds; studies on heterocyclic compounds; spectroscopic studies (using infrared, ultraviolet and electron spin resonance techniques) of molecular conformation and hydrogen bonding.

Biochemistry - effects of irradiation on proteins and aminoacids as studied by electron spin resonance and other techniques; the aging process; synthetic and degradative studies on enzymes, peptides and proteins; nature of materials excreted by algae.

Physical Chemistry - studies in molten salt chemistry, especially mass transport phenomena; kinetics of polymer reactions; experimental and theoretical studies of surfaces, surface reactions and catalysis; quantum chemical calculations on organic molecules; electrochemistry and especially electroplating mechanisms and corrosion studies; spectroscopic studies of species in solution to determine their identity and contribution to the properties of the system.

Details regarding these programmes and the faculty members engaged in them are to be found in a booklet prepared by the Chemistry Department. The booklet also discusses admission procedures, programs of study, teaching and research facilities and equipment and is sent to every potential graduate student who applies for admission. New areas of research are usually added each year.
Graduate Course Descriptions

610. Advanced Nuclear and Radiochemistry. Systematics of atomic nuclei; nuclear models; radioactive decay processes; nuclear reactions; interaction of radiation with matter; radiation detection methods and radiochemical assay; tracers in chemical applications; radiochemical techniques and radiation chemistry.

615. Physical Chemistry of High Polymers. Selected topics in the field.

621. Physical Methods of Inorganic Chemistry. The application of various spectroscopic techniques to problems in Inorganic Chemistry; advanced ligand field theory.

631. Coordination Chemistry. Equilibrium and kinetic aspects of complex species; experimental and calculative techniques for the determination of stability constants; inorganic reaction mechanisms; non-aqueous solvents.

632. Chemical Analysis. An advanced treatment of classical analysis. The application of equilibria and kinetic considerations to the study of deviations from stoichiometric behaviour. The formation and nature of precipitates, non-aqueous solvent methods. analytical separations.

635. Thermodynamics. A rigorous treatment of chemical thermodynamics with emphasis on the complete thermodynamic description of a system.

636. Natural Products. Selected topics in the field of natural products; heterocyclic and alkaloid chemistry; steroids and terpenes, with emphasis on structural determination and biogenesis.

637. Advanced Biochemistry. Selected topics in the field.

642. Chemical Instrumentation. Instrument components and optimum application; rudiments of design; electrical, spectral, migrational and other methods.


646. Theoretical Organic Chemistry. The structure and reactivity of organic molecules emphasizing stereochemistry and reaction mechanisms.


662. **Colloquia on Current Topics in Inorganic and Analytical Chemistry.** Graduate students will each present for discussion short colloquia based on their reading of assigned topics. Participation in the discussions, as well as the actual presentation of papers, will be an integral part of the course. Admission to this course will be at the discretion of the Inorganic and Analytical faculty.

665. **Chemical Spectroscopy.** The determination of the structure of polyatomic molecules from the study of infrared and Raman spectra. Applications in thermodynamics.

666. **Organic Spectroscopy.** Introduction to ultraviolet, infrared, and resonance spectroscopy, with emphasis on applications to studies of organic molecules.

667. **Molecular Biology.** Selected topics of interest to biologists, biochemists and biophysicists will be presented at the advanced level with the aim of evaluating recent work and development in each area. Each will be developed from basic concepts and interrelationships emphasized. Topics will include: the structure of proteins and their properties in solution, transport through biological membranes, cell morphology and physiology, structure and function of selected organelles, biosynthesis of macromolecules, and the chemistry of enzyme action. This graduate course is to be presented by members of the Biology, Chemistry and Physics departments and is intended to cover those areas common to these disciplines. (identical to Biology 667 and Physics 667).

675. **Selected Topics in Physical Chemistry.** Discussion of specialized topics in thermodynamics, electrochemistry, surface phenomena and quantum chemistry at an advanced level.


695. **Theoretical Physical Chemistry.** Quantum Chemistry and statistical thermodynamics. Kinetics and surface chemistry.

699. **Thesis.**

---

**Department of Civil Engineering**

A. N. Sherbourne, B.Sc. (London), M.S. (Lehigh), M.A., Ph.D. (Cambridge) - **Professor and Chairman of Department**

S. T. Ariaratnam, B.Sc. (Eng.) (Ceylon), M.Sc. (London), Ph.D. (Cambridge) - - - - - - **Professor**

M. Z. Cohn, Candidate of Tech. Sc. (Bucharest) - - **Professor**

W. R. Drynan, B.A.Sc. (Toronto), M.Sc., Ph.D. (Texas) - **Professor**

C. P. Fisher, M.A.Sc. (Toronto), Ph.D. (Texas) - - **Professor**

143
N. C. Lind, M.Sc. (Royal Tech. Univ. of Denmark), Ph.D. (Illinois) - - - - - - - Professor
W. A. McLaughlin, B.Eng. (Saskatchewan), M.S., Ph.D. (Purdue) Professor and Associate Chairman.
J. T. Pindera, Dr. of Tech. Science (Poland). Docent habil. (Cracow) - - - - - - - Professor
D. T. Wright, B.A.Sc. (Toronto), M.S. (Illinois), Ph.D. (Cambridge) - - - - - Professor and Dean of Engineering
V. K. Handa, B.Sc. (Calcutta), B.Sc. (Eng.) (London), M.Sc. (Queen’s), M.Sc., Ph.D. (Waterloo) - - Associate Professor
B. G. Hutchinson, B.E. (Sydney), M.Sc. (Queen’s) Ph.D. (Waterloo) - - - - - Associate Professor
H. B. Poorooshasb, B.Sc. (Manchester), Ph.D. (Cambridge) - - - - - Associate Professor
J. D. Scott, B.Sc. (Queen’s), M.S., Ph.D. (Illinois) - - Associate Professor
E. F. Burnett, B.Sc. (Capetown), M.Sc. (London) - - Assistant Professor
R. Green, B.Sc. (Eng.) (London), M.Sc. (Queen’s), M.Sc. (Waterloo), Ph.D. (Texas) - - Assistant Professor
H. M. Hill, B.Eng., M.Sc. (Saskatchewan) - - Assistant Professor
W. Lennox, B.A.Sc., M.A.Sc. (Waterloo) - - Assistant Professor
E. Matyas, B.A.Sc. (Toronto), Ph.D. (London) - - Assistant Professor
J. Shortreed, B.Eng.Sc. (Western), M.Sc. (Queen’s) - - Assistant Professor
T. H. Topper, B.A.Sc. (Toronto), Ph.D. (Cambridge) - - Assistant Professor
T. E. Unny, B.E. (Madras), M.Tech. (Kharagpur), Dr. Ing. (Dresden) - - - - Assistant Professor
O. L. White, B.Sc. (Melbourne), M.A.Sc. (Toronto) - - Assistant Professor
C. Marsh, B.A. (Cambridge) - - - - Adjunct Professor
I. Holubec, B.A.Sc., M.A.Sc. (Toronto) - - - - Lecturer
B. LeLievre, B.Eng. (West Australia), M.A.Sc. (Waterloo) - - Lecturer
P. H. Meincke, B.Sc. (Manitoba) - - - - Lecturer
C. Schmidt, B.A.Sc. (Waterloo), M.S. (Illinois) - - Lecturer
Jan. J. Munk, B.Eng. (McGill), LL.B. (Osgoode Hall) - Special Lecturer

Undergraduate Course Descriptions

22. Mechanics of Deformable Solids II. A general treatment of the behaviour of structural components from the study of stress and strain in solids. Topics include Mohrs circle for stresses, strains and moments of inertia, superposition, theories of failure, elastic and inelastic analysis of unsymmetrical bending, shear centre, torsion of cellular members, columns and stability, virtual work, complementary energy, and an introduction to beams on elastic foundations.
31. Theory of Structures. Analysis of simple determinate and indeterminate
Department of Civil Engineering

structures. Topics include static and moving loads on beams and trusses; influence lines; cables; deflections by virtual work, moment area and Williot Mohr; methods of superposition, slope deflection and moment distribution.

32. Behaviour of Steel Structures. Plastic analysis and the behaviour of structural elements in steel. Topics include inelastic behaviour of steel members, basic theorems of plastic collapse, methods of plastic analysis, beams, tension and compression members, connections.


53. Geotechnical Processes. Hydrology and geomorphology as used in civil engineering planning, design and construction. Erosion, Hydrology: precipitation, evaporation, transpiration. Surface water: rivers and streams, oceans and shorelines. Subsurface water: classification, capillary water, frost action,
permafrost, groundwater flow, artesian water, work of ground water, water supply. Glaciation: continental and valley, erosion, deposition, history. Earth movements due to gravity. Wind: erosion, transportation, deposition. Rock and soil exploration, surface and subsurface methods.

54. Geotechnical Engineering. A critical study of the theories of soil mechanics and their use in soil engineering. Procedures for design and construction of earth retaining structures, shallow and deep foundations, stability of slopes, and earth dams are considered. Structures involving rock mechanics are also discussed.

55. Engineering Aspects of Surficial Soils. Use of geologic and pedologic information and airphoto interpretation principles and techniques in the prediction of engineering properties of soils and the planning of engineering soils surveys.


2 lectures, 3 hours problems, one term.

71. Water Resources Engineering. General introduction to the physical, chemical and biological bases of water treatment and waste water treatment and disposal. Principles of design and construction of facilities for the collection, treatment and distribution of water, and the collection, treatment and disposal of waste waters. The lecture course is supplemented by a series of laboratory experiments related to water quality, measurement and process control.

72. Environmental Health Engineering. An introductory course to the engineering principles underlying environmental sanitation. Environmental health problems of the community and of industry are considered, including water, food, and air supplies, disposal of human and industrial wastes, animal and arthropod vectors, lighting, ventilation, noise, accidents, industrial poisons, and ionizing radiations.

Prerequisite: CE 71.
Department of Civil Engineering


81. Law, Contracts and Specifications. Engineering law. The design and composition of contracts and specifications.

82. Urban Planning. Urban and Regional Planning. The control and administration of land use for various purposes. Problems of regional planning and urban growth related to communications, etc.


84. Design Studies I. Design of civil engineering projects, building structures, bridges, highway and municipal engineering works. Emphasis is given to the interrelationship between practical design and the various sciences and disciplines covered in the undergraduate course of studies.

85. Design Studies II. Advanced studies in civil engineering design related to optional courses offered and direction of special interest.

86. Research Project. Introduction to research problems and procedures in various areas of civil engineering, with particular relation to special interests in optional programmes of students concerned.

Graduate and Research Programmes

Both co-operative and conventional graduate study in Civil Engineering can be undertaken, leading to the degrees of Master of Applied Science or Doctor of Philosophy. There are at present five major areas of study in which specialization may be undertaken: Applied Mechanics*, Geotechnical Engineering, Water Resources Engineering, Transportation Engineering, and Hydraulic Engineering.

Applied Mechanics*. Facilities are available for theoretical as well as experimental research in Applied Mechanics, structural mechanics, concrete, properties of materials, fluid mechanics, and experimental stress analysis. While the major emphasis is placed on thesis research, a number of graduate courses (C.E. 609 through 624) are being offered regularly.

Current research in Applied Mechanics and Structural Engineering includes studies in Structural dynamics, plastic instability of structures, strength and design in reinforced concrete, model testing in soil mechanics, plasticity and instability in plate and shell structures, low cycle metal fatigue, large deflection studies of shells and membranes, theory of design and safety in structures, inelastic behaviour in framed and shell structures, analysis of latticed space
structures, ultimate load studies in reinforced concrete, elastic-plastic strength of pressure vessels, studies of plastic wave propagation, infrared photoelasticity and hydroelasticity.

Geotechnical Engineering. Major subdivisions of study in this area are Soil Mechanics, Foundation Engineering and Engineering Geology. Appropriate courses of study are CE 611, 614, 650 to 654 and 698. The Department has two fully equipped soil mechanics and foundation engineering laboratories.

Current research activities are investigations into the yield behaviour of soils, earth pressure studies, foundation settlement research and model testing in soils, Pleistocene geology of southern Ontario areas, and studies of stresses in earth dams.

Water Resources Engineering. There are several well-equipped laboratories that are used for demonstrations, teaching and research in the area of water resources. Biological and chemical treatment plant units are used to study and evaluate new methods to improve water and waste water quality. Both graduate and undergraduate teaching is carried out in these laboratories.

At the present time, several research projects are being carried out within the water resources laboratories. One project is designed to evaluate the factors that influence the kinetics of anaerobic digestion. The rationalization of design criteria for waste water treatment systems is another current project. A third study is currently in progress that is designed to evaluate the effects and the changes in the concentration of the various forms of nitrogen within an extended aeration unit. Studies of the effectiveness of waste treatment by the algal-bacterial system, within aerated basins, is another current project.

Graduate course offerings in this area, are numbered CE 671 to 675. Supporting courses designed for graduate degree candidates who are interested in water resources are offered by the Department of Biology. Other courses in the area of Hydraulics, Chemistry and related fields are also available.

Transportation Engineering. Major subdivisions of study are Highway Engineering, Traffic Engineering and Urban and Regional Transportation Planning.

In addition to the core courses of C.E. 645 and 646, additional courses (698) are available in the areas listed above. Supplementary courses in urban and regional planning may be taken from the Departments of Geography and Sociology.

Current research activities include investigations into C.B.D. pedestrian circulation patterns, regional highway planning, urban transportation planning, pavement design and materials.

Hydraulic Engineering. Current specialty research underway in this area lies in the fields of open channel hydraulics, sediment transport, hydroelastic vibrations and engineering hydrology. Laboratories are available for experimental study.
A course work Master's degree programme is available in hydraulic engineering for students mainly interested in a professional development programme. Courses in associated areas of fluid mechanics, soil mechanics, planning and economics are available.

Courses available in hydraulic engineering are CE 689, 688, 687, 686 and 698.

**Graduate Course Descriptions**

All courses of one term duration except CE 699 Thesis.


Department of Civil Engineering


646. Transportation Systems II. Systems synthesis. Transportation project planning. Land use and transportation demand relationships, transport requirements.


656. Measurement of Soil Properties. Laboratory and field work in soil sampling and testing. Measurement of soil mechanics parameters for design and research problems. Experiments include permeability, consolidation, direct shear, and triaxial shear.

658. Soil Engineering. (Case Histories) A critical study by the consideration of case histories of the current procedures or design and construction of foundations, earth retaining structures and earth slopes.


675. Air Resources Engineering. The principles of the field of air pollution, health, nuisance, agricultural, etc. Its aspects, causes and sources. Characteristics emission rates and gas flow in ducts and chimneys. The physical properties of particulate matter. The engineering design of air cleaning equipment. Public relations, control ordinances, and zoning. Public administration.


698. **Special Directed Studies.**

699. **Thesis.**

**Department of Classics**

N. H. High, M.S., Ph.D. (Cornell)  
*Acting Chairman of the Department and Dean of the Faculty of Arts*

B. J. Graf, C.R., M.A. (Western) - - - - *Professor*  
P. G. Keleher, C.R., M.A. (St. Mary's, Kentucky) - *Associate Professor*  
P. Keresztes, M.A. (Toronto), Ph.D. (Graz) - *Assistant Professor*  
Sister M. Stella, S.S.N.D., B.A. (Toronto), M.A. (Catholic University) - - - - *Assistant Professor*

R. L. Porter, B.A. (McMaster), M.A. (Princeton) - - - *Lecturer*


W. H. Schnarr, C.R., B.A. (St. Mary's, Kentucky) - - *Lecturer*

S. Haag, B.A., M.A. (Queen's) - - - *Lecturer (part-time)*

V. M. Warrior, (Miss) B.A. (Cambridge), M.A. (McMaster) - *Lecturer*

**Undergraduate Course Descriptions**

*Note:* The number of hours or lectures shown after the course description is an attempt to indicate the "normal"; each instructor determines how often his particular class will meet.

Except for those numbered below 100, all the following courses are Honours courses, but are also open to students in General Arts.

**Greek**

10. **Introductory Greek.** For students who have not matriculated in Greek. 4 lectures.

100. **Epic and Philosophy (to Plato).** Homer, *Iliad*, I, VI, IX; Plato, *Apology* and *Crito*; prose composition and sight translation.  
*Prerequisite:* Grade 13 Greek, Greek 10, or permission. 4 lectures.

152
250. Prose Composition and Sight Translation.
1 lecture.

4 lectures.

350. Prose Composition and Sight Translation.
1 lecture.

3 lectures.

370. Drama and Literary Criticism. Aeschylus, Agamemnon; Sophocles, Oedipus Tyrannos; Aristophanes, Clouds; Aristotle, Poetics.
3 lectures.

450. Prose Composition and Sight Translation.
1 lecture.

460. Philosophy and Political Theory: Plato and After. Plato. Republic (Selections) and Symposium; Aristotle, Ethics and Politics (Selections).

470. Oratory and Biography. Demosthenes, Philippiics I, Olynthiacs; selections from Antiphon, Andocides, Lysias, Isocrates and Isaeus, Plutarch, Demosthenes and Timoleon.
3 lectures.

Latin

10. Introductory Latin. For Students who have not matriculated in Latin. Must be followed by Latin 100 in order to gain credit.
4 lectures.

100. Literature of the Republic. Catullus (Selections); Cicero, Pro Archia; Vergil, Eclogues and Georgics I, IV; prose composition and sight translation. Prerequisite: Grade 13 Latin, or Latin 10, or Latin 50J, or permission.
4 lectures.

250. Prose Composition and Sight Translation.
1 lecture.

260. Letters and Epic. Selections from the letters of Cicero and Pliny; Vergil, Aeneid II, IV, VI.
3 lectures.

350. Prose Composition and Sight Translation.
1 lecture.

360. History, Historiography, and Oratory. Caesar, De Bello Civili I; Livy XXI, XXII; Res Gestae; Cicero, Pro Caelio, Pro Marcello.
3 lectures.
370. Lyric and Elegiac Poetry. Horace, *Odes* and *Carmen Saeculare*; selections from Tibullus, Propertius, and Ovid.
3 lectures.

3 lectures.

450. Prose Composition and Sight Translation.
1 lecture.

3 lectures.

3 lectures.

3 lectures.

Classical Civilization (Courses in Translation)

251. Near Eastern and Greek History. A survey of the civilizations of the Near East and of Greece emphasizing their political, military, social and economic aspects.
3 lectures per week, half course.

252. Roman History. A military, political, social, economic survey of Rome from earliest times to the Empire's fall.
3 lectures per week, half course.

3 lectures.

350. Classical Art and Archaeology. A survey of art and architecture from the Aegean age through the Roman Empire.
3 lectures.

370. Myth, Religion, and Art. Deities, myths, and sagas correlated with literature, religion, philosophy, politics, and art from the 6th century B.C. to the 4th century A.D.
3 lectures.
Department of Design

G. N. Soulis, B.A.Sc. (Toronto)  Professor and Chairman of the Department
J. W. Church, B.Sc. (Queen's), M.A.Sc. (Toronto)  -  Professor
V. K. Handa, B.Sc. (Calcutta), B.Sc. (Eng.) (London), M.Sc. (Queen's), M.Sc., Ph.D. (Waterloo)  -  Associate Professor
P. H. Roe, B.A.Sc. (Toronto), M.Sc., Ph.D. (Waterloo)  -  Associate Professor
N. J. Chaparos  -  Assistant Professor
M. Krampen, Diploma in Visual Communication (Hochschule fuer Gesaltung, Ulm), Ph.D. (Michigan State)  -  Assistant Professor
M. L. Constant, B.Sc. (Toronto)  -  Assistant Professor
C. K. G. Hahn  -  Lecturer

Courses Offered

All courses offered by the Department are one semester and are lecture and laboratory as determined by individual instructors.

The courses are divided into Group A and Group B subjects. Group A subjects have an emphasis on the theory and methodology of design, while Group B subjects have an emphasis on the practical application of theory and methodology in specific problem situations.

Group A

601. Models and Analogues. Analytic and communicative types characteristics of types, parameters of various model types, validity of types, economics of model types.

602. Design Heuristics. The role of decisions and information in heuristics, problem solution mazes and “trees.” Known design heuristics, trial and error, directed trial, sub-set grouping, interactive, etc.


606. Planning of Innovative and Design Processes. Logic of design, determination of operations sequencing, estimates of time, uncertainty, risk and iteration related to design operations and time, determination of design operations nets.


Group B

651. Problems of Spatial Movement and Human Dynamics.
652. Economics of Industrial Product and Structural Design.
653. Industrial Product Design.
654. Design of Visual and Spatial Environments.
655. Design of Communications Media.
656. Analysis and Criticism of Environmental Design.
657. Special Directed Studies.
659. Mass Media: The specific development and implementation of mass media systems.
660. The Design of Cross Cultural Communications.
661. Information and Persuasion through Graphic Symbols.
Department of Earth Sciences

P. F. Karrow, B.Sc. (Queen's), Ph.D. (Illinois)  
Associate Professor and Acting Chairman of the Department

E. C. Appleyard, B.Sc. (Western), M.Sc. (Queen's), Ph.D. (Cambridge)  
Assistant Professor

C. R. Barnes, B.Sc. (Birmingham), Ph.D. (Ottawa) - Assistant Professor

Undergraduate Programmes. Details of the undergraduate programmes offered by the Faculty of Science are to be found on page 88. Combined Honours programmes between Earth Sciences and other departments are being planned. Interested persons should inquire.

Undergraduate Course Descriptions

130. Introductory Geology. An elementary introduction to rocks, minerals and fossils, geological processes and their effects, structural geology, economic geology, and historical geology. Topographical and geological maps; field trips. 2 lectures, 3 hours laboratory.

230. Mineralogy. An introduction to mineralogy and crystallography. Mineral structures and their relations to physical and morphological characteristics. Principles of chemical and optical crystallography. Systematic and determinative mineralogy of rock-forming minerals. 2 lectures, 2 hours laboratory.

232. Petrography. The classification and identification of sedimentary, igneous and metamorphic rocks. The study of rocks in thin sections. Laboratory study of petrographic methods and problems. 2 lectures, 2 hours laboratory. (Half course, winter term).

235. Paleontology. The principles of paleontology, including the species, concept and evolution. The morphology, taxonomy, evolution, paleoecology, and stratigraphic value of fossil animals and plants, with special reference to the invertebrates. Field trips and laboratory study of fossils and fossil assemblages. 2 lectures, 2 hours laboratory.

238. Historical Geology. The historical development of North America with a systematic review of the Precambrian, Paleozoic, Mesozoic and Cenozoic stratigraphy and orogenesis. Field trips. 2 lectures, 2 hours laboratory. (Half course, fall term).

335. **Stratigraphy and Sedimentation.** Stratigraphic principles and practice. The properties, classification, and formation of sedimentary rocks and sedimentary structures. Diagenesis. Sedimentary facies, environments and tectonics. Field trips, laboratory experiments and short projects. 2 lectures, 3 hours laboratory.

337. **Crustal Evolution.** A chronological study of the origin and development of continents and oceans. Geotectonics; orogenesis and epeirogenesis; cratonic and geosynclinal evolution. Shields; islands arcs. Study of selected orogenic belts. 2 lectures, 2 hours laboratory.

338. **Geophysics.** An introductory course on the physics of the earth. Origin, heat and temperature of the earth, study of earthquakes and the earth’s interior through earthquake waves; gravity and isostasy; terrestrial magnetism; effects of heat, temperature, and strain on rocks; origin of continents, mountain ranges; the ocean floors; meteorology; geophysical techniques. 2 lectures.

340. **Structural Geology.** Primary and induced structures in igneous, sedimentary and metamorphic rocks. The physical properties of rocks and the effects of stress on them. The relationship between major and minor structures. Introduction to the methods and interpretation of petrofabrics. 2 lectures, 2 hours laboratory.

†430. **Economic Geology.** Principles and processes governing the formation of ore and industrial mineral deposits. An introduction to mineral economics. The study of important examples, primarily from Canada. Laboratory study will include instruction and practice in ore microscopy. 2 lectures, 2 hours laboratory.

†431. **Geochemistry.** The geological application and interpretation of geochemical data. Chemical characteristics of sedimentary, igneous and metamorphic rocks. Theory of distribution patterns and co-efficients of major and minor constituents. The recognition and elucidation of metasomatic rocks. Introduction to geochemical prospecting. 2 lectures.

†439. **Engineering Geology and Groundwater Geology.** The application of geology to civil engineering problems. Introductory soil and rock mechanics. Urban geology. Groundwater hydrology. The exploitation and conservation of groundwater resources. 2 lectures, 1 hour problems.

†440. **Geomorphology and Quaternary Geology.** The origin and classification of landforms. Weathering and soil formation. Erosional and depositional processes. Stratigraphy and history of the Quaternary Period with emphasis on glaciation. Laboratory study of topographic maps and air photo interpretation. Field trips. 2 lectures, 3 hours laboratory.

† to be offered in 1967.

158
Department of Economics

P. G. Cornell, E.D., M.A., Ph.D. (Toronto)
 Professor and Acting Chairman of the Department.

N. E. Lavigne, C.R., B.A. (Western), M. Comm. (Ottawa),
 M.B.A. (Detroit) - - - - - Associate Professor

L. P. Fletcher, B.Com. (Mount Allison) A.M.,
 Ph.D. (Brown) - - - - - Assistant Professor

W. R. Needham, B.Comm (Carleton), M.A. (Queen's) - Assistant Professor

L. P. Sydor, B.A. (Western), M.A., Ph.D. (Princeton) - Assistant Professor

Note: The number of hours or lectures shown after the course description is an attempt to indicate the “normal;” each instructor determines how often his particular class will meet.

15. Economics. A one-semester course in the elementary principles of Economics offered to Engineering students. The subject matter of the course is the same as that of Economics 100. It differs from the latter course, however, in that more use is made of mathematical analysis, and more attention is given to the application of economic analysis to engineering problems. Winter and Spring Term, 3 lectures.

100. Introduction to Economics. A general survey course in the principles of economics. Among the topics discussed are the determination of prices, the measurement and determination of the level of national income and employment, the monetary and banking system, public finance and fiscal policy, labour unions, international trade, and Canadian economic problems.

3 lectures.


3 lectures.

230. Money and Banking and National Income. A study of the American, British and Canadian banking systems with particular reference to Canadian central banking and monetary policies since 1935. Some time is also devoted to a discussion of the measurements and determination of the level of national income, employment and prices, money flow accounts, monetary and business-cycle theory, the theory of inflation and international monetary economics.

3 lectures.

240. Economic History of Canada. The economic development of Canada in its North American setting. Particular emphasis is given to Canadian development within the framework of the staple export hypothesis and the developing international economy.

2 lectures, 1 hour discussion. Given in alternate years.

255. Principles of Accounting. Double-entry bookkeeping; the bookkeeping cycle; preparation of financial statements; matching revenues and expenses;
depreciation methods and inventory-evaluation problems; accounting for bonds, stocks, and dividends; capital budgeting; direct and indirect costs; consolidation; flow-of-funds analysis; interpretation of financial statements.

3 lectures.

260. **European Economic History.** European economic development from the Roman Empire. Emphasis is given to the nature and origin of the forces which gave rise to particular methods of economic organization and institutions, and to the emergence of the market society.

2 lectures, 1 hour discussion. Given in alternate years.

300. **Statistical Methods.** Frequency distributions; measures of central tendency dispersion; skewness and kurtosis; probability theory; tests of hypotheses; sampling techniques; time series analysis; aggregation and index numbers; the estimation and testing of economic relationships using regression and correlation techniques.

3 lectures.

330. **Public Finance.** The place of public expenditures and revenue in the national economy, taxation, debt management, and the role of fiscal policy in economic stabilization.

3 lectures.

340. **International Trade and Finance.** The pure theory of international trade; balance-of-payments statistics; meaning and measurement of payments imbalances; exchange-rate systems; commercial policy; international investment and foreign aid; problems and suggested modifications of the international monetary system. Considerable emphasis is given to the role of international transactions in development policies.

3 lectures.

365. **Corporate Finance.** A brief survey of the principles of financial organization and control, and of financial management of corporations.

3 lectures.

370. **Labour Economics.** History of trade unionism, wage and employment theory, collective bargaining, labour law, social-security system, unions and democracy, the wage-price issue, labour and economic development.

3 lectures.


3 lectures.

390. **Welfare Economics.** Concept of efficiency; Pareto, Scitovsky, Hicks, and Little criteria for increase in welfare; application of welfare economics to government expenditures and taxation, international economics, location of industry, and public utilities.

3 lectures.
400. Advanced Economic Theory. Analysis of the theories of representative economists. Most attention is given to the writings of Marshall, Chamberlain and Keynes.
3 lectures.

3 lectures.

450. Economics of Development. Examines economic development and growth as they have been conditioned by innovations, technology, savings, methods of resource allocation, factor endowments, public policy, population. Growth theories, land use, and institutional structuring of society are also considered. Prerequisite: Economics 100 and 200.
3 lectures.

3 lectures.

470. Mathematical Economics. Mathematical formulation of economic theory; solutions to systems of simultaneous difference and differential equations; an introduction to dynamic models; analysis of stability conditions; an introduction to linear and nonlinear programming, input-output analysis, and game theory.
3 lectures.

3 lectures.

3 lectures.

Department of Electrical Engineering

A. R. M. Noton, B.Sc. (Sheffield), B.Sc. (London), Ph.D.
(Cambridge) - - Professor and Chairman of Department

R. G. Anthes, B.A.Sc., M.A.Sc. (Toronto)
Professor and Associate Chairman of Department

H. C. Ratz, B.A.Sc. (Toronto), S.M. (M.I.T.), Ph.D.
(Saskatchewan) - - - - - - Professor

L. Y. Wei, B.S. (National Northwestern College, China), M.S., Ph.D.
(Illinois) - - - - - - Professor
Undergraduate Course Descriptions

12. Electricity and Magnetism I. An introductory course in electricity and magnetism.


(b) - Magnetostatics - The Biot-Savart Law. the magnetic induction field, Ampere's Law, solenoids. Torque on a current carrying loop, the galvanometer. Magnetic force on moving charges, the d.c. motor.

23. Analogue Computation: Principles of continuous computation, electronic computing modules, computer diagrams, programming and scaling concepts. The solution of linear and nonlinear differential, equations, transfer function and system simulation. Signal-flow graphs, algebraic equations, steepest descent techniques, partial differential equations, adjoint computing procedures, automatic analogue iteration methods. Introduction to digital-analogue simulator programs, MIDAS programming on the IBM 7040, FACTOLUS programming on the IBM 7040 and 1710 computers. Hybrid computing, the 1710-TR48 hybrid system; Fortran hybrid instructions. Digital control of continuous systems. Hybrid optimizing techniques. Prerequisite: Math. 31. 3 lectures, 3 hours alternate laboratory, one term.

24. Logic and Switching I. The logical design of relay and electronic switching circuits. Boolean algebra. Algebraic equivalent of switching logic; tables of combinations. Relay contact networks, elementary diode, vacuum tube, transistor, and magnetic core switching circuits. Prerequisite: EE 42, EE 52. 3 lectures, one term.

32. Electronics. Introduction to the principles and characteristics of diodes, vacuum tubes, transistors, and other electron devices, and to the design and analysis of rectifiers, amplifiers, and other electronic circuits. Prerequisite: EE 12, EE 13. 3 lectures, 3 hours laboratory, one term.

42. Network Theory. A continuation of GE 12 restricted to linear systems and dominantly electrical components; correspondence between the time domain, and real and complex frequency domains through Fourier and Laplace transforms; systematic formulation procedures for the equations of linear systems; network theorems, analytical solutions for simple periodical and non-periodical excitations, transient and steady state response, frequency response; phasor methods for sinusoidal steady state conditions; resonant circuit, two ports, and balanced polyphase circuits. Prerequisite: GE 12. 4 lectures, one term.

44. Pulse and Switching Circuits. The design and analysis of circuits used in the generation and shaping of non-sinusoidal waveforms, including linear and non-linear wave shaping, and gating, voltage and current sweeps, multivibrators and the blocking oscillator. Prerequisite: EE 42, EE 52. 3 lectures, one term.

45. Network Synthesis. Energy functions. Network functions: synthesis of passive one ports; introduction to the synthesis of LC and RC two ports. Prerequisite: EE 43, Math 44 or Math 45. 3 lectures, one term.

51. Electronics I. Introduction to physical principles of conduction phenomena in vacuum tube, gas tube, and solid state devices. Vacuum diode, gas
diode, and semiconductor diode characteristics and models. Analysis of simple diode circuits, including rectification, filtering, and detection. Vacuum triode, multi-element vacuum tube, and transistor characteristics; piecewise linear and small signal models. Analysis of simple vacuum tube and transistor circuits. Introduction to other electron devices.
Prerequisite: EE 12.
3 lectures, one term.

52. Electronics II. Time domain and frequency domain analysis of various vacuum tube and transistor amplifiers, including RC coupled and feedback amplifiers. Various broad-band low-pass power amplifiers, oscillators, and frequency converters. Amplitude and frequency modulation and detection.
Prerequisite: EE 51, EE 42.
4 lectures, one term.

55. Solid State Electronics. Classical and quantum statistics, carrier concentrations and mobilities in semiconductors, determination of the Fermi level, bulk and surface recombinations, general mechanisms and mathematical treatment of photoconductivity, theory of p-n junction photocell, Dember effect. Macroscopic phenomena of superconductivity, the London equations, Cryotrons. Introduction to quantum electronics, conditions for population inversion, linewidth, gas lasers, injection lasers, ruby and other solid state lasers.

3 lectures, one term.

62. Electromechanics II. Development of dynamic and steady state equations for the generalized rotary energy conversion device. Study of d.c. and a.c. machines as particular types of the generalized device with particular emphasis on their steady state and transient external characteristics.
Prerequisite: EE 61.
3 lectures, one term.

Prerequisite: EE 62.
3 lectures, one term.

65. Power Systems Analysis. Generation of polyphase power, and power calculations in polyphase systems. Symmetrical components analysis of unbalanced systems, sequence components and impedance systems. Fault calculations on transmission lines and distribution networks. Parameters and
Department of Electrical Engineering

characteristics of transmission lines in steady state.
Prerequisite: EE 62.
3 lectures, one term.

3 lectures, alternate 3 hours laboratory, one term.

Prerequisite: EE 71.
3 lectures, 3 hours alternate laboratory, one term.

3 lectures, one term.

75. Dielectrics and Magnetics. Polarization in solids, electron and molecular polarizabilities, dielectric constant, dipole relaxation and dielectric losses, anisotropy and non-linearity in optical dielectrics, piezoelectricity. Magnetic polarization, diamagnetism and paramagnetism, quantum theory of paramagnetism, nuclear and electron spin resonances, ferromagnetism, quantum theory of ferromagnetism, ferrites, spin dynamics, spin waves, magnetic anisotropics, domain walls, small particle magnets, magnetostriction.

81. Control Systems I. Review of modelling of dynamic properties for physical components and systems in terms of ordinary differential equations; Laplace domain models and transfer function concepts for linear systems; block diagram manipulations; analysis of linear systems, with emphasis on feedback systems, in the time domain, s-domain, and frequency domain; stability criteria; performance specifications and system design and compensation through analysis.
Prerequisite: GE 12, EE 51 or EE 32.
3 lectures, one term.

82. Control Systems II. Further study of feedback control systems. Design of control systems, examples taken from electrical and hydromechanical systems. Analogue computer simulation. Introduction to nonlinear systems
analysis, phase plane and describing function techniques. Introduction to statistical systems analysis, optimum system criteria.
Prerequisite: EE 81, EE 23.
3 lectures, one term.

83. Communication Theory. Relation between information content of messages and system capacity; transmission through electric networks; modulation systems; periodic sampling, noise, comparative analysis of information transmission systems. The role of system bandwidth and noise in limiting the transmission of information is stressed.
Prerequisite: EE 52.
3 lectures, one term.

91. Electrical Laboratory I. An introduction to the theory and techniques of measuring instruments for electrical quantities, their uses and limitations, errors.
3 hours laboratory, alternate weeks, one term.

93. Electrical Laboratory III. A series of experiments and problems to accompany electrical engineering courses given in semester IIIA (EE 42, EE 51, EE 61).
4½ hours, one term.

94. Electrical Laboratory IV. A series of experiments and problems to accompany electrical engineering courses given in semester IIIB (EE 52, EE 62, EE 71).
4½ hours, one term.

95. Electrical Laboratory V. A series of experiments and problems to accompany electrical engineering courses given in semester IVA (EE 72, EE 81 plus electives).
6 hours approximately, one term.

96. Electrical Laboratory VI. A series of experiments and problems to accompany electrical engineering courses given in semester IVB (EE 82 plus electives).
6 hours approximately, one term.

99. Seminar. Each student is required to investigate in depth a current engineering topic of his choice. Approval of a topic must be obtained from a member of the department prior to the start of the IVA term. The results of the investigation are to be communicated in the IVB term as a written report and in the form of an oral presentation.

Graduate and Research Programme

Graduate Credit in Electrical Engineering

Graduate credit is measured in "units." A unit is a course at the graduate level taken for one semester, and which requires, as a prerequisite, preparation at the Bachelor's level. Two units are given to a graduate course which con-
tinues for two semesters. Senior undergraduate courses as approved by the Electrical Engineering Department may be allowed as credit for graduate students at one-half unit per semester. For each student, no more than two units total credit can be given to undergraduate courses.

Students transferring from other universities of recognized standing may be allowed a maximum of two units for graduate courses previously taken. No graduate credit is given for any undergraduate course taken at other universities.

A normal full-time load is four units per semester. Under exceptional cases a student is permitted to take a maximum load of five units for a semester. For part-time students, the maximum load is reduced from four units per semester by one unit for each seven hours per week of employment or outside work.

The Master's Degree Programme

The Master's degree programme in Electrical Engineering is designed to be flexible, and to accommodate both regular full-time and co-operative part-time students.

A complete programme consists of at least ten units. Each student's programme must be approved by the Electrical Engineering Department, and is worked out in advance with a professor who acts as an advisor.

The student's course work is considered unsatisfactory, and he is required to discontinue, if more than one course in Electrical Engineering receives a grade below 66%, or more than two courses in fields other than Electrical Engineering receives a grade below 66%.

An essential ingredient in a graduate programme is opportunity for individual work. To be recommended for a Master's degree in Electrical Engineering, a candidate must submit either a Research Thesis (EE 699) or an Engineering Report (EE 698). Topics are worked out in discussion with the faculty, and the project is done under the direct supervision of a professor in the Electrical Engineering Department, and is finally approved and accepted by that professor. A thesis under EE 699, five units, and a project under EE 698, two units. It is not possible to obtain credit under both EE 698 and EE 699 for the same degree.

All course work and thesis for the Master's degree must be completed within four consecutive academic years. It is possible for a full-time student of exceptional ability to complete the requirements for the Master's degree in one academic year.

The Ph.D. Programme

The major objective of the Ph.D. programme is to emphasize the importance of performing original research of high calibre. The requirements of the comprehensive examination, the supervising committee, course work, and the
language examination are all considered aids to performing satisfactory re-
search. Facilities for Ph.D. programmes are available in most fields of study
described below and as described in more detail in the Research Brochure.

Graduate Course Descriptions

601. Advanced Network Theory. Study of linear graphs and their associated
matrices, graphs of passive and active networks. Discussion of the rank and
independence of network equations; analysis of the various procedures for
solution (mesh, node, node-pair, etc.) Study of several topological results useful
Digital techniques are emphasized throughout.

602. System Theory. A review of the fundamental theorems of matrix theory
and linear graph theory. Formulation of system equations based upon terminal
representation of components. Branch-chord equation formulation and trans-
form methods. State-space equation formulation and time-domain methods.
An introduction to constituent matrices and matrix calculus.
2 hours lectures, one term.

604. Network Synthesis I. Properties of driving point and transfer functions
for linear passive networks. Synthesis of general one ports. Synthesis of passive
two ports.

606. Network Synthesis II. A continuation of 604 to include the approximation
problem, time domain synthesis, active synthesis through negative impedance
converters, etc.
One term.

607. Statistical Theory of Communications. Statistical basis for the description
of signals; Lebesque measure and integration. Generalized harmonic analysis;
correlation functions and spectral densities; statistical properties of message
ensembles; optimum linear systems; filtering and prediction; correlation
detection.
Prerequisite: EE 83.
One term.

608. Information Theory. Advanced concepts of information theory; coding
and filtering; properties of information measure; relationship with thermo-
dynamics entropy; language studies; informational redundancy and adaptive
systems; signalling in the continuous channel.
Prerequisite: EE 607, and EE 613.
One term.

609. Electromagnetic Engineering I. Maxwell's equations; time harmonic
complex notation, general orthogonal coordinates. Wave theory; propagation,
reflection, boundary conditions, lossy media. Polarization; polarization ratio,
representation in terms of left and right circularly polarized waves. Plane,
cylindrical, and spherical wave functions; waveguides, cavities, surface wave
transmission. Radiation; Poynting's vector, sources of radiation, Green's functions, the dipole. Antennas; linear antennas, arrays, impedance, gain, supergain, pattern synthesis.

One term.

610. Electromagnetic Engineering II. Boundary value problems; Green's functions, integral equations, variational techniques. Rayleigh-Ritz methods. Microwave circuits; cylindrical waveguide mode expansion, waveguide junctions, network and impedance concepts, scattering matrix, waveguide discontinuities. Introduction to the theory of partial coherence; mutual coherence function, quasi monochromatic analysis, coherent and incoherent limits, interferometer and linear array applications.

611. Advanced Electronics Circuits I. A study in depth of selected circuits used in electronics, using both vacuum tubes and transistors. This is an analysis course in which various techniques are used, but Thevenin and Norton equivalent circuits and the pole zero approach are stressed. Analysis of such amplifier circuits as coscode, differential, operational, feedback, Darlington, etc., are included and are applied in the analysis of more complex circuits. Short-cut methods are introduced, based on these concepts.

One term.

612. Advanced Electronic Circuits II. A continuation of EE 611 to include clamping and clipping circuits, flip flops, twin T configurations, butterworth filters, break point analysis of complex diode circuits, etc.

Prerequisite: EE 611.

One term.

613. Information Transmission. Sampling and quantization of data; information measure; communication entropies and mutual information; coding efficiency and redundancy; noise and error probabilities in transmission channels; block codes and error correction; channel capacity.

Prerequisite: EE 83.

One term.

614. Electrons and Phonons I. Hamiltonian and dynamics of linear lattices, properties of creation and annihilation operators, second quantization Umklap process, electron-phonon interaction, interference condition, Block integral equation, conductivity of metals at high and low temperatures, the general variation principle, Bardeen's theory of metallic conductivity. Theory of mobility in semiconductors, deformation potential, lattice scattering, impurity scattering, impurity conduction, hot electrons.

Prerequisite: Phys. 431 or equivalent.

2 hours, one term.


617. **Communication Systems Engineering.** Consideration of the factor related to the design of communication systems; summary of the historical development of the art; system performance requirements; consideration of channel characteristics; modulation and reception techniques; comparisons of reliability, costs, convenience, availability, and economic factors. 
Prerequisite: EE 83.
Two hours per week, one term.

618. **Electrons and Phonons II.** Collective description of electron interactions, Bardeen and Pines theory of electron-phonon interaction in metals, Nakajima’s transformation, collective descriptions of electron phonon interactions, effective mass theory from a many particle approach. Frohlich theory of superconductivity, Bardeen-Cooper-Schrieffer theory, Bogoliubov’s theory. Theory of Polaran, the Hamiltonian formulation, Feynman’s path integral formulation. 
Prerequisite: EE 614.

619. **Electroacoustics.** Physical and physiological fundamentals of audio vibrations; properties and applications of electroacoustics transducers; analysis and measurement of sound; recording and reproduction of sound, synthesis of sound. 
One term.

2 hours, one term.

623. **Quantum Electronics.** Angular momentum and momentum matrices, time-independent and time-dependent perturbations, Einstein transition probabilities, interaction between matter and radiation, line breadth. Raman effect, Larmor theorem, Zicman and Stark effects, Dirac’s wave equation, electron paramagnetic resonance, ammonia beam maser, solid state maser, gaseous and solid state lasers, quantum tunneling through thin films and across junctions between similar or dissimilar materials. 
Prerequisite: Phys. 431 or equivalent. 
3 hours, one term.

624. **Advanced Techniques and Measurements on Solids.** Crystal growing, x-ray diffraction analysis of crystals, galvanomagnetic effects in semi-conductors, superconductivity, electron paramagnetic resonance, ferroelectricity, infrared and visible light spectroscopy, lasers, Mossbauer effect.

631. **Nonlinear Control Theory I.** Phase plane and state space methods of analysis of nonlinear second order and higher order systems, stability analysis by the second method of Lyapunov, describing function methods for feedback systems.

633. Nonlinear Systems with Random Inputs. Least mean square smoothing and prediction, optimum linear systems; direct and transform methods applied to nonlinear devices; characteristic functions, correlation functions, and power law representation; detection theory, matched filters and maximum likelihood detection.
Prerequisite: EE 607.

634. Control Systems with Random Inputs: Correlation functions and spectral densities, the mean-square error criterion and parameter optimization, Wiener-Hopf integral equations, Wiener filters, addition of mean square constraints, extension to sampled-data systems.
2 hours lectures, one term.


636. Adaptive Control Systems. Simple ad hoc solutions, such as the limit cycling system. Model reference systems. Identification by means of test signals. Learning models and more general approaches using digital techniques.
2 hours lectures, one term.

637. Variational Methods in Control Engineering. Performance criteria, classical calculus of variation, dynamic programming, digital control systems, continuous form of dynamic programming, multi-variable control systems, Pontryagin's Principle with examples, the two point boundary problem, computer control of processes.

EE 638. Process Control and Optimization. Electronic instrumentation for control and measurement in industrial processes, data processing and computer control, sampling and quantization, problems of automatic optimization.

639. Advanced Topics in System Theory. Topics selected may include theorems in matrix calculus, functions of matrices, computer formulation of state-space equations. Hamiltonian formulation, theorems on controllability and observability, the dual problem of control, the identification problem, topics in state-space synthesis, stochastic and time-varying parameters.
2 hours lectures. One term. Offered in Winter term.
Prerequisite: EE 602.

640. Sampled Data and Digital Controls. Modification of Nyquist's and the Root Locus method. The z-transform, stability, discrete filters. Digital control systems, computer word length and sampling rate. Discrete imitations of con-
Continuous controllers. Dynamic programming and the solution for multivariable systems.
2 hours lectures. One term.

2 hours per week, one term.

**698. Special Problems in Electrical Engineering.** Directed study of a special topic of interest to the individual student; may be an experimental or design project, or an engineering application related to a particular problem. Credit given as for a course upon completion of a satisfactory engineering report. Individual supervision. Not a reading course.
One or two terms.

**699. Thesis.** Research leading to the submission of a thesis as part of the requirements for an advanced degree.

---

**Department of English**

W. U. Ober, B.A. (Washington and Lee), Ph. D. (Indiana)

C. F. MacRae, B.A. (Western), M.A. (McMaster),
Ph.D. (Toronto) - - - - - Professor

W. K. Thomas, M.A., Ph.D. (Toronto) - - - - Professor

E. M. Boyd (Miss), A.B. (Grinnell), M.A. (Chicago),
Ph.D. (Columbia) (Roberts Fellow) - - Associate Professor

L. A. Cunnings, A.B. (Washington), M.A. (Missouri),
Ph.D. (Washington) - - - - Associate Professor

W. R. Martin, M.A., D. Litt. et Phil. (South Africa) - Associate Professor

A. I. Dust, M.A., Ph.D. (Illinois) - - - Assistant Professor

H. E. Haworth (Mrs.), M.A., Ph.D. (Illinois) - Assistant Professor

Sister M. Leon, S.S.N.D., B.A. (Toronto), M.A.
(Detroit) - - - - - Assistant Professor

R. Levitsky (Mrs.), B.S.Ed. (Central Missouri S.C.), M.S. Ed.
(Illinois Normal), Ph.D. (Missouri) - - Assistant Professor

J. S. Stone, M.A. (British Columbia) - - Assistant Professor

C. Davison (Mrs.), B.A. (Toronto) - - - - Lecturer
English Major and Note on Numbering

English Major in General Arts

In Year I the prospective English major should select English 101, Philosophy 100, Science 100, at least one of French 100, German 100, and Latin 100, and other subjects in accord with the general regulations.

For the session 1966-67 the following regulations will obtain:

In Year II the English major shall complete at least English 201 and 251.
In Year III he shall complete (a) English 301, (b) another English course chosen from the whole range of courses offered (except 225 and 335), and (c) either English 345 (Senior Essay) or an Honours English course.

Note on numbering: English 101 and 300 are designed for both Honours and General students. Otherwise courses numbered 250-299, 350-399, and 450-499 are Honours courses, and all others are General courses.

Course Descriptions

Note: The number of hours or lectures shown after the course description is an attempt to indicate the "normal"; each instructor determines how often his particular class will meet.

15. English Literature. Designed for students in Applied Physics and Co-operative Mathematics, this course seeks to further the understanding and appreciation of the various types of English literature and of the humanistic values to be found in it. Since such understanding cannot be separated from the clear and effective communication of the ideas concerned, students are required to write a number of essays on topics related to the literature studied.
3 lectures.

50J. Preliminary Year English. General literature and composition; the Ontario Grade 13 curriculum will be followed.
4 lectures.

101. The Art and Themes of Literature. A study, through representative works, of the major genres, modes, and methods of literature, and its principal re-
Department of English

curring themes. For all first-year Arts students electing English.
3 lectures.

130. The Types of English Literature. An examination of the nature and forms of English literature, to be combined with practice in writing. (Primarily for Science students).
3 lectures.

201. Masterpieces of English Literature, I. A study of the masterpieces of English literature from the Middle Ages to the latter part of the eighteenth century.
3 lectures.

210. The Novel. A study, through selected authors, of the principal techniques and movements in the development of the English novel from its beginning to the present day.
3 lectures.

215. The Development of Drama to 1660. A study of the origins and development of English drama, with special concentration on the contribution of the sixteenth and early seventeenth centuries.
3 lectures.

220. Drama from 1660. A study of the principal playwrights, plays, and movements in dramatic history from the re-opening of the theatres in 1660 to the present day.
3 lectures.

225. Principles of Dramatic Production. An introduction to directing, acting, and staging, with practical experience in the University’s Theatre of the Arts.
3 hours a week.

235. Selections from the Literature of Ideas. This course, which deals chiefly with the moral implications of scientific, political, social, and economic thought, is designed both to stimulate thought and to improve the student’s ability to express himself in a clear, organized fashion. Students are required to write essays and seminar papers on the topics discussed. (Primarily for Science students, but open to General Arts students.)
3 lectures.

251. Literary Criticism: Its Origins and Practice. One part of the course is devoted to a study of the major classical critics and of the transmission of their writings through Italian and French critics. The other part provides a training in the application of critical principles to the works of literature.
3 hours a week.

261. Old English and the History of the Language. An introduction to the Anglo-Saxon language and literature in their historical context, and a study of the development of the English language to modern times.
3 lectures.
270. Middle English, with Special Emphasis on Chaucer. A study of Middle English literature, partly in translation and partly in the original, with special emphasis on the works of Chaucer, which will be read in the original. 3 lectures.


300. American Literature. A survey of the development of American literature from the beginning to the present time and an exploration of the themes of such major figures as Poe, Emerson, Thoreau, Hawthorne, Melville, Whitman, Clemens, James, Eliot, and Faulkner. 3 lectures.

301. Masterpieces of English Literature, II. A study of the masterpieces of English literature from the end of the eighteenth century to the present day. 3 lectures.

310. Literature of Canada and the Commonwealth. A survey of Canadian and Australasian poetry and prose, with some consideration of the literatures, in English, from South Africa and the West Indies. 3 lectures.

330J. American and Canadian Literature. The literature and literary history of British colonial America, of the Revolution and early American republic, and of the nineteenth and twentieth centuries in the United States and Canada, with some attention to cultural history, studied by means of lectures, reports, tutorials, quodlibets, papers, and tests. 3 meetings per week.

335. Creative Writing. Aimed at encouraging the student to develop his creative and critical potentials, the course consists of supervised practice, tutorials, and seminar discussions. Enrolment is limited and, in order to be accepted, an applicant must first submit a MS as evidence of his ability to profit from the course. 3 lectures.

340. Nineteenth-Century Literature. Designed to complement English 301, this course provides a more intensive study of Romantic and Victorian literature. 3 lectures.

345. Supervision of Senior Essay. 3 hours a week.

350. Seventeenth-Century Non-Dramatic Literature. A study of the non-dramatic literature of the Jacobean, Caroline, and Interregnum periods, with special attention to Milton's major works. 2 lectures.
360. Drama to 1642. The rise of the drama and dramatic form; the work and influence of Shakespeare's predecessors; the life and works of Shakespeare; the post-Shakespearean drama to the closing of the theatres.
3 lectures.

370. The Augustan Age. An historical and critical study, in seminars, of the drama, poetry, novels, and other writings of the age from Dryden to Burns.
3 lectures.

380. The Romantic Movement. A critical study, in seminars, of the principles and practice of the English Romantic authors (poets, novelists, and essayists) from Blake to Keats.
3 lectures.

390. Beowulf. A literary and linguistic study of the Old English epic Beowulf (and the Finnsburg Fragment) with an investigation of its origins in history and mythology.
Prerequisite: English 261.
2 lectures.

451. Literature of the Victorian Age. An historical and critical study of the writers in the period between the Romantic era and the rise of characteristically twentieth-century literature; with special emphasis on the major poets (Tennyson, Browning, and Arnold), on the more important novelists (Dickens, Thackeray, Eliot, James), and on writers of general and critical prose works of lasting significance (Newman, Ruskin, Mill, Huxley).
4 lectures.

460. Twentieth-Century British Literature. A critical study of works by Shaw, Yeats, Eliot, James, Conrad, Joyce, D. H. Lawrence, and others of the modern period.
3 lectures.

470. History of Literary Criticism. A study in seminars of the literary criticism of the four great ancients and of English writers from the Elizabethans to the present day.
2 lectures.

475. English Linguistics. The principles of English grammar. The first third of the course deals with historical and comparative linguistics, with particular application to the history and development of English; the latter two-thirds stress structural linguistics, with reference to English grammar.
3 lectures.

480. Senior Seminar. Designed specifically for fourth-year students in programs combining Honours English with a fraternal discipline, this course provides a study of the major works in those periods of English literature in which students have not taken Honours courses. Individual syllabi are prescribed for each student, and the course is conducted on a seminar basis, with students presenting and criticizing reports.
3 hours a week.
495. Supervision of Senior Honours Essay.
3 hours a week.

Note: Upon securing the consent of the departmental chairman and the instructor concerned, Science and Engineering students may choose courses from those offered to Arts students.

Graduate Programme

In the autumn of 1967 the Department of English plans to introduce a graduate programme leading to the degree of Master of Arts in English.

Department of French

F. K. Montgomery (Miss), B.A., M.A., (Western), D. de l'U. de Paris - - - - - - Professor and Chairman of Department

M. I. Kieffer, C.R., B.A. (St. Louis), M.A. (McGill), J.C.D. (Gregorian) - - - - - - Professor J

R. L. Myers, B.A. (Western), M.A., Ph.D. (John Hopkins) - Professor

A. Ages, B.A. (Carleton), M.A., Ph.D. (Ohio State) - Associate Professor

D. Walter (Mrs.), B.A., M.A. (Queen's) - - - - - - Professor

J. R. Finn, C.R., B.A. (Western), M.A. (Toronto), Ph.D. (Illinois) - - - - - - Associate Professor J

J. T. Ralston, C.R., B.A. (Western), M.A. (Laval), Ph.D. (Catholic U. of America) - - - - - - Associate Professor J

J. J. Binamé, L. en Phil. rom., Agrégé (Brussels) - Assistant Professor

P. Gaudet, B.A. (Ottawa) - - - - - - Lecturer

D. H. Gauthier, B.A. (Queen's) - - - - - - Lecturer

C. E. Jose, B.A. (Western), M.A. (Toronto) - - - - - - Lecturer

S. Moirenc (Miss), L-ès-L., D.E.S., C.A.E.C. (Paris) - - - - - - Lecturer

A General Arts student majoring in French will complete French 160, 200 and 300 (or 220J and 330, or 310J and 320J) and any two Honours courses chosen in consultation with the departmental chairman.

Note: The number of hours or lectures shown after the course description is an attempt to indicate the "normal;" each instructor determines how often his particular class will meet.

50J. Preliminary Year French. Authors and Composition. The Ontario Grade 13 curriculum will be followed.
4 lectures.

100. A Survey of French Literature from the Middle Ages to the Present Day. Oral practice in the language laboratory.
Department of French

Prerequisite: Grade 13 French. (This course is open to any qualified student not honouring or majoring in French).
3 lectures.

160. Selected Works of the Nineteenth and Twentieth Centuries. Lectures and written reports. Intensive grammar review with the use of the language laboratory.
Prerequisite: Grade XIII French. (This course is open only to students honouring or majoring in French).
4 lectures.

Prerequisite: French 100.
3 lectures.

220J. French Literature from the Pléiade to the Encyclopédistes.
Prerequisite: French 100.
3 lectures.

250. Grammar and Prose Composition; Phonetics and Oral Practice.
Prerequisite: French 100 or French 160.
2 hours of lectures and 1 hour of phonetics and oral practice.

260. French Literature and Culture of the Seventeenth Century. Lectures, reports, discussions in French.
Prerequisite: French 160.
3 lectures.

300. Survey of the French Drama. A study of typical examples of French drama from the 17th century to the present.
Prerequisite: French 100.
3 lectures.

310J. Survey of Twentieth Century French Literature.
Prerequisite: French 100.
3 lectures.

320J. Survey of Nineteenth Century French Literature.
Prerequisite: French 100.
3 lectures.

Prerequisite: French 220J.
3 lectures.

350. Grammar and Prose Composition.
Prerequisite: French 250.
2 lectures.

360. French Literature of the Eighteenth Century. Lectures, readings, reports in French.
Prerequisite: French 260.
3 lectures.
370. **French Literature from Balzac to 1900.** Lectures, readings, reports in French.  
Prerequisite: French 160.  
3 lectures.

450. **Advanced Composition and Oral Practice.** The language laboratory will be used.  
Prerequisite: French 350.  
2 lectures.

460. **Sixteenth Century French Literature.** Lectures and seminars in French.  
Prerequisite: French 360.  
2 lectures.

470. **Medieval French.** Reading of Old French; survey of Medieval French literature, beginning with La Chanson de Roland. Lectures, reports.  
Prerequisite: French 360.  
2 lectures.

480. **French Literature since 1900.** Lectures and seminars in French.  
Prerequisite: French 370.  
2 lectures.

**Graduate Courses**

All graduate courses with the exception of the Thesis are one term courses.

600. **Literary Criticism in French (Problems and Methods)**

601. **History of the French Language**

602. **Medieval French Literature**

603. **Literature of the Renaissance in France**

604. **Reading Course in approved topics**

605. **Classical Tragedy in Seventeenth Century France**

606. **Comedy at the time of Molière**

607. **The Theatre in Eighteenth Century France**

609. **Rousseau or Diderot**

610. **Romanticism in Nineteenth Century French Literature**

611. **Realism and Naturalism in the Nineteenth Century Novel**

620. **Twentieth Century French Literature**

625. **The Literature of French Canada**

699. **Thesis.**
General Engineering

11. Engineering Synthesis. Principles of problem statement, analysis, and concept creation in the design process. Discussion of planning, the flow of information, physical, economic and financial feasibility, and concept selection as related to project design. Discussion of social and economic conditions affecting value and utility, and their relationship with the design process in the solution of engineering problems. The application of simulation, modelling and optimization to the above: three term projects.

2 hour lectures, 1 hour problems, first term.

12. Introduction to Engineering Systems. Introduction to basic methods of analysis through mathematical models for components and processes. Systematic formulation of terminal representations and of system equations or linear systems, utilizing terminal and system graph concepts in conjunction with matrix notation. Solutions through Laplace transforms and by computer methods. Examples are drawn from the various engineering disciplines.

13. Management Science I. Applications of economic performance indices in choosing between engineering alternatives and choosing optimum operating levels. Topics: the planning process; generation and classification of cash flows; accounting concepts; methods for tangible evaluation of alternatives; capital resources and allocation principles; determination of minimum costs and maximum profit; elements of economic measurement, analysis, and forecasting; competition.

3 hours per week.
1 term.


2 hours, one term.


4 hours alternate weeks, one term.

22. Graphics II. The application of graphics to the solution of Vector problems, both co-planar and non-coplanar. Graphic calculus both integration and
differentiation, design of all types of nomographs: design of special slide rules: continuation of free hand sketching.
4 hours, week, one term.

23. Measurement. (First term) Nature of measurement, scales and measurement units. Complementary variables and postulates of measurement. Concepts of accuracy, precision, systematic and random errors. Probability, normal distribution function, elementary sampling. Propagation of errors in calculations, formation of measurement specifications. 2 lectures. Measurement Laboratory. (Second Term) Use of design morphology in development of measurement techniques for specific problems illustrating other Year I courses. 3 hours laboratory, alternate weeks.

24 Tutorial. Students will meet in very small groups with a faculty member designated as their tutor. Performance in problem assignments and conceptual difficulties with other courses will be discussed, along with interrelation of present coursework, later work and engineering practice. The student will be responsible to his tutor for undertaking of certain assignments in the other courses. 1 hour per week, both terms. (Consultation periods with teaching assistants regarding specific course problems as and if required at the initiative of the student or his tutor, will be available).


32. Fluid Mechanics. Physical properties of fluids and fundamental concepts of fluid flow. Dimensional analysis and similitude, a survey of the principal problems of fluid mechanics on the basis of dimensional analysis. Conservation laws for mass, momentum, energy and entropy, applications to a variety of engineering problems such as flow in pipes, turbomachines, etc. 3 hours lectures, 3 hours laboratory.


51. **Micro Structure of Materials.** Crystal structure and lattice, X-ray and electron diffraction analysis, chemical binding, Bloch waves and band model, quantum statistics, imperfections and their interactions, diffusion.

52. **Physical Properties of Materials.** Lattice vibrations, phonon and electronic specific heats, thermal conduction, phases, elasticity, plasticity, mechanical properties, electric conduction in metals, semiconductors and superconductors. 2 hours lectures, 3 hours laboratory.

53. **Structure and Properties of Matter I.** Gases; condensed states of matter; origin of interatomic forces; structure of crystals and non-crystalline solids; free electron theory of metals; semiconductors; physical electronics; optical processes; magnetic properties; nuclear processes. 2 hours lectures, 1½ hours laboratory, 1 term.

54. **Structure and Properties of Matter II.** Properties associated with primary forces, waves and vibrations, theory of systematic reactions; properties associated with defect structures, plasticity, viscosity, hardness, creep, brittle fracture, ductile fracture, fatigue; stability under service environment.

61. **History and Philosophy of Science.** The nature of science; science and technology in Egypt and Babylon. The development of science in Greece; the Orphic mysteries and the Ionian philosophers. Plato and Aristotle; Archimedes. The Alexandrian school and the separation of science and philosophy. Technology under the Roman Empire. The mediaeval attitude toward science. The Renaissance. Copernicus and Galileo. Sir Isaac Newton. The physical and biological sciences during the 18th century. Developments during the 19th Century in physics, chemistry, technology, geology, evolution, and the rise of modern genetics. The 20th century revolution in pure science and technology. 3 lectures, one term.

**Department of Geography**

R. R. Krueger, M.A. (Western), Ph.D. (Indiana)  
Professor and Chairman of Department

A. de Vos, M.Sc. (Wisconsin), Ph.D. (Wisconsin)  
Professor

A. Diem, B.A. (Wayne State), M.A. (Clark), Ph.D. (Michigan)  
Associate Professor

D. K. Erb, B.Sc. (Western) M.A. (Toronto), Ph.D. (McGill)  
Associate Professor

J. T. Horton, B.A. (Wheaton), M.A. (Northwestern)  
Assistant Professor

R. M. Irving, B.A. (Toronto), M.A. (Toronto)  
Assistant Professor

R. A. Murdie, B.A. (Waterloo), M.A. (Chicago)  
Assistant Professor

E. R. Officer, B.A. (British Columbia), M.A. (Wisconsin)  
Assistant Professor

183
N. Pearson, B.A. (Dunelm) - Assistant Professor
H. J. Stolle, Kart. Ing. (Berlin) - Lecturer (Part-Time)

Note: The number of hours or lectures shown after the course description is an attempt to indicate the "normal"; each instructor determines how often his particular class will meet.

15. Survey of Geography. This one term course presents a general review of the field of geography, its scope, approach, and basic concepts. The primary aim is to provide the student with background, material, readings, sources and ideas against which major political developments, international economic relationships, and current problems of the commonwealth and underdeveloped areas may be viewed. Course topics include: the development and character of modern geography; fundamentals of physiography; population patterns and problems; resources, economic growth and industrialization; the geographic bases of political patterns and events; and urban growth and land use planning.
3 lectures, one term.

100. Introductory Physical and Cultural Geography. This course is designed to introduce the student to the field of modern geography, its methods, concepts, materials and point of view. A major part of the course is devoted to a systematic examination of the elements of the natural environment, (including landforms, weather, and climate), and their distribution and significance in the human habitat. Selected aspects of economic and political geography are then considered, with an emphasis on world resources and the geographic bases of economic development, international trade, and political relationships.
Note: Geography 100, or its equivalent, is normally a prerequisite for other courses in geography.
2 lectures, 2 hours laboratory.

210. World Economic and Cultural Geography. Concepts and principles of economic and cultural geography; emphasis on industrial and agricultural geography; population distribution and characteristics; diffusion of culture and technology.
2 lectures, 2 hours laboratory.

220. World Regional Geography. This course studies in depth selected areas of the world's climatic regions, emphasizing characteristic problems of these regions as well as their physical, cultural and economic inter-relationships. Amongst the many factors which are discussed are the utilization of natural resources, the effects of increasing population density, the occupancy and utilization of urban and rural land, and the effects of man's tools, techniques, and institutions on the earth's surface.
2 lectures, 2 hours laboratory.

250. Urban Geography and Settlement Patterns. A description and analysis of the geographic characteristics and relationships of urban centres, their origin, development, distribution, functions, internal structure, economic and political
Department of Geography

organization; industrial and commercial locational factors; the effects of transportation on settlements patterns.
2 lectures, 2 hours seminar.

260*. Cartography. Cartographic principles, techniques, and basic mapping procedures; scales, map projections and design analysis or cartographic presentation, drafting.
3 hours seminar and/or laboratory. (Given in fall term).

275*. Introductory Air Photo Interpretation. The technique of air photo interpretation as applied primarily in the field of geography and resources inventory. Interpretation of landforms, geological features, soils, natural vegetation, drainage patterns, and rural and urban land use.
3 hours laboratory, seminar and field work. (Given in spring term).

300*. Geomorphology. A study of landforms and their origins. Basic geomorphologic processes, the influence of climate, vegetation, soils and geology, and the general significance of landforms to man.
2 lectures, one, two hours laboratory. (Given in fall term).

2 lectures, 2 hours laboratory. (Given in spring term).

341. Regional and Historical Geography of North America. The physical, economic and political geography of North America. The geographical influences of changing patterns of human occupancy. The historical-geographical approach to current economic and political problems.
3 lectures.

345. Political Geography. A study of differences from place to place in political phenomena. Subjects covered include, the interrelationships of states and nations, centripetal and centrifugal "forces" within states, electoral geography, boundary and frontier problems, the location of capital cities, internal organization of states, external relations, and geo-politics.
3 lectures.

355. Principles of Biogeography and Resources Development. Principles of plant and animal geography and biogeography; regional approach to land-use planning and resources management, resources inventories, conservation of renewable resources.
3 lectures.

356. Urban and Regional Planning: Principles of Planning and Design. Fundamentals of design as they relate to regional and urban planning problems; civic design and landscape design; survey analysis and synthesis; construction and layout; models, sketching, perspective, proportion, presentation techniques.
3 lectures.

185
3 hours lecture and/or seminar.

380. Seminar on Subfields of Geography. Seminar discussion on the major subfields of geography not covered in the mandatory core of courses; inventory and prospect of geographical research. Guest lectures will be arranged.
Prerequisite: Honours Geography students only.
3 hours seminar.

Geog. 400. Advanced Geomorphology. Advanced study of geomorphologic processes, morphometric analysis and applied geomorphology. Erosion, mass-wasting and associated slope development processes will be emphasized.
Prerequisites: Geog. 275, 300 and Earth Sc. 130.
3 hours seminar and/or lab.

Geog. 401. Advanced Air Photo Interpretation. Basic photogrammetric principles including mensuration, radial line plotting, the use of stereo plotters, mosaic and map construction. Detailed air photo interpretation, micro feature analysis, and problem studies in geographic and geomorphologic fields, will be emphasized.
Prerequisites: Geo. 275, 300 and Earth Sc. 130.
3 hours seminar and/or lab.

Prerequisite: Geography 260.
2 hours seminar and/or lab.

404. Seminar on Quantitative Methods in Geography.
Prerequisite: Geography 375.
3 hours seminar and/or tutorial.

420-429. Geographic Analysis of Selected World Regions. Detailed study of physical, cultural, economic and political geography; geographic basis of current problems.
Prerequisite: Geography 100 and 220, or consent of instructor.
3 lectures.

422. Eastern Europe and the Soviet Union.
423. Middle East.
424. Asia.
425. Oceania.
426. Africa.

186
427. Latin America.

428. United States of America.

429. Polar Lands.

450. Soils and Rural Geography. The geography and problems of rural land use. The classification of soils and applied soil classification systems. Physical and economic factors affecting agricultural production. 3 lectures.

456. Urban and Regional Planning: Political and Administrative Processes. The origins and development of planning legislation in various regions of the world; the planning process in a statutory context; federal, provincial and municipal powers affecting survey, plan and implementation in urban, regional and resource planning in Canada; social, economic and political problems associated with planning. 3 lectures.

470. Area Studies Seminar. 3 hours seminar and/or tutorial.

475. Special Readings and Seminar on Selected Topics. 3 hours seminar and/or tutorial.

476*. Special Readings and Seminar on Selected Topics.

480. Geographic Thought and Methodology. Historical development of the discipline of geography contributions of German, French, British and American geographers; current trends in the philosophy and methodology of geography. 3 hours seminar.

490. Senior Honours Essay or Research Project Related to Teaching. 3 hours seminar.
Graduate Courses

600. Physical Geography.
610. Economic Geography.
620. Regional Geography.
645. Political Geography.
650. Urban Geography.
656. Urban and Regional Planning
657. Agricultural Land-Use Problems

Department of German and Russian

J. W. Dyck. A.B. (Bethel), M.A. (Missouri), Ph.D. (Michigan)
Professor and Chairman of the Department

E. Heier, B.A., M.A. (British Columbia), Ph.D. (Michigan)
Professor (Germ./Russ.)

H. Hennecke - - - - - - - - - - Visiting Professor

J. Winkelman, M.A. (New York), Ph.D. (Michigan) - Professor (German)

I. Levitsky, A.B. (Rochester), M.A. (Buffalo) Ph.D. (Duke)
Associate Professor (Germ./Russ.)

S. Hoefert, B.A., M.A., Ph.D. (Toronto) - Associate Professor (German)

H. Marsden (Mrs.), B.A. (Randolph-Macon), M.A.
Waterloo - - - - - - - - - - Lecturer

M. A. Davies (Mrs.), B.A. (Washington), A.M. (Radcliffe) - Lecturer

W. Shelest, Diploma (Munich), M.A. (Ottawa) - Assistant Professor (Russian)

M. Richter, Staatsexamen (Berlin and Bonn), M.A. (Toronto)
Assistant Professor (Germ./Russian)

German

Note: (1) All courses are designed to acquaint the student with the thoughts, feelings, and ideas that have been expressed in German, Austrian, and Swiss literature.

Particular consideration is being given to critical analysis of literary texts and their contribution to European thought and to the whole of civilization. The programmes for German major and Honours students are intended to give a coherent and complete picture of German literature.
Department of German and Russian

(2) All courses above 100 are honours courses. Those marked with a † are particularly recommended for general students.

(3) German 270 meets the requirement otherwise referred to in the calendar as cultural or civilization course.

Undergraduate Course Descriptions

The number of hours or lectures shown after the course description is an attempt to indicate the "normal"; each instructor determines how often his particular class will meet.

1. Beginner's German. For Engineering students with no previous knowledge of German. The elements of German grammar, reading and translation. 3 lectures.

10. Scientific German. For Graduate Students with no previous knowledge of German. Usage and structure of German scientific writings. Translation in fields of specialization. 3 lectures.

1-50. Beginner's German. For Arts and Science students with no previous knowledge of German. The elements of German grammar, reading, oral practice, composition. Arts - 5 lectures. Science - 3 lectures.

15. Scientific German. A review of the fundamentals of grammar followed by a more advanced study of grammatical structure and idiom. Readings and translation from contemporary scientific writing in the Physical Sciences with the aim of helping the student to acquire a greater vocabulary and to master the stylistic difficulties peculiar to technical writing. The reading material will be selected in accordance with the field of study of the individual student. (For Engineering students. Can be taken together with German 50 for Science students.) Prerequisite: German I or equivalent. 3 lectures.

50. Scientific German. A review of the fundamentals of grammar is followed by a more advanced study of grammatical structure and idiom. Readings and translation from contemporary scientific writing in the Physical Sciences with the aim of helping the student to acquire a greater vocabulary and to master the stylistic difficulties peculiar to technical writing. The reading material will be selected in accordance with the field of study of the individual student. (For Science students. Can be taken jointly with German 15 for Engineering students. Prerequisite: German I or equivalent. 3 lectures.

100. Introduction to German Literary Movements. Reading and interpretation of representative works of major German authors from the beginning to
the present. Oral practice, composition, grammar. This course is conducted primarily in German.
Prerequisite: Grade 13 German or equivalent. First Class Honours in Grade 12 or permission of the Department Chairman.
3 lectures.

250. Conversation, Composition, Grammar and Phonetics. This course is conducted in German and provides intensive practice in spoken German. Vocabulary building, comprehension, pronunciation and intonation are stressed. Prerequisite: German 100. First Class Honours in Grade 13 or permission of the Department Chairman.
3 lectures.

260. The Age of Goethe. Storm and Stress. The Classical Period. Romanticism. Reading, interpretation and critical analysis of representative works of Lenz, Klinger, Goethe, Schiller, Kleist, Novalis, Brentano, Eichendorff, etc. Prerequisite: German 100.
3 lectures.

270. German Thought and Culture. A study of the major thought movements and masterpieces of philosophy, literature, music, art, etc. This course is taught in English.
3 lectures.

350. Intermediate Conversation and Composition. Written reports on prescribed prose, drama and poetry. (Fontane, Hebbel, Keller, Storm, etc.) Prerequisite: German 100 or equivalent.
3 lectures.

370. Introduction to the History of the German Language with Readings in Middle-High German Literature. (Walther von der Vogelweide, Hartmann, Wolfram, Gottfried, etc.) Prerequisite: German 100, or equivalent.
3 lectures.

380. Enlightenment. Reading, interpretation and critical analysis of prescribed prose, drama, and poetry. (Bodmer, Gellert, Gottsched, Lessing, Wieland, etc.) Prerequisite: German 100 or equivalent.
3 lectures.

450. Advanced Conversation, Grammar and Composition. This course is conducted in German and provides intensive practice in spoken German on the advanced level. Prerequisite: German 350 or equivalent.
3 lectures.

460. Modern German Literature. Reading and interpretation of prescribed works. (Hauptmann, Hofmannsthal, Rilke, Kafka, Mann, Brecht, etc.) Prerequisite: German 100 or equivalent.
3 lectures.
470. **German Poetry.** A study of the main thoughts, themes, forms and schools in German poetry throughout the ages. 
Prerequisite: German 100 or equivalent.
3 lectures.

480. **Renaissance-Baroque.** Reading, interpretation and critical analysis of prescribed prose, drama, and poetry. (Tepl, Luther, Sachs, Grimmelshausen, Gryphius, etc.)
Prerequisite: German 100 or equivalent.
3 lectures.

495. **Reading Course in Approved Topics.**

**Graduate Courses**

600*. **German Literary Criticism.** Research techniques, source material, bibliography.

601*. **Intellectual Foundations of German Classicism.**

620*. **Studies of a Modern Author.**

621*. **Recent German Literature.**

630*. **The German Novel.**

631*. **The German Novelle.**

640*. **Lessing.**

641*. **Schiller.**

650*. **Goethe.**

651*. **Kleist.**

660*. **The German Drama to 1889.**

661*. **Twentieth Century German Drama.**

670*. **Medieval German Literature.**

671*. **History of the German Language.**

680*. **Andreas Gryphius and his Time.**

681*. **Heine and Young Germany.**

690*. **Gothic.**

691*. **Old High German.**

692*. **The History of German Literary Criticism.**

695-.698. **Reading Course in Approved Topics.**


All the courses with the exception of the Thesis are one term courses.

**Russian**

**Notes:**
1. All courses above 100 are Honours courses. Those marked with a † are particularly recommended for general students.
2. Russian 270 meets the requirement otherwise referred to in the calendar as *cultural* or *civilization* course.
3. The number of hours or lectures shown after the course description is an attempt to indicate the "normal"; each instructor determines how often his particular class will meet.

1. **Beginner's Russian.** For Engineering students with no previous knowledge of Russian. The elements of Russian grammar, reading, and translation.
   3 lectures.

2. **Scientific Russian.** For Graduate students with no previous knowledge of Russian. Usage and structure of Russian scientific writings. Translation in fields of specialization.
   3 lectures.

3. **Beginner's Russian.** For Arts and Science students with no previous knowledge in Russian. The elements of Russian grammar, reading, oral practice, composition.

4. **Scientific Russian.** A review of the fundamentals of grammar is followed by a more advanced study of grammatical structure and idiom. Readings and translation from contemporary scientific writings in the Physical Sciences with the aim of helping the student to acquire a greater vocabulary and to master the stylistic difficulties peculiar to technical writing. The reading material will be selected in accordance with the field of study of the individual student. (For Engineering students can be taken together with Russian 50 for Science students).
   Prerequisite: Russian 1 or equivalent.
   3 lectures.

5. **Russian Thought and Culture.** (taught in English). This course is divided into two parts. Part I deals with the chronological development of art, literature, social, political and regional aspects during the time of Imperial Russia. Emphasis will be placed on the Byzantine influence and Mongol domination which caused the eventual isolation of Russia from Western culture. Special lectures are devoted to the "Westernization" of Russia under Peter the Great and Catherine II, the coming of the Slavophiles and the Russian Intelligentsia, a thorough discussion of social and political conditions, literary and philosophical contributions to the 19th century which ultimately led to the over-
Department of German and Russian

throw of the Czarist regime. Part II is entirely devoted to the Soviet Union - cultural, political, nationality problems, the establishment of new social institutions, education, Soviet philosophic thought and scientific achievements are discussed in detail.

3 lectures.

50. Scientific Russian. This course aims to make it possible for students of the Physical Sciences to read scientific writing. Emphasis will be placed on translation and reading skill. The fundamental principles of Russian grammar will be reviewed. (For Science students - can be taken jointly with Russian 15 for Engineering students.)

100. Introduction to Russian Literary Movements. Reading and interpretation of representative works of major Russian authors from Pushkin to the present. Oral practice, composition grammar.
Prerequisite: Grade 13, Russian 1-50 or equivalent.
3 lectures.

250.† Introductory Russian Conversation, Composition and Phonetics. Review of grammar, presentation of oral and written reports.
Prerequisite: Russian 100, first class honours in Grade 13 or equivalent.
3 lectures.

260. A Survey of Russian Literature. Reading in Russian of selected texts of 18th, 19th, and 20th century authors: Radishchev, Karamzin, Griboedov, Nekrasov, Turgenev, Tolstoy, Pasternak, etc.

270.† Russian Thought and Culture. A study of the major thought movements and masterpieces of philosophy, literature, history, music, art, etc. The second half of the course will place emphasis on developments during the last forty years. This course is taught in English.
3 lectures.

350.† Intermediate Conversation and Composition. Written reports on prescribed themes and topics. Oral drill.
Prerequisite: Russian 250 or equivalent.
2 lectures.

360.† Russian Realism. (Gogol, Turgenev, Tolstoy, Dostoyevsky, Chekhov, etc.) Reading, interpretation and critical analysis of prescribed prose, drama and poetry.
Prerequisite: Russian 100.
3 lectures.

370. The Golden Age of Russian Literature. (Krylov, Zhukovsky, Pushkin, Lermontov, etc.) Reading, interpretation and critical analysis of prescribed prose, drama, and poetry.
Prerequisite: Russian 100.

380. The Peoples of the Soviet Union. Especially emphasized will be the influence of the non-Slav peoples (the Uralic, Mongol, Caucasian, etc.) on
Russian race and culture. Czarist and Soviet policy towards national minorities, assimilation and integration problems in the light of linguistic divisions; development of literary languages. Some achievements of Soviet anthropology. 3 lectures.

390. The Image of Russian and the Russians in Western Thought and Writings. This is a critical appraisal of the changing image of the Russian and Russia as presented by West European writers, poets and thinkers. Consideration will also be given to the image of western man in Russian literature. 3 lectures.

450. Advanced Conversation, Composition, Grammar and Phonetics. This course is conducted in Russian and provides intensive practice in spoken Russian on the advanced level. Prerequisite: Russian 350 or equivalent. 2 lectures.

460. Soviet Literature. (Gorki, Mayakovsky, Babel, Fedin, Pasternak, Sholokhov, etc.) Reading, interpretation and critical analysis of prescribed prose and drama. Prerequisite: Russian 100. 3 lectures.

470. Russian Literature in Translation. Major works by Pushkin, Gogol, Turgenev, Tolstoy, Dostoevsky, Chekhov, and Gorki. Prerequisite: At least one course in any other literature. 3 lectures.

480. Russian Poetry Throughout the Ages. A study of themes, forms and schools. (Pushkin, Lermontov, Essenin, Mayakovsky, Pasternak, etc.) Prerequisite: Russian 100. 2 lectures.

Graduate Courses

600*. Russian Literary Criticism. (Problems and Methods)

601*. Pushkin or Lermontov.

620. Old Church Slavonic.

621. History of the Russian Language.

630*. Tolstoy.

631*. Dostoevski.

640*. The Russian Drama.

641 - 645. Reading Course in Approved Topics.

650*. Contemporary Soviet Literature.
651*. Early East Slavic Literature (the Epics, the Byliny, the Chronicles.)


Note: All 600 courses are one term courses with the exception of 620, 621, and 699.

Ukrainian

200. Introduction to Ukrainian Literature. Review of Ukrainian grammar; the place of Ukrainian in the Slavic family of languages; reading and interpretation of representative selections chosen from the works of Skovoroda, Kotliarevsky, Shevchenko, Franco, L. Ukrainka, Stefanyk, Kobylians'ka, Tychyna, Ryl's'ky, and other contemporary writers.
3 lectures. Admission by consent of the instructor.

300. Taras Shevchenko and His Age. Kharkov and Kiev as literary centers; the Brotherhood of SS. Cyril and Methodius; the literary revival in Western Ukraine. Reading and critical analysis of prescribed prose, drama, and poetry (Shevchenko, Kostomariv, Kulish, Shashkevych, and others).

Department of History

P. G. Cornell, E.D., M.A., Ph.D. (Toronto)  
Professor and Chairman of the Department.

K. A. MacKirdy, M.A. (British Columbia), Ph.D. (Toronto) - Professor

A. W. Rees, M.A. (Wales) - - - - - Professor R

H. MacKinnon, B.A. (Montreal), Ph.L., S.T.L. (Gregorian), M.A. (Toronto), D.Phil. (Oxon) - - - - - Professor

Ph.D. (Washington) - - - - - Associate Professor

E. P. Patterson, B.A. (Baylor), M.A. (Kansas), Ph.D. (Washington) - - - - - Assistant Professor

Y. F. Zoltvany, B.A. (Loyola), M.A. (Montreal), Ph.D. (Alberta) - - - - - Assistant Professor

R. C. MacGillivray, B.A. (Queen's), A.M., Ph.D. (Harvard) - - - - - Assistant Professor

D. A. Davies, B.A., Ph.D. (Washington) - - - - - Lecturer

H. Schlossberg, B.A. (Bethel), M.A. (Missouri), Ph.D. (Minnesota) - - - - - Lecturer

S. L. Sandler, B.A. (Houghton), M.A. (Columbia), Ph.D. (London) - - - - - Lecturer

T. Barcsay, M.A. (Toronto) - - - - - Lecturer

P. E. Dembski, M.A. (Toronto) - - - - - Lecturer
1. General Course. Students majoring in History will normally choose their courses from History 100, 201/202, 211/212, 221/222, 231/232, 301/302, 303/304, 311/312. They will fulfill the requirement History 349.

Students in the General Course in any field with a standing of at least B average in their previous year may, with the permission of the department, be admitted to any History course.

2. Honours Course. The Honours History programme recommended on page 34 is the standard prescription. The programme for each student must be arranged in consultation with the department.

A student in Honours in any discipline other than History can be admitted to any History course with the permission of the department.

3. Master of Arts. In History there are two programmes leading to the degree of Master of Arts.

In proceeding to the degree by courses alone the candidate will offer: (a) History 600, and (b) three other graduate courses selected in consultation with the staff. Subject to departmental approval, one of the courses may be selected from graduate courses in another department. The candidate will also be required to have a reading knowledge of an appropriate second language.

In proceeding to the degree by courses and a thesis the candidate will offer:

(a) History 600, (b) a minor field (a second graduate course) and (c) a major field (a thesis and a comprehensive examination in the period). The candidate will also be required to have a reading knowledge of an appropriate second language.

4. Not all the courses listed below are offered each year.

5. The number of hours or lectures shown after the course description is an attempt to indicate the "normal"; each instructor determines how often his particular class will meet.

Undergraduate Course Descriptions

100. An Historical Introduction to the Ideas of Western Civilization. Designed especially for freshmen.
2 lectures, 1 hour discussion groups.

110. An Introduction to Historical Method. This course is designed to introduce the gifted freshman student to the concepts, methods and materials of historical study. One significant theme or limited historical period will be dealt with in some depth.
3 hours, lectures and seminars.

201. Expansion of Europe since 1400 - The American Phase
3 hours
Department of History

202. * Expansion of Europe since 1400 - The Afro-Asian Phase. Surveys the course of Portuguese, Spanish, Dutch and French colonial expansion as compared to the historical development of British overseas institutions (1400 to the 20th century).
3 hours

211. " British History, 800 A.D. to 1714.
3 hours

212. * British History, 1715 to the present.
3 hours

221. * Modern European History: Central Europe from the Peace of Westphalia to the Revolutions of 1848. Political, social and economic problems will be stressed.
3 hours

222. * Modern European History: Eastern Europe with an Emphasis on Russian History from the Seventeenth Century. Political, social and economic problems will be stressed.
3 hours

5 hours

232. * European History 1867 to World War I. Select problems in the political, industrial and cultural development of Western Europe.
3 hours

250. History of Medieval Europe.
3 hours, lectures and seminars.

3 lectures.

3 hours, lectures and seminars.

270. Asian History.
3 hours, lectures and seminars.

274. * Modern Russian History. The course will focus on important aspects in the development of the Russian state and society from the founding of the Romanov dynasty. Particular attention will be given to: (a) the growth of Tsarist autocracy, (b) the expansion of the Russian empire, (c) the evolution of serfdom, (d) the rise of the intelligence, (e) The Russian Revolution.
3 hours

276. * Modern German History. The course will cover in some depth selected topics during the period 1600 to 1850. (a) The Thirty Year's War; its causes
and consequences. (b) The rise of Brandenburg-Prussia. (c) The Habsburg realm and Prussia in the early 19th century. (d) 1848 and its aftermath in Central Europe.
3 hours

277. History of France.
3 hours, lectures and seminars.

280. History of French Canada.
3 hours, lectures and seminars.

3 hours, lectures and seminars.

3 hours.

295. History of the United States to 1865.
3 hours

296. History of the United States since 1865. The growth of a new nation; the territorial and economic expansion of the United States from the Revolution to the Second World War; inter-relationship of economic, social, political, and intellectual developments.
3 hours

301. Canadian History to 1867.
3 hours

302. Canadian History since 1867.
3 hours

303. American History to 1865.
3 hours

304. American History since 1865.
3 hours

3 hours

3 hours

349. Senior Essay. Required of all History majors in the third year of the general course.
1 hour.

3 hours, lectures and seminars.

361. Modern British History to 1660.
3 hours, lectures and seminars.
Department of History

362. Modern British History since 1660.
3 hours, lectures and seminars.

3 hours, lectures and seminars.

380. Canadian History.
3 hours, lectures and seminars.

450. History of the United States. Selected periods in the history of the United States of America (History 295/296, normally a prerequisite).
2 hours.

460. History of the Far East in the Nineteenth and Twentieth Centuries.
3 hours, lectures and seminars.

463. Modern International History, Mainly since 1900.
3 hours, lectures and seminars.

465. Historiography and the History of Historical Writing.
3 hours, lectures and seminars.

470. Senior Tutorial in English History.
3 hours, lectures and seminars.

470. Senior Tutorial in English History.
2 hours.

471. Senior Tutorial in Canadian History.
2 hours.

472. Senior Tutorial in Medieval History.
2 hours.

473. Senior Tutorial in Imperial and Colonial History.
2 hours.

474. Senior Tutorial in German History.
2 hours.

475. Senior Tutorial in Asian History.
2 hours.

476. Senior Tutorial in History of Renaissance and Reformation.
2 hours.

477. Senior Tutorial in the History of Native Response to Colonial Rule.
2 hours.

478. Senior Tutorial in Russian History.
2 hours.

499. Senior Honours Essay. (Required of all History honours students in their fourth year.)
Graduate Courses

600. Historiography and the History of Historical Writing.
610. Canadian History: The Conservative Tradition.
611. Canadian History: The French-Canadian Tradition.
615. Colonial and Imperial History.
620. Modern English History.
621. German History.
622. Medieval History.

Department of Mathematics

R. G. Stanton, B.A. (Western), M.A., Ph.D. (Toronto)
   Professor and Chairman of the Department,
   Dean of the Faculty of Graduate Studies

K. D. Fryer, B.A. (Western), M.A., Ph.D. (Toronto)
   Professor and Associate Chairman of the Department

J. Aczel, Ph.D. (Budapest), Habil. D.Sc. (Hung. Ac. of Science) - Professor
G. Berman, M.A., Ph.D. (Toronto) - - - - - Professor
J. Edmonds, M.A. (Maryland) - - - - - Visiting Professor
W. T. Tutte, M.Sc., M.A., Ph.D. (Cambridge) - - - Professor
H. H. Crapo, A.B. (Michigan), Ph.D. (Massachusetts Institute of Technology) - - - - Associate Professor
G. E. Cross, M.A. (Dalhousie), Ph.D. (British Columbia) Associate Professor

H. F. Davis, S.M., Ph.D. (Massachusetts Institute of Technology)
   Associate Professor
M. A. McKiernan, M.A. (Loyola), Ph.D. (Illinois Institute of Technology)
   Associate Professor
R. A. Staal, M.A., Ph.D. (Toronto) - - - Associate Professor
F. C. Y. Tang, B.Sc. (Hong Kong), M.S. (South Carolina), Ph.D. (Illinois) - - - - Associate Professor
D. G. Wertheim, B.A. (McMaster), M.A., Ph.D. (Toronto) Associate Professor
C. F. A. Beaumont, B.A. (McMaster), M.A. (Toronto) - Assistant Professor
T. M. K. Davison, B.Sc. (Sir George Williams), M.A., Ph.D. (Toronto) Assistant Professor
A. Kerr-Lawson, B.A. (Toronto), S.M. (Chicago), Ph.D. (McMaster) Assistant Professor
Department of Mathematics

R. C. Mullin, B.A. (Western), M.A., Ph.D. (Waterloo)  Assistant Professor
P. J. Ponzo, B.A.Sc., M.A. (Toronto), Ph.D. (Illinois) Assistant Professor
K. A. Rowe, B.A. (Toronto), M.S. (Wisconsin), Ph.D. (Illinois) Assistant Professor
R. A. Wentzell, B.Sc. (Acadia), M.Sc., Ph.D. (Western) Assistant Professor
J. Wilkinson, B.S., Ph.D. (California Institute of Technology) Assistant Professor
E. R. Bishop, B.S. (Acadia), M.Sc. (Waterloo) Lecturer
E. G. Butz, B.Sc. (Toronto), M.A. (Waterloo) Lecturer
R. A. Honsberger, B.A. (Toronto) Lecturer
E. Koch, B.Sc., M.A. (Waterloo) Lecturer
W. P. Kotorynski, B.Sc. (Western), M.A. (Waterloo) Lecturer
D. J. Miller, B.Sc. (McMaster) Lecturer
J. P. McClure, B.Sc. (Waterloo) Lecturer
G. N. Robertson, M.A. (Manitoba) Lecturer
K. Saulkaskas, B.A.Sc. (Toronto), M.Sc. (Waterloo) Lecturer
R. S. D. Thomas, B.Sc. (Toronto), M.A. (Waterloo) Lecturer
B. S. Thomson, B.Sc. (Toronto), M.Sc. (Waterloo) Lecturer
II. I. McIntosh, B.A. (Toronto), F.S.A. (American Society of Actuaries)
Adjunct Professor

D. B. Sumner, B.A., M.A. (Witwatersrand), M.Sc. (Cambridge), Ph.D. (Witwatersrand) Adjunct Professor

Computer Science Division

J. W. Graham, M.A. (Toronto) Associate Professor and Director of Computing Department
D. D. Cowan, B.A.Sc., (Toronto), M.Sc., Ph.D. (Waterloo) Assistant Professor
J. D. Lawson, B.A.Sc. (Toronto), M.Sc., Ph.D. (Waterloo) Assistant Professor
J. C. Wilson, B.A.Sc. (Toronto), M.Sc. (Waterloo) Assistant Professor
Mrs. S. Aczel, M.A. (Szeged) Assistant Professor (part-time)
J. W. Dodd, B.A.Sc. (Toronto), M.Sc. (Waterloo) Lecturer
P. W. Shantz, B.Sc., M.A. (Waterloo) Lecturer

Statistics Division

D. A. Sprott, M.A., Ph.D. (Toronto) Professor
G. W. Bennett, B.Sc., Ph.D. (Adelaide) Assistant Professor
Undergraduate Course Descriptions

Note: The number of hours or lectures shown after the course description is an attempt to indicate the “normal”; each instructor determines how often his particular class will meet

12. Calculus I. Functions and limits, the derivative. Differentiation formulae. Applications to tangents, rates, extremes. The indefinite and definite integrals, fundamental theorem of integral calculus. Applications to area, volume, centroids, moments of inertia, fluid pressure, work, potential. Introduction to the trigonometric, inverse trigonometric, exponential, logarithmic functions. Transcendental functions. Parametric and polar equations. Formal integration and applications to physical problems. Students will work selected problems under supervision. A certain proportion of the problems will include mathematical formulation of physical problems.
3 lectures, 2 hours problems.

2 lectures, 1 hour problems.

3 lectures, one term.

2 hours problems, one term.

2 hours problems, one term.

3 lectures, one term.
Prerequisite: Math 23. 
2 lectures, 4 hours problems, one term.

33. **Differential Calculus**. Real numbers, sequences, limits, continuity. The derivative. General Theorem of Mean Value. Functions of several variables. Implicit functions, Jacobians. Power series with complex terms, the Taylor series for functions of several variables, constrained extrema. The elementary functions for a complex variable. 
Prerequisites: Math 22, 31. 
3 lectures, one term.

Prerequisites: Math. 21, 31. 
3 lectures, one term.

3 lectures, one term.

42. **Vector Methods**. Scalar and vector products; curl, divergence, and gradient. Use of vectors and matrices in discussion of physical problems in mechanics, fluid flow, and electromagnetism. Introduction to tensors. 
Prerequisites: Math 22, 31, and consent of instructor. 
2 lectures, 1 hour problems, one term.

44. **Complex Variable**. Cauchy-Riemann equations, the Cauchy integral theorems, conformal mapping, the Taylor and Laurent series, contour integration. 
2 lectures, 1 hour problems, one term.

45. **Applied Analysis II**. A continuation of some topics listed in Math. 41, complex variables, calculus of variations. 
2 lectures, one term.

Prerequisite: Math 22. 
2 lectures, 3 hours problems, one term.

52. **Mathematical Probability**. Probability distributions, recurrent events,
stochastic processes, with applications to Brownian movement, diffusion, and noise.

3 lectures, one term.

Prerequisites: Math 22, 31, and consent of instructor.
2 lectures, 1 hour problems, one term.

Prerequisites: Math 22, 31, and consent of instructor.
2 lectures, 1 hour problems, one term.

Prerequisite: Math 32.
3 lectures, one term.

Prerequisite: Math 21.
3 lectures, one term.

3 lectures.

100. Fundamental Concepts of Mathematics. A terminal course designed for Arts students who wish to learn something of the fundamental ideas of mathematics but who will not be encountering technical problems of application. The course will include discussion of the fundamental concepts involved in a selection of topics chosen from mathematical areas such as Calculus, Statistics, Probability, Projective Geometry, Non-Euclidean Geometry, Set Theory, Group Theory, Field Theory, Boolean Algebra, Mathematical Logic, Vector Spaces, Matrices, Numerical Analysis.
3 lectures.
3 lectures.

2 lectures, one hour problems.

1 lecture, 2 hours problems.

140. **Calculus.** The topics of Mathematics 130, presented with a view to the special needs of Social Science students. Emphasis will be on basic concepts rather than on the more difficult manipulative techniques.
3 lectures.


2 lectures.

3 lectures.

1 lecture, 2 hours problems.

234. **Applied Mathematics (Mechanics).** The statics of particles and rigid bodies, work and the stability of equilibrium. Motion of a particle in a uniform field. Oscillatory motion in one dimension. Motion of a system of particles and of a rigid body. Central forces. Accelerated reference systems. Motion of a rigid body in three dimensions.
2 lectures.

235. **Actuarial Mathematics.** The theory of compound interest and of life contingencies. An elementary course on the mathematics of investment and

2 lectures.


2 lectures.


3 lectures.


2 lectures.

243. Statistics for the Social Sciences. The topics of Mathematics 233 presented with a view to the special needs of Social Science students. Emphasis will be on basic concepts rather than on the more difficult manipulative techniques.

Prerequisite: Mathematics 140 or equivalent.

3 lectures.

253. Concepts of Statistics. The topics of Mathematics 243 treated without the use of Calculus. In addition to the basic statistical methods, emphasis will be placed on the nature of evidence and inference.

3 lectures.


3 lectures.

331. Abstract Algebra II. Vectors and vector spaces; transformations and matrices; quadratic and Hermitian forms. Algebraic structures, rings and ideals. Matrices with entries from a ring. Canonical forms and eigenvalues; the orthogonal group.

2 lectures.


3 lectures.
2 lectures.

2 lectures, 2 hours laboratory.

335. Finite Differences. A theoretical course in the calculus of finite differences to include summation, the differences of zero, numerical integration, the relation between integration and summation. An introduction to difference equations.
2 lectures.

336. Life Contingencies. An advanced course on problems of single lives and on the death and survival of multiple lives.
3 lectures.

2 lectures.

2 lectures.

2 lectures.

425. Introduction to the Theory of Numbers.
2 lectures.

2 lectures.

427. Graph Theory. Introduction to basic concepts and theorems, connectivity, planarity, arboricity, directed graphs, partial orderings, girth and regularity, the four-colour problem.

2 lectures.
431. **Algebra III.** A continuation of course 331.  
2 lectures.

2 lectures.

433. **Metric Spaces and Integration.** Theory of metric spaces, completeness and compactness, measure in Euclidean n-space, the Lebesque integral, convergence theorems, the Fubini theorem, differentiability, absolute continuity. A study of Branch spaces.  
2 lectures.

2 lectures, 1 hour problems.

435. **Laboratory.** Numerical problems arising in actuarial science and statistics.  
2 hours laboratory.

436. **Mathematical Logic.** An informal introduction to the logic of sentences and predicates, with emphasis on analogies with familiar mathematical structures. Syllogisms and the algebra of sets related to predicate logic. Simplification, logical deduction, duality, consistency and completeness. The concepts of constant, variable, function, and set. Axiomatics.  
2 lectures.

437. **Graduation and Mortality.** Methods of constructing and graduating mortality tables.  
2 lectures.

438. **Estimation and Hypothesis Testing.** The mathematics and logic or estimation and hypothesis testing. Information. Consistency. Efficiency. Sufficiency. Fiducial and confidence intervals. The problems of large and small samples.  
2 lectures.

2 lectures.

440. **Advanced Probability.** Recurrent events. Markov processes and applications to Physics and Biology, including diffusion processes and epidemics.  
2 lectures.

2 lectures.
Department of Mathematics


443. Electromagnetism II. Applications of the Maxwell equations. Reflection and refraction. Introduction to wave guides and antennae. 2 lectures.


446. History of Mathematics. The development of Mathematics from ancient to modern times, including study of prominent mathematicians and their works. Problems will be worked using both modern and historical approaches. 2 lectures.

447. Statistical Mechanics. Applications of probability theory to theoretical Physics. 2 lectures.


Graduate and Research Programmes

Extensive computer facilities are available in the Computer Center and include an IBM 1401, an IBM 1620, an IBM 1710 system, and an IBM 7040. Each year, one or more Visiting Professors spend a term with the Department. Recent visitors include G. Temple (Oxford), W.B. Pennington (Aberystwyth), H. Rund (South Africa), G. Menges (Saarbrucken), C. St. J. Nash-Williams (Aberdeen).

Extensive opportunities for fellowship assistance are available through National Research Council Fellowships and Province of Ontario Graduate Fellowships. In addition, the Department of Mathematics offers a number of Teaching Fellowships which may be held singly, or in conjunction with other Fellowships. For details, correspondence should be addressed to the Department Chairman.

Candidates for the degrees of M.A., M.Sc., M.Phil. and Ph.D. are accepted under the general regulations set forth in the section of the calendar pertaining to the Faculty of Graduate Studies. Candidates for the M.A. or M.Sc. degrees in Mathematics are normally advised to take the degree by course work rather than by thesis.

**Graduate Course Descriptions**

**601.** A series of courses in Numerical Analysis.

(a) **Introduction to Numerical Analysis**
1 term.

(b) **Solution of Ordinary Differential Equations**
1 term.

(c) **Constructive Theory of Functions (Approximation Theory)**
1 term.

(d) **Numerical Methods in Linear Algebra**
1 term.

(e) **Solution of Partial Differential Equations**
1 term.

(f) **Problems in Numerical Integration**
1 term.

604. **Special Functions.** Elliptic functions. The hypergeometric function. The gamma and beta functions. The functions of Laplace, Legendre, Lamé, Mathieu, and Bessel. Orthogonal functions; the functions of Laguerre, Hermite, Chebyshev.

605. **Groups and Matrices.**

611. A series of courses in Probability.

(a) **Introduction to Random Variables.** Probability, random variables, distribution functions, expectation, discrete transform methods.
1 term.

(b) **Theory of Probability.** Measures on a sample space, types of convergence, limit theorems, laws or large numbers.
1 term.

(c) **Stochastic Processes I.** Discrete space — discrete time processes. Discrete space — continuous time processes. Applications in Physics, Biology, Queuing Theory, etc.
1 term.

(d) **Stochastic Processes II.** Mathematical foundations of stochastic processes, continuous space processes. Time-series analysis.

(e) **Special Topics in Probability.**
1 term.

614. **Integral Equations**
1 term.

615. **Group Characteristics and Representation Theory.**

617(a) **Integral Transforms**
1 term.

(b) **Complex Variable Techniques**
1 term.

(c) **Fourier Series and Orthogonal Functions**
1 term.

(d) **Group Theory in Physical Problems**
1 term.


622. **Vector and Tensor Analysis.** Vector spaces, linear transformations, matrices. Euclidean spaces, groups of transformations, algebra of tensors; covariant
differentiation, divergence, Laplacian, curl. Generalizations to Riemannian spaces. Applications to other fields including differential geometry, mechanics, elasticity, hydrodynamics, electricity, and general relativity.

624. Advanced Statistics.

625. Galois Theory.


632. Topics in Variational Theory.

634. Topics in Ordinary Differential Equations.

635. Algebraic Numbers.

639. Functional Equations.


(a) Special Methods. Algebra of probability distributions; Monte Carlo methods; application to queuing theory, replacement theory, and inventory control.
1 term.

(b) Model Analysis. Partially ordered models, stochastic models, general model logic; examples from business, industry, and the military including the Leontieff model from Economics; construction of models, optimization, computational methods.
1 term.

(c) Competitive Models. A selection of topics from game theory, gaming, and decision theory.
1 term.

642. Optimization Techniques.

(a) Analytic Methods. Review of classical methods; optimization of discrete functions, inequalities, introduction to linear programming, steepest descent and optimal control.
1 term.

(b) Search Techniques. Selected topics including Fibonacci search, steepest ascent, partan, pattern search, Robbins-Monro procedure.
1 term.

(c) Linear Programming. Simplex methods; flows in networks; application to transportation problems; assignment problems, and project cost curves.
1 term.
Programming. A selection of topics from non-linear programming including the simplex method for quadratic programming, Lagrangian differential, gradient and gradient projection; introduction to integer programming and dynamic programming.
1 term.

644. Mathematical Genetics.

645. Rings and Ideals.

649. Functional Analysis.

(a) Partial Differential Equations
1 term.

(b) Hyperbolic Partial Differential Equations
1 term.

(c) Elliptic Partial Differential Equations.
1 term.

(d) Parabolic Partial Differential Equations
1 term.

655. Combinatorial Analysis.

659. Linear Operators.

663. Mathematical Logic.


665. Topics in Number Theory.

666. Universal Algebra.

667. Extrema in Graphs.

669. Harmonic Analysis.

672. Statistical Information Theory.

673. Transfinite Arithmetic.

674. Statistical Decision Theory.

675. Linear Graphs. Definitions and basic theorems. Planar graphs and Kuratowski's theorem. Selected topics from advanced graph theory.

676. Analytic Graph Theory.
679. Abstract Measure Theory.
684. Topics in Decision Theory.
685. Topics in Graph Theory.
688. Special Topics in Algebra.
695. Lie Groups.
698. Special Topics in Analysis.

Department of Mechanical Engineering

G. T. Csanady, Dipl. Ing., (Munich), Ph.D. (New South Wales)

Professor and Chairman of Department

S. Alpay, Dipl. Ing., Dr. Ing. (Berlin) 
T. A. Brzustowski, B.A.Sc. (Toronto), A.M., Ph.D. (Princeton) 
M. J. Hillier, B.Sc. (Eng.), B.Sc. (Gen.) (London), D.I.C., M.Sc. (Eng.) (London) 
A. A. Bruneau, B.A.Sc. (Toronto), D.I.C., Ph.D. (London) 
E. W. Brundrett, B.S.A. (Ontario Agricultural College, Guelph), B.A.Sc., M.A.Sc., Ph.D. (Toronto) 
H. L. Evans, M.Sc. (Wales), D.I.C., Ph.D. (London) 
J. H. G. Howard, B.Sc. (Queen's), M.Sc., Ph.D. (Birmingham) 
W. B. Nicoll, S.M. (Massachusetts Institute of Technology), Engineer (Stanford) 
G. F. Pearce, B.A.Sc. (British Columbia), M.A.Sc. (Toronto) 
G. M. Bragg, B.A.Sc. (Toronto), Ph.D. (Cambridge) 
D. E. Coates, B.A.Sc. (Toronto), M.S. (Illinois) 
C. E. Hermance, B.E. (Yale), M.A., M.S.E., Ph.D. (Princeton) 
K. R. Pickarski, Dipl. Ing. (London) 
A. Plumtree, B.Sc., Ph.D. (Nottingham) 
A. M. Hale, B.Sc., M.A. (New Brunswick), B.A.Sc. (Toronto), M.A.Sc. (Waterloo) 
T. Kowalski, B.Sc. (Glasgow), M.S. (Stevens Institute) 
V. Kuppu Rao, B.E. (Bangalore), M.S. (Cornell) 
A. B. Strong, B.A.Sc. (Waterloo)

Professor
Professor
Professor
Associate Professor
Associate Professor
Associate Professor
Associate Professor
Associate Professor
Assistant Professor
Assistant Professor
Assistant Professor
Lecturer
Lecturer
Lecturer
Undergraduate Programmes

Details of the undergraduate programme in Mechanical Engineering are to be found on page 72. All courses extend over one semester only.

Undergraduate Course Descriptions

3 lectures, 3 hours laboratory.

2 lectures, 3 hours laboratory.

2 lectures, 2 hours laboratory.

23. Analysis and Synthesis of Machines. Principles of optimum design, optimizing for minimum cost, maximum power capability, minimum weight, effects of manufacturing errors on product performance, statistical considera-
tion for the factor of safety, optimum design of machine elements; torsion
shafts, beams, gears, etc. Fluctuating loads, impact forces. Analog methods.
Prerequisite: ME 22.
3 lectures.

25. Mechanical Vibrations. A broad development of mechanical vibration and
impact. Transient phenomena, self-excited vibration, torsional oscillations,
multi-mass systems, analogies and analog computer. Forced vibrations,
elimination and absorption of vibration. Measurement of vibration.
3 lectures.

31. Physical Metallurgy I. Nucleation and growth in metals. Diffusion and
sintering. Fundamental aspects of condensed phase equilibria in binary metal
systems. Dinary and ternary entectic phases. Non-equilibria in metal systems.
Surface phenomena. Corrosion and oxidation in metals.
2 lectures.

32. Physical Metallurgy II. Elasticity and plasticity of metals. Recovery,
recrystallization and grain growth. Hardening mechanisms. Heat treatment of
metals and alloys. Shear transformations. Failure in metals.
2 lectures.

Electronic, atomic, electron-atomic and quantum imperfections. Slip disloca-
tions and twinning dislocations. Grain boundaries and domain walls. Shear
transformations. Techniques for observing imperfections. Diffusion.

35. Introduction to Nuclear Engineering. An introductory course in nuclear
reactions and their engineering applications, including neutron/fission chain
reactors, and nuclear radiation uses. Topics covered will include kinds and
characteristics of nuclear reactions and radiations, principles of fission and
decay chain reactions, elementary nuclear reactor design, radiation detection,
effects of radiation, hazards and shielding.
Prerequisite: Physics 15 or equivalent, at least 3B standing.
3 hours lecture per week, 2 hours laboratory every second week.

37. Ceramics. The crystallography of ionic and co-valent compounds. A study
of the mechanical properties of single crystals and polycrystals. Properties of
special ceramic materials.
3 lectures.

38. Materials in Nuclear Technology. Mechanical and physical requirements
of materials used as fuels, moderators, shields and structural components in
reactors. Special problems related to corrosion, radiation damage and high
2 lectures.

41. Manufacturing Science I. Models of a plastically deforming metal; yield
and flow. Analysis and mechanics of mechanical working operations. Patterns
of flow, limiting factors; force, instability and temperature. Influence of pro-
cesses on work piece properties. Applications to forging, drawing, extrusion,
rolling, sheet-drawing and deep drawing. Modern developments: high velocity forming; chemical, electro-magnetic and spark discharge methods.


49. Metrology. Theory and practice of high precision mechanical measurements under strict control conditions — super micrometry; measurements by comparators; profilometry; surface profilography; environmental effects on measurements accuracy; theodolite techniques in the measurements of large structures; collimator applications in machine installation; photography as a mensuration tool for moving (dynamics) conditions, stroboscopic measurements for frequency drift in rotating machinery.

53. Heat Transfer I. Introduction to heat transfer mechanisms. The formulation of heat transfer problems. Temperature distributions in solids under steady and transient heat conduction. Laminar forced convection, the use of boundary layer theory and the integral method for evaluating the heat transfer coefficient. Laminar and turbulent free convection, empirical correlations and introductory analysis. Reynolds and Colburn analogies. 3 lectures, 3 hours laboratory, alternative weeks.

54. Thermodynamics II. Review of the basic concepts and postulates of thermodynamics and the conditions for equilibrium. Reactive systems. An introduction to irreversible thermodynamics. Applications to selected engineering systems including direct conversion devices, gas turbines, other heat engines. Prerequisite: GE 31. 2 lectures, 3 hours laboratory.
Prerequisite: GE 31.
3 lectures.

Prerequisite: ME 53.
3 lectures.

3 lectures.

62. Fluid Dynamics. Ideal Fluids: Equations of motion of non-viscous fluid; sample solutions of two and three-dimensional problems; Fourier analysis; conformal mapping in two-dimensional flow; shortcomings of ideal fluid models. Real Fluids: viscosity, the Navier-Stokes equations, flows at low Reynolds number; laminar boundary layers; short introduction to turbulent flow.
3 lectures.

3 lectures.

3 lectures.

66. Turbulent Flow I. Reynolds stresses, intensity and scale of turbulence. The "law of the wall," logarithmic velocity profile and velocity defect laws,
Department of Mechanical Engineering

3 lectures.

73. Human Factors Engineering. The problems of incorporating human beings into engineering systems. The topics discussed are: the human visual, auditory and musculo-skeletal system, multiple sensory inputs, man-machine dynamics, environmental factors, human stress, group dynamics, and work-place design; the evaluation and testing of man-machine systems.
3 lectures.

81. Seminar. Designed to give the student personal experience in oral presentation of technical information. Also provides an opportunity for students to attend seminars on topics of interest presented by recognized workers in the field.
1 hour.

82. Mechanical Engineering Projects. Engineering assignments requiring the student to demonstrate initiative and assume responsibility. Student activity is guided and co-ordinated by faculty supervisor. In selecting and assigning projects, particular account is taken of the student's field of specialization. Projects, in general, involve technical disciplines beyond the strictly mechanical engineering field.
9 hours laboratory.

90. Nuclear Engineering I. Engineering problems arising from utilization of nuclear reactions. Topics covered include multi-group diffusion theory, kinetics and stability, heat removal and materials problems in nuclear power reactors, direct conversion of nuclear energy to electricity, accelerator design and shielding, and process applications of nuclear radiations.
Prerequisite: Math 55 or equivalent, ME 35 or equivalent and 4B standing.
Two hours lecture per week. 2 hours laboratory every second week.

Graduate and Research Programmes

A. The Master's Degree. Two types of Master's degree are awarded in mechanical engineering: one based on a research thesis, type R, supplemented by some course work, the other based entirely on course work or "scholarship," type S.

Master's degree by course work: Type S is intended mainly for the student entering after some years in industry to bolster his technical background. Part-time or full-time co-operative graduate students may be particularly interested in this degree. The requirements for the degree consist of not less than 8 one-semester courses which must be passed with an average of 66% or better. The courses are selected with a view to ensuring that the student becomes a competent specialist in a certain branch of engineering science. Areas of specialization in which a Master's degree, type S, is offered are, at present.

1) Materials Science
2) Thermodynamics and Heat Transfer

3) Fluid Dynamics

4) Manufacturing Science

A student desirous of entering this programme is advised to consult the co-ordinator of the area of specialization in which he is interested. Course work programmes for the degree are drawn up by the co-ordinator in consultation with the student.

No financial assistance, in the form of teaching or research fellowships is offered to candidates working toward a Master's degree, type S.

The Master's degree, type S, is regarded as a terminal qualification and it is not normally contemplated to admit a graduate having this degree to our Ph.D. programme.

Master's degree by research work: The Master's degree, type R, may, on the other hand, also be regarded as the first year of a coherent three-year course of study toward the Ph.D. degree. However, this is not intended to mean that such is the exclusive purpose of a type R Master's degree: many students may wish to proceed no further than this degree. Also from the University's point of view the M.A.Sc. is a complete qualification and students attaining it are not necessarily admitted to further study toward a Ph.D. degree, but only if they have demonstrated the required ability to carry out independent fundamental research.

In a field of applied science such as mechanical engineering the core of graduate work is normally (excepting the Master's degree, type S, described before) a thesis project with substantial experimental content. The choice of the thesis project is an important decision, because a later change in the student's field of research usually entails loss of time. The most satisfactory way to choose a topic is for the prospective graduate student to interview several faculty members active in research in a field of possible interest to the student, and select a project with the concurrence of a faculty member who will then act as thesis supervisor. Normally, such a faculty member also arranges financial support for the graduate student with the aid of externally obtained research grants. Financial commitments for the support of students are usually made by the faculty early in April so that it is advisable to complete negotiations before the end of March. Arrangements with overseas students and others unable to visit Waterloo several months prior to registration are made on the basis of their interests described on the application form. A faculty member may under such circumstances offer to a prospective student financial support for research in a specific area of the faculty member's interest. Active fields of research in which students may at present be accepted are listed and described in the faculty research brochure. It must be kept in mind, however, that the list is only intended as a guide since new topics are added frequently as the sphere of interest of the faculty expands while some projects are completed or abandoned.
Department of Mechanical Engineering

Once a thesis project has been chosen, a suitable programme of course work to support the research work is agreed upon between the student and the supervisor. When approved by the Faculty of Graduate Studies, this programme, together with the thesis project, constitutes the official set of requirements for obtaining the degree sought by the student.

Candidates registered for an M.A.Sc. degree, type R, will be requested to give advance notice of their intention to submit a thesis, approximately three months before the estimated date of submission. At this time an assessor will be appointed to aid the candidate's supervisor in evaluating the thesis. In most cases the assessor would be a member of the mechanical engineering department, except where some interdisciplinary research is involved.

The official set of requirements for the award of a Master's degree, type R, are (a) that the candidate obtains a pass in all prescribed subjects with an average of 66% or better (b) that his thesis be accepted.

B. The Doctor of Philosophy Degree. This degree is awarded after the candidate has satisfied his supervising committee that his thesis is a substantial original contribution to knowledge and has also demonstrated a high degree of competence in areas of knowledge related to his specialization. The candidate will, to this latter end, take lectures and sit for examinations in a number of courses offered at the graduate level. Approximately at the end of his first year of residence as a Ph.D. candidate a comprehensive oral examination is administered to him by his supervising committee.

The mechanics of thesis topic selection is very much as described under the Master's degree and very often a candidate proceeds from study for a Master's degree type R, to Ph.D. work in the same area of specialization. In order to be admitted to graduate study as a Ph.D. candidate he must have demonstrated his ability to do original research in the course of his Master's degree work. For this reason, should a graduate with a Master's degree, obtained without producing a research thesis, desire to enter our Ph.D. programme, he would have to satisfy the Department that he is able to carry out independent research. To this end he would at first be registered as a candidate for an M.A.Sc. degree, with research thesis. After one year his case would be reviewed and if he had demonstrated the required ability to carry out independent research he would be permitted to change his registration to Ph.D. candidacy with credit, meaning that his course of study would have a minimum length of two academic years counted from his registration for an M.A.Sc. degree with research thesis. In other words, one year of residence would be credited to him towards the total of three required to obtain a Ph.D. degree, on the strength of his course-work type Master's degree as is ordinarily done if the Master's degree involves a research thesis.

The supervising committee of five consists of the supervisor and four other members appointed on the advice of the supervisor. One of these is usually appointed from outside the university, another one from outside the department (often from Mathematics or Physics.)
Comprehensive Examination: A comprehensive examination is normally held approximately 12 months after the candidate has embarked on his Ph.D. programme. It is an oral examination administered by the supervising committee, except that the external assessor may be replaced by a member of the university faculty. On the basis of the examination, the committee decides whether:

a) The scholarly competence of the candidate in his chosen field of specialization and in closely related fields is adequate,

b) The candidate should be instructed through his supervisor to extend his reading of specified fields or even to take further specific courses,

c) The candidate is so lacking in competence in his chosen field that his registration as a Ph.D. candidate should be terminated.

Language Requirements: The candidate must have an adequate knowledge of at least one foreign language as specified by the department. This requirement may be fulfilled either by direct language examination or by the completion of an approved language course with a final grade considered to be satisfactory. When the native tongue of a student is not English, its knowledge is not normally acceptable as satisfying the foreign language requirements, except when the native tongue is French, German or Russian.

Examination of the Thesis: Upon completion of the research the candidate is required to submit four typed copies of the final draft of his thesis to the supervising committee. The thesis is read by each of the members of the Committee. One copy of the four is filed with the Graduate Studies Office for three weeks and is available for all members of the faculty of the University to review. Recommendations of the readers of the thesis may be in one of four categories:

a) Acceptance as submitted.

b) Acceptance with minor modifications as noted.

c) Conditional acceptance with major modifications usually requiring a re-submission.

d) Complete rejection.

Public Presentation: The candidate is required to give a public presentation of his thesis before a colloquium held by his major department. This public delivery will be well advertised in advance throughout the University and possibly at neighbouring institutions. Although this is not construed as an examination, an adequate time is allowed for questions from the floor.

Graduate Course Descriptions
(All one semester courses)

605. Kinematics II. An extension of ME 13. Computing mechanisms, space mechanisms. Use of computers in synthesis and analysis. Four-bar linkage,
Department of Mechanical Engineering


631. Fluid Power Control Systems II. Fluid power conversion: positive displacement pumps and motors; energy storage in fluids in unsteady flow, elastic systems. Fluid power transmission: dynamic response characteristics for hydraulic and pneumatic power control systems; instability; non-linear effects in hydraulic systems with inertial loading.


640. Thermodynamics of Solids. This course will deal with the atomistic and thermodynamic interpretation of the fundamental properties of solids such as diffusion, solidification, surface properties and equilibrium in multicomponent systems.


645. Machinery of Manufacture - Design and Utilization. Modular design vs. composite design; multiple purpose design vs. special function design; tooling design as a parameter in machine tool design; machine tool efficiency analysis by percentage time of cutter contact; effect of climb compensation on tooling costs; three dimensional development by selective etching and tape control. Discussions of actual problems in machine tool applications in Canadian industry.

3 lectures.

Prerequisites: ME 53, GE 32.


662. Viscous Laminar Flows. Survey of experimental results. Equations of motions in tensor form; Navier-Stokes equations; some exact solutions of Navier-Stokes equations in steady and unsteady flows; limiting cases of small and large Reynolds numbers; two-dimensional boundary layers, exact and approximate solutions; three-dimensional axisymmetric boundary layers; boundary layer control. Free jets.

664. Theory of Turbulence. Instability of laminar flows and transition to turbulence; stochastic properties of turbulent flows; measurement methods; homogeneous turbulence models; theories of local isotropy; structure of turbulence in shear flows.


690. Nuclear Engineering II. Advanced topics in nuclear reactor design and analysis: elementary transport theory applications in core design and shielding, coupled nuclear/thermal systems kinetics, fuel and poison management optimisation. Prerequisite: consent of instructor. 2 hours lecture per week.

698. Specially Directed Studies. Directed study of a special topic of interest to an individual student or group of students. May consist of a series of lectures, assigned reading, and a report.

Active Research Projects

Fluid Mechanics. Studies of non-viscous and viscous fluid mechanics; Incompressible and compressible flows; Heat and mass transfer in problems of forced and free convection; Wave phenomena in fluids; Surface and internal waves in the Great Lakes; Fluid power control systems; Fluid mechanics of turbomachinery components: secondary flow in impeller passages, flow in annular and annular diffusers, radial flow with swirl; Problems of Cavitation.

Mechanics of Turbulent Flows. Stability of laminar flows and its effects on transition to a turbulent regime; Turbulent diffusion and its application to studies of diffusion in the atmosphere and in the Great Lakes; Free turbulence in jets, wakes, and plumes; Air pollution; Aerodynamic Noise; Mechanics governing turbulent flow near rigid and flexible surfaces; Turbulent boundary layers with heat and mass transfer; Advanced topics in turbulence.

Materials. Theoretical and experimental studies of dislocations in both single and polycrystalline solids; Physical and mechanical behaviour of materials in reactive environments; Investigation of internal stresses in plastically-deformed solids; The design and properties of composite materials; Microstructural aspects of fatigue; Atomistic growth processes occurring on solidification of metals; Mechanical properties of bones. Hysteretic damping of materials.

Nuclear Engineering. Economics of reactor operation using digital computer models; Heat removal, experimental studies; Fuel and structural materials, experimental and theoretical studies.

Combustion and Heat Transfer from Flames. Combustion of liquid fuels above the critical pressure; Heat transfer from metal-powder flames; Electrical pro-
Department of Mechanical Engineering

properties of metal-powder flames; Flame spread in fires; Ignition and combustion of solid propellants; Combustion instability of solid propellants.

Manufacturing Science. Plasticity applied to forming processes; Instability problems and limiting conditions in forming operations; Bulging, deep drawing, strip buckling in cold rolling; Electromagnetic forming.

For further details the faculty research brochure may be consulted.

Management and Systems Engineering

A post-graduate programme in applied mathematical and systems analysis in Management is offered by the University of Waterloo. Individually tailored training is provided in quantitative techniques for the definition and solution of planning, organizational, and operational problems in industrial, commercial, and financial enterprises.

Research and professional work by Waterloo faculty in closely related fields provide an interdisciplinary environment for Management study: psychology, sociology, manufacturing technology, design, transportation, resource and economic planning and management, control systems, computer technology, simulation and econometrics, statistics and optimisation theory, and others.

The University's Computing Centre includes IBM 7040, IBM 1620 and IBM 1710/Pace TR48 computers with extensive auxiliary equipment and software.

Requirements for the Master's Degree. The Master's degree will be awarded to students who successfully complete four semester-courses from the Management and Systems Engineering curriculum, two from Mathematics, and two courses which may be selected from any Department. Selection of courses is made by the student, in consultation with a faculty advisor, to suit his particular needs and objectives.

In addition to course work, the candidate for the M.A.Sc. degree must present a report or project study incorporating a substantial application of Operations Research or Management and Systems Engineering techniques, to some appropriate real world problem. For co-operative students, the problem must be found within the operational area of the candidate's own firm, and the firm must be willing to allow access to data and, when necessary, clerical assistance for successful completion of the project. The firm will very probably enjoy realizable benefits from the project. There is no requirement for publication of such reports and every attempt will be made to ensure the integrity of confidential information. Full-time students will choose such a problem with the help of faculty. The candidate has, of course, full access to the Library, the computational and consultational facilities of the University and its faculty members, for the project.

Full-time students will require a minimum of one academic year (2 terms) to complete the Master's degree. Part-time students will require at least twice as long. The programme will run year-round and students may enter in September, January, or May.

227
Admission

Candidates entering prior to September 1966 will be accepted only on a part-time co-operative basis. From September 1966, full-time students will be accepted. The University admission regulations and procedures as described in the calendar will apply, and in addition, the Management and Systems Engineering Committee will use the following criteria in recommending individual programmes:

1) The candidate should hold an Honours degree, or equivalent in one of the following or related areas: Engineering, Mathematics, Economics.

2) The candidate should have successfully completed University-level courses in: Advanced Calculus, Numerical Analysis, Basic Statistics, Computer Programming (Fortran).

Where it appears appropriate candidates may be admitted to the programme with the requirement that prerequisite courses be taken.

In view of the requirement for a project study, co-operative programme candidates must assure themselves of support from their employers, and the Management and Systems Engineering Committee will require some evidence that such support is forthcoming.

Application for admission should be made as early as possible on forms provided by the Office of the Registrar. Academic transcripts and other supporting documents should be forwarded as soon as they become available.

Financial Assistance

Priority in eligibility for teaching fellowships and support under faculty research grants, when available, will be given to full-time students in continuous residence at the University for two or more consecutive terms. Co-operative students in residence for non-consecutive terms will be eligible for such support also. Part-time co-operative students are not eligible for University financial support.

Course Descriptions

GE 13. Management Science I. Applications of economic performance indices in choosing between engineering alternatives and choosing optimum operating levels. Topics: the planning process; generation and classification of cash flows; accounting concepts; methods for tangible evaluation of alternatives; capital resources and allocation principles; determination of minimum costs and maximum profit; elements of economic measurement, analysis, and forecasting; competition.
3 hours per week.
1 term.

GE 14. Management Science II. A review of basic statistical concepts and the use of statistical methods in engineering and management problems, with pri-

2 hours.
1 term.

600. Mathematical Foundations of Management Science I. A special review course in advanced calculus, numerical analysis, basic statistics, and computer programming to the level required for entry to the Management Science programme. Degree credit is not given for this course.
1 term.

601. Introduction to Management Science. Concepts and approaches in management science. This course will be in two parts. Part I — advanced concepts of planning; resource allocation and scheduling; Part II — the application of management science principles in one of the following areas: project management, financial management, marketing, engineering (facilities), engineering (Product development), production, national economic planning. This course is meant as a survey in Management Science for those interested in specializing in Operations Research or Computer Sciences.
Prerequisite: consent of instructor.
2 hours.
1 term.

602. Mathematical Foundations of Management Science II. Review of the mathematical background, beyond calculus, for students interested in management science, operations research, and difference equations, linear matrix algebra, stochastic processes, advanced probability and statistics.
Prerequisite: consent of instructor.
2 hours.
1 term.

603. Complex Information Processing Systems. The nature of information as a product of complex systems; element and rule concepts; decision tables; document tracing; report generation; communication networks, data banks; decision-organization and work flow relationships; generalized study of the creation of an information system; nature and role of EDP in an information system; information retrieval.
2 hours per week.
2 terms.

604. Simulation and Econometrics. The concept of corporate planning; the decision process; inter-relation of forecasting and actual results; macro or micro approaches to simulation; job shop simulation; corporate simulation; econometric principles and concepts; SIMSCRIPT; the IBM General Purpose
Simulator; creating a corporate model. This is an advanced course in management science concepts applied to high level corporation planning. Prerequisites: GE 13, GE 14, and a knowledge of FORTRAN programming; or consent of instructor.
2 hours per week.
2 terms.

605. Advanced Quantitative Planning. Concepts of interrelated systems; national economic planning; strategic implications and alternative courses of action; product mix concepts; value analysis, weapon systems; installing planning systems; simulation as a planning tool; PERT/CPM — problems and benefits; national resource problems; allocation concepts.
Prerequisites: GE 13, GE 14, and a knowledge of FORTRAN programming or consent of instructor.
2 hours per week.
2 terms.

606. Advanced Business Systems. The nature of a system; system elements and relationships; structuring a business system; management objectives, organizational concepts; the information system; integrated systems — a "personnel" case in depth; organizing a data processing center; task force selection and training, hardware selection; satellite computer systems; tele-processing; data linkages and sub-systems; the total system concept.
Prerequisites: GE 13, GE 14, and a knowledge of FORTRAN programming or consent of instructor.
2 hours per week.
2 terms.

607. Production Planning, Scheduling and Resource Allocation. Cyclical production operations; line of balance criteria; parts requirements; quality control and recoverable rejects; inventory management; product mix; optimum batch size; rate of return versus minimum cost; distribution problems; warehouse location; transportation networks; feedback loops; simulation concepts; inventory models; use of computers.
Prerequisites: GE 13, GE 14, and a knowledge of FORTRAN programming or consent of instructor.
2 hours per week.
2 terms.

608. Management Practice in Administrative Services. A course covering computer-oriented practices current in the areas of: general business administration, international trade, law, personnel relations, industrial relations, contracts and computer controls.
Prerequisites: GE 13, GE 14, and a knowledge of FORTRAN programming or consent of instructor.
2 hours per week.
2 terms.

609. Management Practice in Finance. A course covering computer-oriented practices current in the areas of: cash flow, treasury profit, banking and loans,
Department of Mechanical Engineering

mergers and acquisitions, stock market offerings, controllership concepts, international finance, corporation organization and taxation, mathematical theory of a profit, computer controls.
Prerequisites: GE 13, GE 14, and a knowledge of FORTRAN programming or consent of instructor.
2 hours per week.
2 terms.

610. Management Decision-Making Laboratory. Participation in analysis, planning, and decision-making under competitive and fast-time stress using functional and industrial simulations.
2 hours per week.
1 term.

611. Market Research, Product Analysis, and Resource Allocation. Techniques in market research, product and market analysis; modelling of consumer and industrial market behaviour; competitive strategy in marketing planning and sales forecasting.
2 hours per week.
2 terms.

698. Specially Directed Studies.


Music

100. Music of the 18th, 19th, and 20th Centuries and its relationship to the Arts.
Prerequisite: Gr. XIII Music or the equivalent, and consent of the instructor.
3 lectures.

110. History of Music. A critical survey of the history of music from the Greek period to the present. Special emphasis will be given to basic rudiments, form and style.
3 lectures.

310. Music and Literature. A study of music that is either inspired by, or makes use of literary texts, or serves as incidental music to drama. Special emphasis will be placed on music related to Greek Drama, the Bible, and German literature of the Romantic period, but also included will be music related to Spanish, English, French, Russian and Chinese writings.
3 lectures.
Department of Philosophy

J. S. Minas, B.A. (Wayne), Ph.D. (Illinois) - Professor and Chairman
R. J. Butler, B.A., M.A. (New Zealand) - Visiting Professor
L. L. Haworth, B.A. (Rollins), M.A., Ph.D. (Illinois) - Professor
Z. Adamczewski, B.A. (London), M.A. (Columbia)
  Ph.D. (Harvard) - - - - - Associate Professor
L. Armour, B.A. (British Columbia), Ph.D. (London)
  Associate Professor and Deputy Chairman
R. J. C. Burgener, M.A., Ph.D. (Toronto) - Associate Professor
R. A. George, M.A., Ph.D. (Michigan State) - Associate Professor
J. F. Narveson, B.A. (Chicago), M.A., Ph.D. (Harvard) - Associate Professor
P. Seligman, B.A., Ph.D. (London) - - - - Associate Professor
B. H. Suits, B.A., M.A. (Chicago), Ph.D. (Illinois) - Associate Professor
W. R. Abbott, B.A. (Kenyon), Ph.D. (Ohio State) - Assistant Professor
J. R. Horne, B.A., M.A. (Western Ontario), B.Th. (Huron),
  Ph.D. (Columbia) - - - - Assistant Professor
D. D. Roberts, B.A. (Roosevelt), M.A., Ph.D. (Illinois)
  Assistant Professor and Executive Secretary
J. W. Van Evra, B.A. (Thornton), M.A., Ph.D.
  (Michigan State) - - - - Assistant Professor
J. Wubnig (Miss), B.A. (Swarthmore), M.A., Ph.D. (Yale) Assistant Professor
Richard M. Fox, B.A. (Ohio), M.A. (Georgetown) - - Lecturer J

Undergraduate Course Descriptions

Notes: (1) Unless otherwise noted in the course listing, all courses offered by the Department may be taken by any student in the University, subject only to his meeting the specific prerequisites listed in the individual course descriptions.

(2) Some of the advanced courses (those numbered 300 or above) will not be available every year. Each Spring, the Department will publish a list of the courses to be offered for the following academic year. This list will include descriptions of courses whose content is not specified below and names of instructors for each course.

(3) The attention of all first-year students is called to the fact that several courses in addition to Philosophy 100 are open to them, any full course or two half courses of which can be used to satisfy part of the University requirement under group A(i). These are the courses numbered 125, 135, 140, and 150 as well as 221/222, 240, and 280/281. Of these, the courses numbered 221/222, 240, and 280/281 are especially recommended for the student contemplating further study in Philosophy. (See recommended Honours Programmes, pp. 39).
Department of Philosophy

(4) The number of hours shown after the courses merely indicates the weight of courses relative to one another and does not determine the number of hours the course meets. The number of class meetings per week is determined by the instructor.

(5) Courses suffixed with a 'J' are administered by St. Jerome's College.

Notes to Honours Philosophy Students:

(1) The attention of students in Honours Philosophy Programmes is drawn to the following list of recommended electives: Classical Civilization 251, Classical Civilization 260, History 260, and English 350.

(2) The following courses in Philosophy are especially recommended to those Honours students who intend to pursue graduate studies in Philosophy: Philosophy 340, 350, 363, 455, and 465.

100. Introduction to Philosophy. A broad selection of the main problems in philosophy will be considered. For example: How can we know whether anything is right or wrong? How can we know about things we cannot directly observe? Can we know whether there is a God? Is mind in any sense distinct from matter? Original texts of both classical and contemporary thinkers are employed. No prerequisite. 3 hours.

100J. Introduction to Philosophy. A study of St. Thomas and his writings; fundamental Thomistic principles. 3 hours.

125.* Fundamentals of Social and Political Philosophy. The central question of the course is: What reasons can I have for acting on the issues which will face me as a member of society? Such problems as divorce, democracy, socialism, the Bomb, and international politics will be critically discussed in the light of readings from both classical and contemporary philosophers. No prerequisite. 3 hours.

135.* Fundamentals of the Philosophy of Religion. Basic ideas common to all religious beliefs will be discussed from a non-denominational viewpoint. What do we mean by revelation, sin, redemption? Can the existence of a supreme being be proved to the satisfaction of man's reason? Both classical and contemporary readings will be used. No prerequisite. 3 hours.

140.* Fundamentals of Logic. Basic types of reasoning will be analyzed. The reasons for using symbols in logic will be explored, and some simple systems considered. Attention will also be devoted to informal arguments and scientific method. No prerequisite. 3 hours.

140J. Logic and Epistemology. Nature and division of Philosophy; nature of logic; the term; the proposition; argumentation; induction and deduction;
scientific demonstration. Truth; certitude; evidence; sense and intellectual knowledge; criterion of truth; contemporary theories. 3 hours.

150. Fundamentals of Epistemology and Metaphysics. Discussion of the nature of reality. Rival theories concerning mind, matter, freedom, the existence of God, and the place of experience and reason in human knowledge. No prerequisite. 3 hours.

200J. Cosmology and Philosophy of Science. Corporeal bodies and change; quantitative and qualitative characteristics; motion; time, space; hylomorphic theory. Nature of science; abstraction; necessity; foundation and object of science; scientific method; hypothesis and theory. 3 hours.

221. Ethics I. The classic literature of ethics will be analyzed, and the principal problems brought to light. No prerequisite. 3 hours.

222. Ethics II. Contemporary theories will be explored, and recent philosophical methods applied in the discussion of the principal problems of ethical theory. Prerequisite: Philosophy 221 or consent of instructor. 3 hours.

223. Moral and Social Philosophy. An examination of theories for evaluating personal conduct and political, social, and economic systems and policies. Such concepts as right and wrong, justice, individual rights, and the ends of political organization form the principal subject-matter of the course. Both classical and contemporary readings are employed. Prerequisite: Philosophy 100 or equivalent, or honours status in any Social Science department, or consent of instructor. Not open to students in Philosophy 221-2 or 325-6. 3 hours.

240. Logic. A systematic development of the propositional calculus and of the first-order predicate calculus, including the theory of identity and of definite descriptions and some attention to the theory of relations. Considerable attention will be devoted to formalization of various applied theories in, e.g., economics, measurement, utility theory, etc. Prerequisites: None for second-year and above, students; consent of instructor for others. 3 hours.

240J. Ethics. End of Man; the human act; law, conscience; morality; rights and duties; duties of a man as an individual and as a member of society. 3 hours.

280. History of Ancient Philosophy I. From the beginnings to Plato. Prerequisite: Consent of instructor for students not taking philosophy as their main subject. 3 hours.
281.* History of Ancient Philosophy II. From Aristotle to the close of classical antiquity.
Prerequisite: Philosophy 280.
3 hours.

282.* History of Modern Philosophy I. Earlier period beginning with Descartes.
Prerequisite: One full or two half philosophy courses, preferably 280/281.
3 hours.

283.* History of Modern Philosophy II. Later period including Kant.
Prerequisite: Philosophy 282.
3 hours.

299. Tutorial for Honours Students. Students wishing to enrol in 299 should consult the Department.

300J. Metaphysics and Natural Theology. The notion and analogy of being; the primary principles of being; the properties, division, and causes of being. Demonstration of existence of God; His nature and attributes; the divine intelligence and will; creation and providence.
3 hours.

321* — 324.* Studies in Ethics. Various half courses dealing with special topics; one or more of these will be offered each year as announced by the Department.
Prerequisite: Philosophy 221/222.
3 hours.
325.* Political Philosophy I. Philosophical analysis of central concepts in political theory and its relation to moral and metaphysical problems of various periods. 
Prerequisite: One full or two half Philosophy courses.
3 hours.

326.* Political Philosophy II. A detailed discussion of contemporary theories. 
Prerequisite: Philosophy 325, or consent of instructor.
3 hours.

327.* Philosophy of Law. Analysis of legal notions; the bearing of philosophical systems on theories of law. Historical and contemporary examples will be used. 
Prerequisite: One full or two half Philosophy courses.
3 hours.

331. Aesthetics. Philosophical consideration of the immediately given, of art and beauty. A study of the basic problems with examples from historical and contemporary writers. 
Prerequisite: One full or two half Philosophy courses.
3 hours.

335.* Philosophy of Religion. A philosophical approach to the basic ideas of great world religions. The phenomenology of religious experience and mysticism as well as the nature of religious symbolism and language will be discussed. 
Prerequisite: One full or two half Philosophy courses.
3 hours.

340. Logical Theory. A rigorous development of the propositional and predicate calculus in a general framework in terms of which various alternative calculi may be examined. Particular attention is given to such concepts as completeness, consistency, extensionality, modality, etc., from both formal and philosophical points of view. Intended primarily for those interested in the philosophical issues connected with logic. 
Prerequisites: Philosophy 140, or (preferably) Philosophy 240, or consent of instructor.
3 hours.

340J. History of Philosophy. A survey of Philosophy from the Presocratics to contemporary philosophers.

345.* Philosophy of History. Consideration of various possible views about the ultimate nature of history and historical knowledge. Both classical and contemporary views will be examined. 
Prerequisite: One full or two half Philosophy courses.
3 hours.

348J. Seminar in Philosophy. A special study of the principal philosophers of the modern and contemporary eras.
3 hours.
350. Epistemology. A systematic course in the analysis of human knowledge. Phenomenalism and various kinds of realism will be considered, as well as other main topics such as the a priori, our knowledge of other minds, and our knowledge of abstract entities.
Prerequisite: One full or two half courses in Philosophy. Students not taking Philosophy as their main subject should consult the instructor.
3 hours.

361. Philosophy of Science. Logical analysis of scientific methods and concepts. Some special topics are also considered, e.g., the role of mathematics in empirical science, problems arising from the relations among some of the sciences, such as those employing theoretical as opposed to observational concepts, and comparison of science with other human activities.
Prerequisite: Philosophy 240 (which may be taken concurrently), or consent of instructor.
3 hours.

363. Analytic Philosophy. Contemporary philosophical literature is employed in the exploration of both formal and "ordinary language" analysis. This course should be especially useful for persons contemplating graduate study in Philosophy.
Prerequisite: Consent of instructor, or Honours status in Philosophy.
3 hours.

365* - 366.* Oriental Philosophy. Studies of a selected area of non-western Philosophy (e.g. Indian or Chinese). Parallels will be drawn between modes of Eastern thinking and European conceptions with emphasis on essential differences as well as similarities.
Prerequisite: Consent of instructor.
3 hours.

370* - 372.* Special Subjects. One or more half courses will be offered at different times as announced by the Department.
Prerequisite: Consent of instructor.
3 hours.

380* - 389.* Studies in the History of Philosophy. Various half courses dealing with a particular philosopher, a selected work or period; one or more of these will be offered each year as announced by the Department.
Prerequisite: Philosophy 280/281 and 282/283.
3 hours.

390*. Medieval Philosophy I. The early period to the thirteenth century.
Prerequisite: Philosophy 280/281.
3 hours.

391.* Medieval Philosophy II. The later period, from the thirteenth century.
Prerequisite: Philosophy 390.
3 hours.
399. Tutorial for Honours students. Students wishing to enrol in 399 should consult the Department.

440° — 444.° Studies in Logic. Various half courses dealing with specific topics; one or more of these will be offered each year as announced by the Department. Prerequisite: Philosophy 240 or Mathematics 436. 3 hours.

455. Metaphysics. Theories of reality, mainly of the last hundred years. Prerequisite: Two full courses (or equivalent) in Philosophy. 3 hours.

465. Existential Philosophy. A study of selected readings. Prerequisite: Consent of instructor. 3 hours.

471° — 473.° Problems. One or more half courses will be offered at different times, as announced by the Department. Prerequisite: Consent of instructor. 3 hours.

480° — 489.° Advanced Studies in the History of Philosophy. Various half courses dealing with a particular philosopher, a selected work or period; one or more of these will be offered each year as announced by the Department. Prerequisite: Consent of instructor. 3 hours.

499. Tutorial and Honours Essay. Students wishing to enrol in 499 should consult the Department.

Graduate Course Descriptions

610 — 619. Seminar in the Study of a Recent Philosopher. Names at present contemplated from which a choice may be made should the demand be sufficient: Bradley, Heidegger, McTaggart, Price, Russell, Ryle, Sartre, Wittgenstein.

621. Seminar in Ethics.

625. Seminar in Political Philosophy.

630. Seminar in Aesthetics.

635. Seminar in Philosophy of Religion.

640. General Logic. In this course philosophical issues connected with extensionality, modality, and "alternative logics" will be developed systematically in a general framework.

641. Seminar in Logic.

650. Seminar in Epistemology.
Department of Philosophy

655. Seminar in Metaphysics.

660 — 662. Seminar in Philosophy of the Sciences.

670. Specially Directed Studies.


698(a) — (n). Pre-Thesis Graduate Research in Special Areas.


Note: Depending on what is appropriate in a given case, 600 courses may be for a full academic year’s duration or for one semester only. In the latter case they will be counted as “half-courses” in the interpretation of general calendar requirements.

Department of Physical and Health Education

D. J. Pugliese, B.A., B.P.E. (McMaster), Ed.M. (Buffalo)
Assistant Professor and Chairman of the Department

C. A. W. Totzke, B.A. (Western) - Special Lecturer, Director of Athletics

D. Hayes, B.Sc., B.P.E., M.Sc. (Springfield) - Assistant Professor

N. J. Ashton, B.Sc. (P.E.) (McGill), M.S. (Michigan) - Assistant Professor

H. J. Green, B.A., B.P.H.E. (Queen’s), M.A. (Alberta) - Lecturer

W. A. Delahey, B.A. (B.P.H.R.E.) (Western) - Lecturer

W. N. Widmeyer, B.A. (Western), B.P.E. (McMaster) - Lecturer

Ruth Hodgkinson, (Miss) B.P.H.E. (Toronto) - Lecturer

Course Descriptions

400. History and Principles of Physical Education. A study of the history of physical education and of the principles and problems involved in present day physical education programmes.
3 lectures, first term.

405. Historical Foundations in Dance. A study of the history of the dance from its origin in prehistoric times to the present. An examination of the materials, growth and function of the dance in society.
3 lectures, first term.

410. Coaching Foundations. A study of the history of coaching and its underlying principles applied to physical education today. An examination of different methods and problems connected with coaching specific teams and individual sports.
3 lectures, first term.

239
420. Administration of Physical and Health Education Programmes. The function of administration with respect to planning, staff, public relations, facilities, equipment, legal responsibilities, intramural and interscholastic programmes. The drafting of schedules and the organization and conduct of tournaments and meets. The study of special problems of health and physical education pertinent to the administrator.
3 lectures, second term.

425. Public Health and Preventive Medicine. A course designed to acquaint the student with the medical resources of the community and the function of the school medical services. Problems of mental health in school and community, and medical statistics as they relate to the illness of different age groups. Certain topics relating specifically to health education, such as alcoholism, the use of tobacco or drugs, are made the subjects of seminars. Nutrition and its relation to health and modern concepts of preventive medicine are reviewed in a general manner. Visits to schools and clinics which are relevant to the course will be arranged.
3 lectures, first term.

440. Human Anatomy. A study of the system of the human body as to structure with particular emphasis on the skeleton, joints and muscles. The functions of these and other systems will be studied in relationship to the needs of physical education.
3 lectures, 2 hours laboratory, first term.

3 lectures, 2 hours laboratory, second term.

445. Care and Prevention of Athletic Injuries. Prevention and correction of accidents in athletic activities. The use of proper personnel and field equipment; support methods, conditioning exercises, the medical examination and therapeutic aids. Laboratory work includes the clinical use of physiotherapy equipment, massage and advanced training methods used in the care of personnel injured in the various skill courses, recreational, intramural and varsity activities.
3 lectures, first term.

450. Corrective and Adapted Physical Education. A study of common postural and structural defects with appropriate preventive and remedial exercises. A study of pathological defects and their relationship to physical education. The principles involved in adapting physical education programmes for the handicapped and the convalescent.
3 lectures, second term.

455. Physiology of Physical Activity. Physiological changes in human organism due to physical exercise, including a study of muscle tissue, muscle training, nerve control, the role of oxygen in activity, energy cost and efficiency, respiration and artificial respiration, blood composition and circulation, the heart and pulse rate, fatigue, staleness and physical fitness.
3 lectures, second term.
Department of Physical and Health Education

2 lectures, 1 laboratory first term.

465. Research Project. Selection of an approved topic in health, physical education or recreation to be studied for research purposes. Direction in methods of research and the presentation of findings in seminar and report form.
1 lecture, 2 laboratories second term.

620. Educational Psychology. An application of psychological principles to educational problems, together with a survey of relevant research findings concerning child and adolescent behaviour.
3 lectures, second term.

480. Skills:

Team Skills — Teaching and practice of the basic fundamentals of the following activities: soccer, football (men), field hockey, track and field, lacrosse (men), low organizational games, officiating.

Dual Skills — Teaching and practice of the basic fundamentals of the following activities: tennis, judo.

Individual Skills — Teaching and practice of the basic fundamentals of the following activities: canoeing, sailing, gymnastics, aquatics, archery, weight training, isometrics.
12 hours first term.

Team Skills — Teaching and practice of the basic fundamentals of the following activities: volleyball, basketball, hockey, curling and officiating.

Dual Skills — Teaching and practice of the basic fundamentals of the following activities: badminton, wrestling (men), dance.

Individual Skills — Teaching and practice of the basic fundamentals of the following activities: gymnastics, aquatics, golf, skiing.
12 hours second term.

Skill School:

Orientation of the students to the skills programme with an introduction to the basic fundamentals of the following activities: sailing, canoeing, orienteering, tennis, badminton, golf, archery, track and field, field hockey.
50 hours first week.
Department of Physics

J. A. Cowan, B.Sc. (Manitoba), M.A., Ph.D. (Toronto)

Professor and Chairman of the Department (on sabbatical leave, 1965-66)

G. E. Reesor, B.A., M.A. (McMaster), Ph.D. (Toronto)

Professor and Acting Chairman of the Department, 1965-66

F. W. Boswell, B.A., M.A., Ph.D. (Toronto) - - - Professor

R. A. Aziz, B.A., M.A., Ph.D. (Toronto)

Associate Professor (on sabbatical leave, 1965-66)

G. A. Bakos, B.A. (Trnava), M.A. (Bratislava), M.A., Ph.D. (Toronto) - - - - Associate Professor

D. E. Brodie, B.Sc., M.Sc., Ph.D. (McMaster) - Associate Professor

I. R. Dagg, B.Sc. (Manitoba), M.S. (Penn. State), Ph.D. (Toronto) - - - - - Associate Professor

P. C. Eastman, B.Sc., M.Sc. (McMaster), Ph.D. (U. B. C.)

Associate Professor

H. K. Ellenton, B.Sc. (Western), M.A. (Toronto) - Associate Professor

J. Grindlay, B.Sc. (Glasgow), D.Phil. (Oxon) - Associate Professor

D. J. Henderson, B.A. (U.B.C.), Ph.D. (Utah), F. Inst. P. - Associate Professor

N. R. Isenor, B.Sc. (Acadia), M.Sc., Ph.D. (McMaster) - Associate Professor

C. C. Lim, B.A. (DePauw), M.A. (Nebraska), Ph.D. (Toronto)

Associate Professor

J. L. Ord, B.A.Sc. (Toronto), M.S., Ph.D. (Illinois) - Associate Professor

M. G. Rochester, B.A., M.A. (Toronto), Ph.D. (Utah) - Associate Professor

S. F. Wang, B.E. (Port Arthur, China), D.Sc. (Nagoya) - Associate Professor

S. H. Chen, B.Sc. (Taiwan), M.S. (Michigan), Ph.D. (McMaster)

Assistant Professor

S. G. Davison, B.Sc., M.Sc., Ph.D. (Manchester) - Assistant Professor

D. Hemming, B.Sc., Ph.D. (Bristol) - - - Assistant Professor

J. D. Leslie, B.A.Sc. (Toronto), M.S., Ph.D. (Illinois) - Assistant Professor

H. M. Morrison, B.Sc., Ph.D. (Edinburgh) - - - Assistant Professor

H. J. T. Smith, B.Sc., Ph.D. (London) - - - Assistant Professor

B. H. Torrie, B.A.Sc. (Toronto), Ph.D. (McMaster) - Assistant Professor

K. A. Woolner, B.Sc. (London) - - - Assistant Professor

Undergraduate Course Descriptions

Details of the undergraduate programmes offered by the Faculty of Science are to be found on page 88.

11. Mechanics, Wave Motion and Heat. Vectors, rectilinear motion, plane motion, dynamics of particles, work and energy, linear momentum, rotational
14. **Optics.** Geometrical optics, interference, diffraction and polarization. 3 lectures, 3 hours laboratory, one term.

15. **Modern Physics.** The fundamental particles of matter, assemblies of particles, nuclei and atoms, the wave-particle experiments, introductory quantum mechanics and atomic structure. 3 lectures, one term.

43. **Nuclear Physics.** The atom and its nucleus, radioactive decay, nuclear masses and nuclear stability, nuclear spin and moments, structure of nuclei, gamma radiation processes, alpha decay, beta decay, nuclear reactions, fission, interaction and radiation with matter, counters, particle accelerators and reactors. 3 lectures, one term.


45. **Introductory Statistical Mechanics.** Review of essential classical and quantum mechanics, microcanonical, canonical and grand canonical ensembles; quantum statistical mechanics, theory of the density matrix; applications. 3 lectures, one term.


100. **General Physics I.** Newtonian mechanics, conservation laws, heat and thermodynamics, electrostatics, D.C. circuits. 3 lectures, 3 hours laboratory alternate weeks.

131. **Mechanics, Wave Motion and Heat.** Vectors, rectilinear motion, plane motion, dynamics of particles, work and energy, linear momentum, rotational motion, statics, angular momentum, harmonic motion, gravitation, wave motion, sound waves, temperature, heat, first and second laws of thermodynamics, kinetic theory of gases. 3 lectures, 3 hours laboratory.

200. **General Physics II.** Electromagnetism, A.C. circuits, geometrical and physical optics, introduction to atomic and nuclear physics. 3 lectures, 3 hours laboratory.
232. Electricity and Magnetism. Electrostatics, magnetic fields, electromagnetic induction, alternating current theory, the development of Maxwell's equations. 2 lectures, 3 hours laboratory and one hour problems on alternate weeks.

Note: Students in Honours Physics take 3 hours laboratory or problems weekly.

233. Laboratory. Selected experiments in electricity and magnetism, optics, electronics and structure of solids. 6 hours per week.

235. Optics. An elementary course in geometrical and physical optics. Refraction, and reflection at plane and curved surfaces; thin and thick lenses; optical instruments. The wave nature of light; interference; diffraction; slits and gratings, resolution. Polarization; optical activity; photometry. 2 lectures, 3 hours laboratory.

Note: Students enrolled in the Chemistry and Physics courses take laboratory work in alternate weeks.

236. Physical Optics. The wave nature of light; interference, diffraction, slits and gratings, resolution. Polarization, optical activity, photometry. 3 lectures, 3 hours laboratory alternate weeks, one term.

237. Astronomy I. A survey course in astronomy. Aspects of the sky; motions of the earth; the earth and the moon; the solar system; gravitational astronomy; the sun; the stars; stellar motions; comets; meteors; meteorites; interstellar matter; the structure of the galaxy; exterior systems; cosmogony; radio astronomy. 3 lectures.

242. Electricity and Magnetism. Electrostatics, D.C. circuits, magnetic fields, electromagnetic induction, A.C. circuits, electrical measurements, introductory electronics. 2 lectures, 3 hours laboratory and 2 hours problems on alternate weeks.

243. Electricity and Magnetism. Electrostatics, D.C. circuits, magnetic fields, electromagnetic induction, A.C. circuits, electrical measurements. 3 lectures, 3 hours laboratory alternate weeks, one term.

245. Structure of Solids. Electronic structure of atoms and atomic bonding, crystal structure and space lattices, symmetry, crystal geometry, stereographic projections, theory of X-ray diffraction, X-ray methods, crystal formation, crystal defects, physical properties of crystals. 3 lectures, one term.

332. **Electronics.** A survey of electronic circuits. Basic A.C. circuit theory; rectifiers and filter circuits; triode, pentode and transistor amplifiers; equivalent circuits; feedback and oscillators; regulations; electronic measuring devices; pulse circuits.  
2 lectures. 3 hours laboratory alternate weeks for students not taking Physics 333.

333. **Intermediate Laboratory.** Selected experiments in mechanics, heat, sound, optics, spectroscopy, X-ray, atomic physics, electricity, magnetism, and electronics.  
6 hours laboratory.

334. **Atomic and Nuclear Physics I.** Special theory of relativity, growth of atomic concepts, quantum theory of thermal radiation, particle aspects of electromagnetic radiations. Rutherford atom, Bohr atom, wave aspects of particles, wave mechanics, solution of Schroedinger's equation, one-electron atoms.  
3 lectures.

3 lectures.

336. **Physical Mathematics I.** Vector analysis; vector differential operators and associated integral theorems. Introduction to tensors. Curvilinear co-ordinate systems. Partial differential equations of mathematical physics; Laplace's, wave and diffusion equations; Legendre and Bessel functions. Fourier analysis; eigenfunctions.  
2 lectures.

337. **Astronomy II.** Selected topics in astrophysics, cosmogony, and radioastronomy.  
2 lectures.

338. **Geophysics I.** An introductory course on the physics of the Earth. Origin, heat and temperature of the Earth, study of earthquakes and the Earth's interior through earthquake waves; gravity and isostasy; terrestrial magnetism; effects of heat, temperature and strain on rocks; origins of continents, mountain ranges, the ocean floors, meteorology; geophysical techniques.

339. **Atomic and Nuclear Physics.** Fundamentals of modern physics; special theory of relativity, quantization of electromagnetic radiation, wave properties of particles, the hydrogen atom, atomic and X-ray spectra, nuclear structure, nuclear reactions, molecular and solid state physics.  
3 lectures.

340. **Quantum Physics I.** The origins of quantum theory. Planck's radiation law, photo-electric and Compton effects, the nuclear atom and Bohr model,
wave-particle experiments. Schroedinger equation. Solutions for potential barriers and wells.
3 lectures, one term.

3 lectures, 3 hours laboratory, one term.

341B. Electronics II. A continuation of Electronics I covering feedback, regulated power supplies, pulse circuitry, servosystems, electrical analogies and a variety of special purpose circuits.
2 lectures, one term.

2 lectures, one term.

2 lectures.

3 hours per week, second term.

433. Advanced Laboratory. Selected experiments in atomic and nuclear physics, solid state physics, thermodynamics; electrical and electronic measurements; vacuum techniques. In addition, a short research problem will be assigned.
3, 6 or 9 hours laboratory.

434. Atomic and Nuclear Physics II. Multi-electron atoms: identical particles and the Pauli principle, the helium atom, Hartree theory of multi-electron atoms, the periodic table, the vector model. Nuclear physics: particle acceleration and detection, nuclear structure, the decay of unstable nuclei, nuclear reactions, elementary particles.
2 lectures.

435. Solid State Physics. Atomic bonding; crystal structure and space lattices; symmetry; crystal geometry; defects; physical properties of crystals; free electron theory of metals; band theory; properties of semiconductors and insulators.
3 hours per week, first term.
3 lectures.

437. Topics in Theoretical Physics. Selected subjects for advanced study by theoretically inclined students; topics in relativistic, quantum, and statistical physics.
3 hours per week, second term.

438. Geophysics II. A more advanced discussion of seismology and the internal constitution of the Earth, mechanical properties of the Earth's interior, figure of the Earth and its gravitational field, temperature and thermal history of the Earth, internal magnetic field of the Earth and its electrical properties at depth, the rotation of the Earth and its geophysical effects.
2 lectures.

3 lectures, one term.

441. Electromagnetic Theory. A generalized treatment of the basic laws of electricity and magnetism; mathematical techniques for the problems of electrostatics; solutions of Maxwell's equation in free space and the study of plane waves; theory of waveguides and introduction to radiation.
2 lectures.

442. Metal Physics. The course will provide explanations of the physical properties and behaviour of metals and alloys from the viewpoint of atomic physics. Topics included are: solidification of pure metals, perfect and imperfect crystals, alloys, phase diagrams, diffusion, solid state phase transformations, the iron-carbon system, physical properties of metal crystals, elastic and plastic deformation, twinning, radiation damage, recovery and recrystallization creep, fatigue, fracture, internal friction, free electron and zone theories of metals, electrical, thermal and magnetic properties.
2 lectures.

3 lectures, one term.

Graduate and Research Programmes
See page 105 for general information.

There are at present several major areas of study in the Department in which graduate students may specialize. These include:

Low temperature physics: experimental studies of condensed inert gases, liquid helium, superconductivity, energy gap and Fermi surface determinations.
Physics of lattice defects: layer structures, properties of vacancies and impurities.

Thin film physics: epitaxial, anodic oxide, and semi-conducting films - active thin film devices.

Laser Research: ruby laser research, solid state injection lasers.

Microwave research: dielectric constant measurements, field induced adsorptions, microwave spectrometry.

Theoretical Physics: geophysics, theory of liquids, theoretical solid state physics

Graduate Course Descriptions

   Three lectures, first term.

   Three lectures, second term.

622. Group Theory and Quantum Mechanics. Introduction to group theory; groups, representations of groups, character tables. Group theory and quantum mechanics, the permutation and rotation groups. Applications of the theory to atomic spectra, the theory of angular momentum. molecular symmetry and solid state physics.
   3 lectures, one term.

623. Advanced Quantum Mechanics. Dirac theory; the single particle description of relativistic quantum mechanics; bound state and scattering problems— the need for a many-particle (field) approach. Classical relativistic field theory. Feynman-Schwinger quantization of this theory. The radiation field, the electron field. Interaction of these fields. The S-matrix; Compton scattering, Coulomb scattering. The magnetic moment of the electron, the Lamb shift. Renormalization.
   3 lectures, one term.

627. Atomic Spectra. The fine and hyperfine structure of one-electron and many-electron atoms, the Zeeman and Stark effects.
   3 lectures, one term.

   3 lectures, one term.
Department of Physics

3 lectures, one term.

634. **Advanced Classical Mechanics.** Review of elementary mechanics, Lagrangian formulation, variational principles, Hamiltonian formulations; rigid body kinematics and dynamics, special relativity, transformation theory, Hamilton-Jacobi theory.
3 lectures, one term.

635. **Electromagnetic Theory I.** The electrostatic and the magnetic field; energy, force and momentum relations in the electromagnetic field; Maxwell's equations, solutions of the wave equation; radiation.
3 lectures, first term.

636. **Electromagnetic Theory II.** The special theory of relativity; the electromagnetic tensor; the field of moving charges; magnetohydrodynamics; selected topics.
3 lectures, second term.

640. **Electron Optics and Electron Microscopy.** Electrons in electrostatic fields, the electrostatic lens, the magnetic lens, aberrations, the electron microscope, theory of image contrast, Fresnel diffraction and image contour phenomena, electron diffraction and dark-field microscopy, experimental methods in electron microscopy.
3 lectures, one term.
641. **Electron Diffraction.** General theory of the diffraction of waves by crystals, experimental technique of electron diffraction, kinematic theory and interpretation of electron diffraction, patterns, refraction of electron waves, atomic scattering, dynamical theory, electron interference effects in electron microscope images.
3 lectures, one term.

645. **Statistical Mechanics.** Review of essential classical and quantum mechanics; microcanonical, canonical and grand canonical ensembles; quantum statistical mechanics, theory of the density matrix; fluctuations, noise, irreversible thermodynamics; transport theory; application to gases, liquids, solids.
3 lectures, one term.

647. **Low Temperature Physics.** Production and measurement of very low temperatures. Low temperature materials and techniques. Thermal, magnetic and electrical properties of matter at very low temperatures. Superconductivity. Liquid Helium.
3 lectures, one term.

650. **Solid State Physics.** An introductory undergraduate course in classical solid state physics, or equivalent, is assumed. The free electron model in metals, band theory of solids, application of Brillouin zone theory, semiconductors, optical properties of solids and devices of current interest are some of the topics which are covered.
Three lectures, second term.

651. **Imperfections in Crystals.** Perfect and imperfect crystals, general properties and origins of point defects and dislocations, stacking faults, interactions of imperfections, influence of lattice imperfections on physical properties and their role in deformation of crystals and phase transformations, experimental detection and observation of imperfections.
3 lectures, one term.

3 lectures, one term.

3 lectures, one term.

654. **Advanced Quantum Theory of Solids.** Theoretical and experimental techniques for determination of the band structure of metals and semiconductors; electrical and thermal conduction processes and electron-lattice interactions.
3 lectures, one term.
Department of Physics

655. Optical Properties of Semiconductors. Reflection and refraction of electromagnetic waves at dielectric and conducting interfaces. Dispersion, absorption processes, photo effects, magneto-optical effects, emission of radiation. 3 lectures, one term.

656. Magnetism. Introduction to the theory of magnetic phenomena in metals and non-metals. Relevant experimental work will also be discussed. 3 hours per week, one term.

660. Selected Topics in Physics. 3 lectures, one term.

667. Molecular Biology. Selected topics of interest to biologists, biochemists and biophysicists will be presented at the advanced level with the aim of evaluating recent work and development in each area. Each will be developed from basic concepts and interrelationships emphasized. Topics will include: the structure of proteins and their properties in solution, transport through biological membranes, cell morphology and physiology, structure and function of selected organelles, biosynthesis of macromolecules, and the chemistry of enzyme action. This graduate course is to be presented by members of the Biology, Chemistry, and Physics Departments and is intended to cover those areas common to these disciplines (identical to Biology 667 and Chemistry 667).

670. Physics of the Earth's Interior. Selected topics in theoretical geophysics; seismology, rheology of the Earth, geomagnetism, the Earth's rotation. 3 lectures, one term.


Department of Political Science

T. H. Qualter, B.A. (New Zealand), Ph.D. (London)  
Associate Professor and Chairman of Department

A. D. Nelson. A.B., A.M., Ph.D. (Chicago)  -  Associate Professor

S. Andracki, LL.M. (Poznan), M.Sc. (London), Ph.D. (McGill)  
Assistant Professor
L. G. E. Edmondson, B.Soc.Sc. (Birmingham), M.A. (Queen’s)  
Assistant Professor

D. R. Gordon, B.A. (Queen’s), M.A. (Toronto)  
Assistant Professor

W. D. K. Kernaghan, B.A. (McMaster), M.A. (Duke)  
Assistant Professor

J. M. Wilson, B.A., M.A. (Toronto)  
Assistant Professor

Notes: (1) Students electing an Honours Programme or a Major in Political Science, or an Honours Programme in such related subjects as History, Economics, Sociology or Psychology are encouraged to register in Political Science 110 in their first year. Other students are encouraged to register in Political Science 100. Either of these courses will serve as a prerequisite for senior courses in Political Science.

(2) Courses designated “Full course, half year” are comparable to a normal year course in their content. They are, however, offered, on a more concentrated basis during one term only. In drawing up a programme a student would regard such a course as two courses during the term in which it is offered and would combine it with another such course, or two half-courses during the remaining term. The advantage of such a combination of courses is that it allows a more concentrated study of a more limited number of subjects at any given time.

(3) The number of hours or lectures shown after the course description is an attempt to indicate the “normal”; each instructor determines how often his particular class will meet.

15. Government and Politics. An introduction to liberal democratic ideals and a comparative treatment of the institutions and practices of modern democratic government with particular reference to Canada, the United States and Great Britain. Note: This course is restricted to students in the Co-operative Engineering programme.

100. Introduction to Political Science. A study of the origin, nature and impact of contemporary political doctrines including Communism, Fascism, Democratic Socialism and Democratic Capitalism, together with a study of the institutions and practices of modern government, with particular reference to the governments of Canada, the United States and Great Britain. 3 lectures.

101. Introductory Politics. (a) A study of some of the leading political ideas of the contemporary world. (b) A comparative treatment of the institutions and practices of modern government with particular reference to Canada. Note: This course is restricted to students in the Co-operative Mathematics programme. Parts (a) and (b) will be offered in alternate terms.

110. Democratic Government. An examination of the theory and practice of constitutional democracy in modern industrial “mass” society. The relationship between basic political objectives and general features of organization,
procedure and practice will be emphasized, with primary reference to Canada
Great Britain and the United States.
Full course. 3 lectures.

250. The History of Political Theory. An examination of the theories of some
of the major figures in the history of western political thought, from ancient
Greece to the present day.
3 lectures.

261.* Contemporary International Politics. A study of the main political de-
velopments and issues in the relations of nations since World War II.
3 lectures. Fall term only.

270. Public Administration. A comparative analysis of the public services of
the major democracies with particular reference to the legal basis, organization
and political and judicial control of the administrative processes.
3 lectures.

280. Canadian Government and Politics. A critical examination of the struc-
ture of Canadian government and politics.
3 lectures.

281. American Government and Politics. The theory and practice of Ameri-
can government and politics at the federal and state levels.
Full course, half year. Fall term only.

282. British Government and Politics. A critical examination of the theory and
practice of government and politics in Great Britain.
Full course, half year. Winter term only.

283.* The Dynamics of Soviet Politics. A survey of both the theoretical and
practical aspects of political life in the Soviet Union, emphasizing Soviet
domestic politics and political institutions.
3 lectures. Fall term only.

284.* Government and Politics in Western Europe. A comparative study of the
government and politics of France, Italy and the Federal German Republic in
the post-war world.
3 lectures. Winter term only.

363.* The Soviet Union and the World. An analysis of Soviet foreign policy
and the international communist movement, with particular emphasis upon
the Sino-Soviet conflict.
Prerequisite: Political Science 283 or 261.
3 lectures. Winter term only.

364. Theory and Practice of International Relations. An examination of the
concepts of international relations and the study of International Relations as
a discipline. A treatment of foreign policy analysis with special emphasis on
components of national power and methods and trends in the pursuit of
national and collective interests.
Prerequisite: Political Science 261 or consent of instructor.
3 lectures.

372. * Provincial Governments. A study of the history, structure and operation of government and politics at the provincial level in Canada, with special emphasis on the particular problems of special provinces. 3 lectures, Fall term only.

381. * The State and Economic Life. An analytical and comparative study of the growth of government intervention in the economic process, and of the development of the welfare state. 3 lectures. Fall term only. Admission by consent of instructor.

382. * Federalism - Classical and Co-operative. A study of the evolution, structure and functions of modern federalism in selected countries. 3 lectures. Winter term only. Admission by consent of instructor.

390. * Political Parties. An analytical and comparative study of the development, organization, activity and function of political parties, and the nature of contemporary party systems. 3 lectures. Fall term only. Admission by consent of instructor.

391. * The Electoral Process. An analytical and comparative treatment of electoral machinery and law, voting systems, and redistribution problems. 3 lectures. Fall term only. Admission by consent of instructor.

392. * Interest Group Politics. A study of interest group theory and comparative analysis of the internal politics of interest groups and their role in the political process. 3 lectures. Winter term only. Admission by consent of instructor.


450* — 455.* Advanced Theory Seminars. A series of half courses providing for a detailed study of the political theory of one selected period or school. One or more of these courses will be offered in each year. 3 lectures. Admission by consent of instructor.

460. International Law and International Institutions. An examination of concepts and rules of international law relevant to the development of international institutions. An evaluation of the United Nations system and of regional systems with special reference to common institutional problems. Prerequisite: Political Science 364 or consent of instructor. 3 lectures.

461. * International Migrations. A comparative survey of the migration policies of immigration countries with special reference to Canada, Australia and the United States. Concepts and techniques developed in the various countries in
the matter of selection, admission and exclusion of immigrants will be analysed systematically against the background of immigration policies and laws.

3 lectures. Admission by consent of instructor.


3 lectures. Admission by consent of instructor.


3 lectures. Fall term only. Admission by consent of instructor.

482 — 485. Comparative Government Seminars. A series of half courses on the government and politics of selected countries, regions or systems.

3 lectures. Admission by consent of instructor.

490. Public Opinion and Propaganda. A detailed study of the nature of public opinion and the attempt to control it through propaganda.

3 lectures. Winter term only. Admission by consent of instructor.

491. Political Behaviour. An examination of the objectives, characteristics, problems and results of contemporary research on political behaviour, with emphasis on democratic electoral behaviour.

3 lectures. Admission by consent of instructor.

498. Senior Research Seminar.

3 lectures. Admission by consent of instructor.

---

Department of Psychology

R. H. Walters, B.A., Dip.Ed., M.A. (Bristol), B. Phil. (Oxford), Ph.D. (Stanford), F.B.Ps.S. - Professor and Chairman of Department

J. S. Minas, A.B., M.A. (Wayne State), Ph.D. (Illinois) - Professor (Philosophy and Psychology)

R. K. Penney, B.Sci. (Wayne State), Ph.D. (State University of Iowa) - Professor

E. A. Salzen, B.Sc., Ph.D. (Edinburgh) - Professor

D. A. Sprott, B.A., M.A., Ph.D. (Toronto) - Professor (Mathematics and Psychology)

R. K. Banks, B.A., M.A., Ph.D. (Toronto) - Associate Professor

M. P. Bryden, S.B. (Massachusetts Institute of Technology), M.Sc., Ph.D. (McGill) - Associate Professor

T. E. Cadell, B.A. (British Columbia), M.A. (Massachusetts), Ph.D. (Wisconsin) - Associate Professor

W. D. Fenz, B.A., (Southern Missionary), M.A., B.D. (St. Andrews), M.Sc. (Hawaii), Ph.D. (Massachusetts) - Associate Professor
A first-year student intending to major in Psychology must select Psychology 110 and Philosophy 100 or two of Philosophy 125, 135, 140, 150. Students without high school Biology should include Biology 131 in their programmes. Students with less than three Mathematics papers in Grade XIII are, in addition, advised to take Mathematics 85.

In Year II the general student majoring in Psychology must take Psychology 200, and at least one other full-year or two half-year Psychology courses. Psychology 280 is strongly recommended in the second year. During Year III the student must complete two full year or four half-year Psychology courses at either the 200 or 300 level, including Psychology 280 if it has not been taken previously. Students who expect to proceed to graduate study in Psychology are strongly recommended to include the following courses in their programme: Biology 231, Mathematics 140, Mathematics 233, Philosophy 220.

Prerequisites may be taken concurrently with courses for which they are prescribed.
Note on numbering: Courses numbered 250-299, 350-399 are Honours courses. Ordinarily, General Course students will take the courses numbered 200-249 or 300-349. Honours students may take a limited number of 200-249 and 300-349 courses but Honours standing will be required. Undergraduate courses ending in 0 and 99 are full-year courses. Courses ending in odd numbers are half-year courses offered in the fall term, while courses ending in even numbers are half-year courses offered in the winter term, with the exception of those courses offered to students in co-operative programmes. Courses numbered 250-299 and 350-399 are intended primarily for honours students.

Graduate offerings: Courses numbered 600-650 are offered on a half-year basis. Courses numbered 699 and above are full-year courses.

Candidates for a graduate degree in psychology who possess an ordinary bachelor's degree must take at least one preliminary year of work in psychology to ensure that their preparation is equivalent to that of a graduate of an honours course in psychology.

Candidates with an honours bachelor's degree or preparation equivalent may select either a research-oriented course leading to the Ph.D. degree or a professionally-oriented course leading to a master's degree.

Ph.D. candidates must pass a general examination plus an examination in their major and their minor field of specialization. Permissible major areas of specialization are: sensory and perceptual processes, learning, physiological and comparative, social, and clinical. Permissible minor areas of specialization are: any one of the five permissible major areas, counselling, developmental, educational, human-factors engineering, and industrial. Candidates who wish to work with children should select developmental as their minor area.

Candidates electing to major in clinical psychology will be required to complete internship training under conditions approved in advance by the Department.

Students intending to qualify at a subdoctoral level for work in applied psychology settings are advised to take the master's programme in applied psychology. This programme is set up on a co-operative work-study basis (see page 48 for general principles). The programme commences with a six-week summer session, starting July 1st, during which all candidates will be in residence. Candidates for the degree are then divided in two streams, A and B. Over two regular academic years, each stream spends a half-year in residence and a half-year in an approved work-setting. Attendance at summer sessions, following completion of the first and second year of the programme, is required of students in both streams. The degree thus requires two calendar years and one summer of preparation beyond the honour bachelor degree in psychology or equivalent preparation.
Undergraduate Course Descriptions

Note: The number of hours or lectures shown after the course description is an attempt to indicate the "normal"; each instructor determines how often his particular class will meet.

15. Introductory Psychology. A short introduction to the methodology and basic principles of some of the major areas of modern psychology such as learning, emotion, and perception. (For engineering students only.)
3 lectures.

110. Introductory Psychology. This course is designed to provide the students with an understanding of the basic concepts and techniques of modern psychology as a behavioural science. The development of behaviour, learning, motivation, emotion, sensation and perception, and individual differences will be studied with reference to physiological correlates and to environmental factors.
3 lectures.

111. Introductory Psychology I. This course, together with Introductory Psychology II, is equivalent to Psychology 110, but is given in two self-contained units. (For Co-operative Mathematics students only).

112. Introductory Psychology II. (For Co-operative Mathematics students only.)
Prerequisite: Psychology 111.
3 lectures.

150. Experimental Methods in Psychology. An introduction to experimental methods in psychology. In respect to content, emphasis will be placed on the fields of learning, perception, and physiological psychology. (For students in Honours Psychology and Honours Biology and Psychology. Other students by permission of Department only.)
2 lectures, 2 hours laboratory.

200. General Experimental Psychology. An introduction to the methods of experimental psychology. Laboratory experience will be used to introduce the student to the data and theories of learning and perception. (This course is required of all general B.A. students in Psychology unless both Psychology 290 and Psychology 360 are substituted.)
2 lectures, 2 hours laboratory.

211. Developmental Psychology. The genesis and development of behaviour will be traced from conception to maturity.
3 lectures, fall term.

212. Social Learning and Motivation. An analysis of the motivational aspects of human behaviour from a developmental point of view.
3 lectures, winter term.
251. Comparative Psychology. An introduction to the study of animal behaviour in natural and laboratory situations. Cross-species comparisons. 2 lectures, 2 hours laboratory, fall term.

252. Physiological Psychology. The relationship between patterns of behaviour and physiological processes. 2 lectures, 2 hours laboratory, winter term.

280. Statistical Methods in Psychology. An introduction to the logical and theoretical bases of the application of statistical methods to the solution of problems in the social sciences. Consideration will be given to descriptive statistics, to sampling statistics, to inferential statistics, and also to the effective use and interpretation of statistics in the design of experiments. Required of all Honours Psychology students. 2 lectures, 1 hour laboratory.

290. Principles of Learning. This course is designed to introduce the student to learning theory and to provide an understanding of experimental techniques in this area. Required of all Honours Psychology students. 2 lectures, 2 hour laboratory.

300. Social Psychology. In this course the student will study socialization, social perception, interaction within and between groups, and the communication process. 3 lectures.

331. Individual Differences. The basic problems in measuring individual differences in intelligence, personality, and other characteristics will be studied. 3 lectures, fall term.

332. Applied Psychology. An introduction to the methods and problems of such applied areas as counselling, educational, and industrial psychology. 3 lectures, winter term.

351. Personality Theory. An examination and evaluation of some of the outstanding theories of personality. 3 lectures, fall term.

352. Psychopathology. The nature and origin of deviant behaviour will be considered. Time will also be devoted to an examination of current research on behaviour disorders. Prerequisite: 351. 3 lectures, winter term.

360. Sensation and Perception. The characteristics of sensation and perception will be studied in relation to the physics of the stimuli and physiology of the sensory apparatus. Required of all Honours Psychology students. 2 lectures, 2 hours laboratory.

370. Animal Learning. More advanced study of learning principles, together with a presentation of, and practice in, the techniques of experiments with animals. 2 hours lectures, 2 hours laboratory.
380. **Advanced Physiological Psychology.** More advanced study of the physiological basis of behaviour, with particular reference to the functioning of the nervous system.
Prerequisite: 252.
2 hours lectures, 2 hours laboratory.

390. **Motivation and Emotion.** Past experience, the social environment, and physiological responses as determinants of motivated behaviour.
Prerequisite: 290.
2 hours lectures, 2 hours laboratory.

410. **History and Systems.** An examination of current theoretical approaches to psychological problems presented in a historical context.
3 hours lectures.

430. **Problems in Contemporary Psychology.** Conducted, for the most part, as a seminar class, the purpose of this course will be to examine the latest developments in psychology, chiefly through journal publications, in order to evaluate contemporary trends in research and theory.
2 lectures.

2 lectures.

499. **Senior Honours Essay.** Each student will work under the direction of a member of the department on an experimental study. The result of this investigation will be presented in the form of a thesis, which will be critically examined by members of the department and also, where pertinent, by members of other departments.
5 hours supervised research, seminar.

**Graduate Course Descriptions**

**A. Courses for Credit Toward the Ph.D. Degree**

611. **Human Factors Engineering I.** The human being as an element in an engineering system; his physical and mental capabilities and limitations; his assets and liabilities as compared to automatic elements; his physical and mental requirements for optimum functioning as an element in a system.

612. **Human Factors Engineering II.** More advanced study of selected problems presented in Psychology 611, together with laboratory demonstrations.

621. **Introduction to Clinical Psychology.** A critical evaluation of concepts and principles of particular concern to the clinical psychologist. The course will include historical developments, ethical problems, and role definition. Practicum involves presentation of clinical test materials with lectures pertaining to the development and reliability of, and the validation research on, each test.
Department of Psychology

622. Psychodynamics. This course deals with the theoretical structures upon which psychological treatment is based. Coverage ranges from orthodox psychoanalytic theory to current phenomenological and social-learning theories. Practicum work includes supervised examinations of school children on standard measures of intelligence and report writing.

623. Personality Assessment. This course deals with the nature, validity, and underlying assumptions of the major "diagnostic" clinical tests. Emphasis is placed on the more difficult "projective" tests. Practicum work includes discussion and interpretation of protocols secured from hospital and reformatory populations.

624. Psychopathology. Course materials concern orientations to psychopathology, problems in current approaches, and suggestions for other theoretical systems. Practicum work involves collection of clinical data in a clinical setting under supervision of staff persons.

625. Psychotherapy. A detailed coverage of psychotherapeutic systems and theories of personality change and of related research.

626. Psychotherapy practicum. Students will conduct continuing psychotherapy under supervision of the staff. Theoretical and practical issues will be discussed.

627. Seminar in Clinical Psychology I. This seminar is designed to enable individual staff members to present their current points of view and research contributions.

628. Seminar in Clinical Psychology II. Presentations by individual staff members supplementary to those given in 627.

629. Group Psychotherapy. A study of the underlying principles of group therapy with emphasis on the psychodynamics of the individual as he operates in a group situation.

630. Directed Study. This course offers an opportunity for students who have previously taken a half-year course in a specific area to explore selected problems in greater depth.

Prerequisite: Psychology 280 or its equivalent.

632. Experimental Design. Basic principles used in the design of experiments and the analysis of experimental data, with emphasis on complex analysis-of-variance techniques.
Prerequisite: Psychology 631.


640. Selected Topics in Psychology.

698. Internship.


702, 722, 742. Learning I, II, III. A series of seminars devoted to critical reviews of basic theoretical issues and recent advances in selected topics in learning.

703, 723, 743. Physiological and Comparative, I, II, III. A series of seminars in which implications of recent experimental advances in brain research and animal behaviour will be presented and discussed.

704, 724, 744. Social Psychology, I, II, III. A series of seminars dealing with theoretical issues and research findings in the area of social and social industrial psychology.

705, 725. Child Behaviour and Development, I, II. A series of seminars dealing with recent experimental advances in the area of child psychology and with theoretical issues and research in the areas of child development and behaviour.

750. Individual Research Project. A supervised experimental study, together with a survey of relevant findings in the literature.

760. Advanced Experimental Psychology. Detailed study of selected problems in the students' major area of specialization, e.g. cognition, learning, motivation, perception.

770. Instrumentation for the Behavioural Sciences. An introduction to the principles of electricity, relay circuiting, and biological amplifiers.

780. Behaviour of Non-human Primates. A seminar on various aspects of non-human behaviour, including learning, concept formation, and social behaviour, accompanied by training in observational and testing techniques appropriate to the area of study.

B. The Master's Programme in Applied Psychology

First Summer (Six-week session):

801. Tests and Measurements, I. An introduction to methods of test construction and of assessing the reliability and validity of tests. A survey of the rationale and purposes of the most commonly used psychological tests. 4 lectures, two hours practicum, each week.

802. Introduction to Applied Psychology. An overview of the various fields of applied psychology and of the manner in which psychological principles and methods have been employed for the solution of problems of human behaviour in applied settings. 4 lectures each week.
Department of Psychology

First Residence Term (Twelve-week session):

2 hour seminar.

812. Assessment of Intelligence. Theories of intelligence and the nature of tests derived from these theories. Criteria for the selection of tests. Review of relevant research. Practice in test administration and evaluation of results.
2 lectures, two-hour practicum.

813. Assessment of Personality, Attitudes, and Interests. The development and use of personality tests and the relationship of tests to personality theories. Nature and theoretical bases of tests of aptitudes and interests. Reviews of relevant research. Practice in administration and evaluation of results. The emphasis in this course will be on paper-and-pencil group tests.
3 lectures, two-hour practicum.

Second Summer (Six-week session):

4 lectures, two-hour practicum.

822. Social Problems. An overview of the literature on socially deviant behaviour, e.g., drug addiction, delinquency, and on problems of adjustment in industry and education.
4 lectures.

Second Residence Term:

831. Theories of Psychopathology. A review of leading theoretical interpretations of deviant behaviour, e.g., psychoanalytic, Rogerian, and social-learning theories.
3 hours a week.

832. Special Areas of Applied Psychology. A more detailed treatment of the problems, theories, and research of particular interest in one of the following fields:
   (a) Educational psychology or
   (b) Industrial psychology or
   (c) Counselling psychology.
2 hour seminar.

833. Interviewing. Theories and methods of interviewing. Demonstration and practice. The course will be divided into several sections to permit the development of techniques appropriate to the kind of setting in which the student proposes to work.
2 hours seminar, two-hour practicum.

Third Summer (Six-week session):

841. Professional Issues. Professional ethics and professional role; problems of communication.
2 hour seminar.

843. Essay. A formal paper which may either:
(a) report a research study carried out under supervision during work terms; or
(b) present an extensive review of the literature on some aspect of applied psychology; or
(c) present a series of related case studies within a theoretical framework.

844. Comprehensive Examination.

Religious Knowledge

J. W. Fretz, A.B. (Bluffton), B.D. (Chicago Theol. Seminary), Ph.D. (Chicago) - - - - - Professor G W. Klaassen, B.A. (McMaster), B.D. (McMaster Divinity School), D.Phil. (Oxford) - - - - - Associate Professor G A. M. McLachlin, M.A. (Toronto), B.D. (Emmanuel) - - - - - Associate Professor P J. R. Horne, M.A. (Western), B.Th. (Huron), Ph.D. (Columbia) - - - - - Assistant Professor R L. J. Siess, Ph.D., S.T.L. (Gregorian, Rome) - - - - - Assistant Professor J D. A. Kirwan, C.R.. B.A. (Western) - - - - - Lecturer J (part-time)

50J. Grace and the Sacraments. Grace; concepts pertaining to all the sacraments; the meaning of sacramental life to the individual and to society. 3 lectures.

100G. Biblical Foundations of Christian Faith. A survey and interpretation of the history of Israel and of the life and teachings of Jesus. 3 lectures.

100J. Christian Apologetics. Establishment of the claims of Christianity; the divinity of Christ; the Church; sources of dogma; faith, God and His nature the divine attributes: the Trinity; Incarnation; Redemption; Mariology. 3 lectures.

100P. New Testament Greek. This course will consist of two parts:
(a) An Introduction to Greek grammar with appropriate grammatical exercises and development of vocabulary;
(b) An exegetical study of the Greek Text of the Synoptic Gospels, with Mark as the basis. 3 lectures.
Religious Knowledge

110P° - 111P°. Christian Belief. A survey of the basic elements of the Christian faith. The relationship between revelation and reason, the authority of Scripture, the doctrines of God, of man, of the Church, of God's activity in history, and of the Christian life.
3 lectures. (Fall and Winter Terms)

110R. History and Philosophy of the World's Major Religions. The history and philosophy of the world's major religions, compared and contrasted with the unique message of Christianity.
3 lectures.

200G. The Left Wing of the Reformation. The history and philosophy of the sixteenth century sectarians contrasted with the major reformers and evaluation of their place in modern Christianity.
3 lectures.

200J. Sacred Scriptures. Inspiration; origin; the canon of the Scriptures; manuscripts and versions; Biblical history of the Old and New Testaments.
3 lectures.

3 lectures.
212G History of the Late Medieval and Reformation Church (A.D. 1200-1560). Especially emphasized are parish life and belief and the causes of the reformation. The Anabaptist movement is studied as a significant part of the reformation in addition to the traditional concern with Lutheran, Reformed and Anglican Christianity.
3 lectures.

300J Catholic Social Doctrines. The Church and society; the pronouncements of the Church on civil, domestic, professional and international societies.
3 lectures.

Russian — See page 192.

Science

100 Introduction to General Science. A survey course for Arts students the first half of which is designed to give a basic grounding in the principles of physics and chemistry, and the historical development of scientific concepts and methods. The second half of the course is devoted to a study of science in the Twentieth Century, an examination of some of the more important recent developments, such as relativity, the quantum theory, nuclear physics, organic and biochemistry, genetics and evolution. (Not acceptable as an Arts elective for Science students).
3 lectures.

400 The History and Philosophy of Science. The nature of science; science and technology in Egypt and Babylon. The development of science in Greece; the Orphic mysteries and the Ionian philosophers. Plato and Aristotle; Archimedes. The Alexandrian school and the separation of science and philosophy. Technology under the Roman Empire. The mediæval attitude toward science. The Renaisance, Copernicus and Galileo. Sir Isaac Newton. The physical and biological sciences during the 18th century. Developments during the 19th century in Physics, Chemistry, Technology, Geology. Evolution and the rise of modern Genetics. The 20th century revolution in pure science and technology.
2 lectures.

Department of Sociology and Anthropology

H. J. Fallding, B.A., B.Sc., M.A., Ph.D. (Australian National University) — Professor and Chairman of Department
J. W. Fretz, A.B. (Bluffton), M.A., Ph.D. (Chicago) — Professor
N. H. High, B.S.A. (Toronto), M.S., Ph.D. (Cornell) — Professor
H. D. Kirk, B.S. (City College, New York), M.A., Ph.D. (Cornell) — Professor
Department of Sociology and Anthropology

W. L. Sauer. B.A. (Wayne State), M.A., Ph.D. (Michigan State)  
Associate Professor

W. G. Scott. B.A. (Western), M.A. (Toronto)  
Associate Professor

E. W. Vaz, B.A., M.A. (McGill), Ph.D. (Indiana)  
Assistant Professor

M. Kurokawa, B.A. (Tokyo Women's Christian College), M.A. (California)  
Assistant Professor

A. J. Muntean, B.A. (Youngstown), M.A. (Michigan State)  
Assistant Professor

Wm. B. Roosa, B.A. (Texas Christian), M.A. (New Mexico)  
Assistant Professor

D. R. Badir, B.Sc. (Manitoba), M.Sc. (Syracuse), M.Sc. (London)  
Lecturer R

W. L. Choate, C.R., B.A. (St. Mary's, Kentucky), M.A. (St. Louis)  
Lecturer J

Undergraduate Course Descriptions

Notes:
(1) Students electing an Honours Programme or a Major in Sociology should register in Sociology 100. Students electing to major in Anthropology should register in Anthropology 101 or 102, but Anthropology 101 and 102 cannot be substituted for Sociology 100 towards further work in Sociology. (Plans are under way to offer a General B.A. in Anthropology in the near future.)

(2) General students who major in Sociology must elect the following courses: Sociology 100, Anthropology 102, Sociology 210, 315, 320, 325 and one of the following: Sociology 300, 301, 339.

(3) Students who pursue an Honours Programme in Sociology must take the following courses in their 4th year: Sociology 450, 470, 499 and two electives. Courses at the 400 level are normally open to Honours students only, but may be open to General students with the permission of the instructor.

(4) The number of hours or lectures shown after the course description is an attempt to indicate the “normal”; each instructor determines how often his particular class will meet.

Anthropology

101*. Origins of Man and Culture. An introductory course in Physical Anthropology and Archaeology. Lectures on living and fossil primates, the fossil evidence for the origins and development of man, modern races, and archaeological evidence for the origins and development of culture. 3 lectures.

102*. Cultural and Social Anthropology. An introductory course on the nature of culture. Data are presented on several primitive cultures. 3 lectures.
222. North American Archaeology. A survey of North American archaeology from the earliest known cultures to the time of European contact. Data on the Great Lakes area will be emphasized. Prerequisites: 101 and 102, or permission of the instructor. 3 lectures.

225. North American Indians. A survey of North American Indian cultures as they were at the time of European contact. Data on the present-day status of several selected groups will be included. Prerequisites: 101 and 102, or permission of the instructor. 3 lectures.

357. Hunting and Gathering Cultures of North America. Archaeological and ethnological data on various prehistoric and historic groups are presented. Emphasis is on hunting and gathering cultures as a distinct type. Prerequisites: 101 and 102, or permission of the instructor. 3 lectures, alternate years.

444. Method and Theory in Archaeology. An advanced course in archaeology with emphasis on method and theory. Prerequisites: 101, 102, 222, or permission of instructor. 3 lectures, alternate years.

Sociology

15. Sociology. A general introduction to the subject covering the main concepts, theories and ideas and how they relate to study of groups in society.

100. Introductory Sociology. The sociological approach to social phenomena emphasizing analytical concepts and tools of investigation. 3 lectures.

202. Sociological Statistics. A first course in sociological statistics: sampling, central tendency, probability, co-variance, as illustrated in specifically sociological data. 3 lectures.

205. Social Problems. An analysis and interpretation of contemporary social problems and the dynamic forces creating them. 3 lectures.

210. Introductory Social Psychology. The place of interaction, language, and culture in the development of human identity. The analysis of interpersonal relationships in situational contexts. Determinants of definitions of situation, types of interpersonal strategies, representations and misrepresentations of self, empathy, role taking, and the imputation of motives. 3 lectures.

211. Social Structure and Character. The relationship between social organization and modal as well as deviant personality types. Differential processes
of socialization, and the effects of personality types on social organization. Social structures considered will include occupational, fraternal, and kinship groupings.
3 lectures.

230*. Family and Kinship. An evaluation of the origin and growth of the family as a social institution; its structures and functions in primitive and modern societies; the effect of modern technology on the family; trends and contemporary problems.
3 lectures.

240*. Collective Behaviour. The sociological analysis of the behaviour of crowds, mobs, publics, and related phenomena and their relationships to social organization and social change.
3 lectures.

241*. Social Movements. The sociological analysis of varieties of social movements and their relationships to social organization and social change.
3 lectures.

250*. Crime and Society. An analysis and criticism of the major theories of criminal behaviour. Emphasis is given to the relationship between social structure and criminal behaviour; types of criminal behaviour such as drug addiction; statistics and contemporary research. A sound knowledge of sociological concepts is advisable.
3 lectures.

251*. Ethnic and Racial Relations. Relations between different racial and cultural groups; analysis of majority-minority group status.
3 lectures.

252*. Juvenile Delinquency. A systematic analysis and criticism is presented of biological, psychological, psychoanalytical and sociological theories of juvenile delinquency. Attention is given to statistics and contemporary research with special emphasis on the distribution and types of delinquent subcultures. Students should possess a sound knowledge of basic sociological concepts.
3 lectures.

260*. Population. The study of population as an area of sociological investigation; population size, composition, and distribution; population trends and problems.
3 lectures.

270*. Communication. An analysis of the role of language and other symbol systems in social interaction; the interplay between communication and the social system; the formation of attitudes through language; social and individual disorders as caused by, and reflected in, the breakdown in the communication process.
3 lectures.
300. Human Communities. A comparative analysis of different types of human communities from mainly sociological and anthropological points of view: primary emphasis on types of communities found in non-literate, folk, and pre-industrial societies; major theories concerning communities of these types. 3 lectures.

301. Urban Sociology. The comparative study of urbanization as a process; the culture and social organization of cities, urban problems; special attention is given to industrial cities of Western societies. 3 lectures.

315. Social Stratification. Analysis of social classes in society including their bases for development, composition, and consequences for society. 3 lectures.

320. Sociological Research. A systematic treatment of the logic and practice of methods basic to social research. Examination of problems of experimental design, sampling, data gathering, and analysis in the context of case studies of research. Students will be given laboratory experience in several techniques of research. 3 lectures.

325. Sociological Theory. Major European and American sociologists and "schools" from Comte to the present. Emphasis will be less on history and biography than on the ideas, and their application to an understanding of major issues generated in human societies. 3 lectures.

331. Social Change. A systematic review and analysis of major theories of social change with particular attention to evolutionism, historicism and functionalism. Theoretical problems are then examined within a specific context, such as social organization, social stratification, economic institutions, urban structures, etc. 3 lectures.

335. Sociology of Science. The study of science as an institution; its historical development and contemporary relationships with other institutions including government, education, and industry. 3 lectures.

339. Industrial Sociology. Sociological analysis of industry, including relationships between labour and management and industry and society. 3 lectures.

340. Formal Organizations. A survey of theory and research on formal organizations making use of selected contributions from the scientific management and human relations approaches, but with emphasis on the structure and functions of large scale organizations. The nature and types of formal organizations; control techniques and leadership; relations of the organization to its
clients and publics; informal aspects of the organization; organizational tensions and pathologies of bureaucratic systems; how the organization adjusts to change.
3 lectures.

341\textsuperscript{o}. Sociology of Occupations. The sociological study of occupations as an aid to understanding the social structure; social and demographic aspects of the labour force; the meaning of work; the relation of work and leisure; career and occupational mobility patterns; occupation and status; professionalization; trends in occupations.
3 lectures.

355\textsuperscript{o}. Sociology of Religion. The analysis of religion as a social institution; its relationship to culture, personality and social change with consideration given to theories of religious behaviour and contemporary research findings.
3 lectures.

360\textsuperscript{o}. Political Sociology. The sociological analysis of the institutionalization of power, political movements, parties, conflict and its accommodation.
3 lectures.

365\textsuperscript{o}. Social Structure of the Soviet Union. A sociological analysis of contemporary Soviet society focusing on the patterns and functions of its basic institutions including the family, government, education, and industry; consideration of class formation and distribution of power.
3 lectures.

380\textsuperscript{o}. Sociology of Health and Welfare. The structure and processes of health and welfare services are examined as parts of the institutional network of North American society. Professionalization and bureaucratic organization as aids and obstacles toward institutionalized goals. The impact of scientific and technological changes on the structure of health and welfare services and careers.
3 lectures.

385\textsuperscript{o}. Education and Society. The structure and processes of education are examined in relation to those of community and society. Schools as sources, recipients, and modifiers, and professionalization of personnel in relation to the institutionalized goals of education in North American society.
3 lectures.

1 - 3 hours.

465. Readings. Selected readings and essay assignments under the direction of a staff member.
3 - 4 hours.
470. **Seminar: Practicum in Theory and Methodology.** A preparation for advanced undergraduate students for an independent, sophisticated orientation to graduate study. The practicum provides opportunities for:

(1) developing research designs on the basis of extant theory, and

(2) theorizing on the basis of the reanalysis and reinterpretation of extant data. 1-3 hours.

499. **Senior Honours Essay.** Required of all honours students in Sociology or Psychology — Sociology in their fourth year.

**Graduate Programme**

At the time of printing, plans for the establishment of the Graduate Programme were not completed. For details, correspondence should be addressed to the Department Chairman.

**Department of Spanish and Italian**

J. C. McKeegney, B.A. (Western), M.A. (Oregon), Ph.D. (Washington)  
*Associate Professor and Chairman of the Department*

M. I. Kieffer, C.R., B.A., (St. Louis), M.A. (McGill),  
J.C.D. (Gregorian)  
*Professor*

C. M. Fernandez, Lic. en Arq. (Madrid), M.A. (Tulane)  
*Assistant Professor*

J. C. Forster, B.A., M.A. (King's College, Cambridge),  
Doctor en Filosofía y Letras (Granada)  
*Assistant Professor*

E. Grey, B.A. (Texas Western), M.A. (Colorado), Ph.D. (Harvard)  
*Assistant Professor*

C. D. Sardinha, M.A. (Toronto)  
*Lecturer*

**Undergraduate Course Descriptions**

General Arts students who wish to major in Spanish will take Spanish 100, 200, 300 and any two Honours Spanish courses chosen in consultation with the department chairman.

**Note:** The number of hours or lectures shown after the course description is an attempt to indicate the "normal"; each instructor determines how often his particular class will meet.

1-50. **Introduction to Spanish.** Intensive drill in the fundamentals of grammar and composition. The language laboratory will be used regularly. No prerequisite, though the student should have Grade XIII French. 5 lectures.
100. Survey of Spanish Literature. Intensive review of grammar and composition. Survey of Spanish literature. The language laboratory will be used regularly. 
Prerequisite: Spanish 1-50 or Grade XIII Spanish. 
4 lectures.

200. Survey of the Spanish Novel. For students in General Arts only. Critical survey of representative Spanish novels, from Lazarillo de Tormes to the mid-twentieth century. Lectures, readings, reports.
Prerequisite: Spanish 100.
3 lectures.

210. Spanish Civilization. A study in English of the main historical and cultural currents in Spain and Spanish America. (Honours Spanish students may not take this course for credit.)
3 lectures.

Prerequisite: Spanish 100.
3 lectures.

260. Prose and Drama of the 18th and 19th Centuries. Critical reading of the principal authors and playwrights of the period. Lectures in Spanish, readings, reports.
Prerequisite: Spanish 100.
3 lectures.

300. Survey of the Spanish Drama. For students in General Arts only. Critical survey of representative Spanish plays, from Juan del Encina to the mid-twentieth century. Lectures, readings, reports.
Prerequisite: Spanish 200.
3 lectures.

350. Advanced Composition. Writing of essays based on critical examination of selected plays and novels; discussion, in Spanish, of these works; practice in the language laboratory.
Prerequisite: Spanish 250.
2 lectures.

360. Spanish Prose and Drama of the 16th and 17th Centuries. Critical study of the literature of the Spanish Golden Age.
Prerequisite: Spanish 260.
2 lectures.

2 hours.

370. Survey of Spanish American Literature. A critical study of Spanish American literature from the Cortés letters to the present.
Prerequisite: Spanish 100.
3 lectures.
375. Individual Playwrights of the Golden Age.
3 hours seminar.

450. Senior Spanish Composition and Oral Practice. The language laboratory
will be used regularly.
Prerequisite: Spanish 350.
2 lectures.

455. Individual Writers of the Twentieth Century.
3 hours seminar.

460. Spanish Literature of the 20th Century. Critical examination of the works
of the most significant writers of this Century.
Prerequisite: Spanish 360.
2 lectures.

465. Cervantes and His Age.
3 lectures.

470. Mediaeval Spanish. Study of the literature from the beginnings to 1500
A.D.; introduction to Old Spanish grammar; elementary Portuguese.
Prerequisite: Spanish 370.
2 lectures.

475. The Modernista Movement.
3 lectures.

476. The Novel in Mexico.
3 lectures.

480. Survey of Spanish Poetry. From the Poema del Cid to the present.
Lectures, reports.
Prerequisite: Spanish 300 or 360.
2 lectures.

Ukrainian — See page 195.
Department of Co-ordination and Placement
Functions of Department of Co-ordination and Placement

The Department of Co-ordination and Placement is responsible for the successful operation of the industrial periods of the Co-operative Programmes. In addition, the department provides assistance to undergraduate and graduating students in all faculties in obtaining full-time or summer employment.

The staff of the department is comprised of professional personnel having extensive industrial experience. Each co-ordinator is responsible for a designated area and is the liaison officer between the University and the employers of students in his territory. Each acts as a counsellor and advisor to these students.

Director
A. S. Barber, P. Eng.

Engineering, Applied Physics and Applied Chemistry

Assistant Director
G. L. White, B.A.Sc. (Toronto), P.Eng.

Co-ordinators
D. G. S. Anderson, B.A.Sc. (Toronto), P.Eng.
H. D. Ball, B.A. (Western), P.Eng.
R. Grant, B.A.Sc. (Toronto), P.Eng.
L. B. Jones, B.A.Sc. (Toronto), P.Eng.
A. L. Lind, B.Sc. (Queen’s), P.Eng.
A. M. Moon, B.A.Sc. (Toronto), P.Eng.
R. D. Mumford, B.Sc. (Queen’s), P.Eng.
M. M. Smith, B.Sc. (Queen’s), P.Eng.
M. S. Stevens, B.Sc. (Queen’s), P.Eng.

Co-operative Mathematics

Assistant Director

Co-ordinators
D. V. Deverall, B.A. (Bishop’s)
R. J. Wieser, B.Eng. (Saskatchewan), P.Eng.

Co-operative Psychology

Co-ordinator
R. J. Walsh, B.A. (Queen’s)

Graduate Placement and Summer Employment

Co-ordinator
C. F. Burk, M.A.Sc. (Toronto), P.Eng.
The Co-operative Plan

What it is:

Co-operative education is based on the principle that during the undergraduate years an academic programme combined with integrated work experience in alternating terms, is relevant to, and desirable for, effective professional preparation. The work terms allow the student to acquire experience in the area of his career interest, while the academic terms can more properly be devoted to fundamental and theoretical studies. At Waterloo, the programme consists of eight four-month academic terms and six four-month work terms. Thus the practical experience is in no sense a substitute for, but is rather a complement to, the academic studies.

The motivation, responsibility and opportunity for insight gained through co-operative education can be of inestimable value for the student's future. The co-operative principle is important precisely because it enables those with a career orientation to become full-time students of their subject — not only during the academic terms on campus but during the related work experience gained, not in a random and uncertain manner, but within a structure of organized purpose and serious study.

Operation of the Plan

The necessary arrangements for the integration of the work terms, the securing of potential employers of the students, the arranging of interviews, the professional guidance involved, the grading of "work reports" and generally the whole management of the co-operative employment scheme is handled by a special department of the University - The Department of Co-ordination and Placement. The co-ordinators counsel their students, visit them on their work assignments, and introduce students to the necessary discipline of work and responsibility.

The Work-Study Sequence

The eight terms of study and six terms of industrial employment provided in the course are arranged as shown in the diagram below:

<table>
<thead>
<tr>
<th>1966</th>
<th>1967</th>
<th>1968</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Winter</td>
<td>Spring</td>
</tr>
<tr>
<td>Stream</td>
<td>First Term</td>
<td>Second Term</td>
</tr>
<tr>
<td>Stream “A”</td>
<td>Work Period</td>
<td>Second Term</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1969</th>
<th>1970</th>
<th>1971</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td>Spring</td>
<td>Fall</td>
</tr>
<tr>
<td>Stream</td>
<td>Fifth Term</td>
<td>Work Period</td>
</tr>
<tr>
<td>Stream “A”</td>
<td>Work Period</td>
<td>Fifth Term</td>
</tr>
</tbody>
</table>

| Stream “B” | Work Period | Fifth Term | Work Period | Sixth Term | Work Period | Seventh Term | Eighth Term |
All year I students enrol in September and spend the first term together at the University. As indicated on the diagram, they rejoin as a class for the last term to complete their course, and graduate together. Between the first and last terms, the diagram shows that each class is split into two approximately equal groups (streams) for continuity of employment opportunity on the co-operative programme. Both groups, of course, have the same total time on campus and in industry; one group having a double academic term at the start of the course and the other having a double academic term at the end of the course. The division at the end of the first term of study is based upon student preference, financial considerations of students, etc. Precise dates for the beginning and end of various terms are shown in the Academic Calendar.

Co-operative Work Assignments

A basic requirement of the Co-operative Programmes at the University of Waterloo is satisfactory performance during co-operative work assignments.

Registration in a co-operative course implies that students will accept work assignments either through the regular interview procedure or where their best interests are served on an assignment that the Department may determine. All positions held by students must be approved by the Co-ordination Department in order to be considered as part of the required work assignments.

Students and employers' representatives choose each other through the Department's placement process. Salaries paid co-operative students are determined within the employer's own wage structure, although consultation does take place with the University's Co-ordination Department.

Although the Co-ordination Department does not guarantee placement of students in industry, every effort is made to ensure that appropriate employment is made available.

Job notices are posted on the bulletin boards and students are asked to examine the notices and indicate their interest by signing for an interview appointment. An interview schedule is prepared and the company representatives interview the students on campus. The experience obtained in dealing with industry is a fundamental part of the student's education.

It is inevitable that some students will not be successful in being selected for employment on an assignment of their choice, and likewise that some companies will not obtain the students they have selected. Consequently, the Department will make every effort to place these students and satisfy the companies where the best interests of each can be served. On the other hand, the Department is not responsible for assisting in the placement of students required to repeat an academic term, until evidence of the successful completion of such term has been received.

Satisfactory co-operative work assignments are a requisite to graduation and poor performance is thoroughly investigated. No student may continue in a co-operative course at the University of Waterloo if he is not capable of acceptable progress in his work assignments. Repetition of poor performance will
result in a required withdrawal from a co-operative course or suspension from the University. The Co-ordination Department maintains a close liaison with the faculties, with industry and with the students, so that a valid assessment of a student's progress can be made by members of the Department.

Remuneration during work assignments is in accordance with prevailing wage policies of the individual employers, and depends on the nature of the work being performed. Wages can be expected to increase when merited as the student progresses through the course and assumes more responsibility. However, the student should not ordinarily expect the income from his work periods to make him completely self-supporting.

The preparation of a "work report" by the student is required for each work assignment. The report must cover some phase of the student's current employment and it must be presented to, and be approved by, the employing company two weeks prior to the end of each term of employment. This report must then be submitted to the Co-ordination Department of the University.

These reports serve a dual purpose. Experience is gained in the preparation of written reports similar to those which an employer expects from a responsible employee. In addition, the necessity of gathering material for such a report will develop in the student a thorough appreciation of job analysis. In effect, the work report is designed to help train the student to think, to organize and to express himself on paper in a clear, logical and concise form. The work report together with an evaluation report from the employer forms the basis for grading the student's performance on his work assignment.

**Conduct and Responsibilities**

During his early years in the course, the work assignments teach the student the importance of being co-operative, industrious and punctual in his daily work. Although his initial assignments may not necessarily be related to the work done by professional personnel, he is provided with an increasing opportunity to gain experience in his chosen field as he progresses through the course.

It is emphasized that during the student's periods in industry he carries a responsibility to build and maintain his own good reputation as well as that of the University. Poor performance, unexcused absence from work, consistent lack of punctuality, inability to work with supervisors or fellow workers, lack of interest in the job, will be interpreted as an indication that he is not acceptable for professional training. A student who fails to honour an agreement to work with a company or who leaves his co-operative employment without prior approval from the Co-ordination Department, or who conducts himself while on the job so as to purposely cause his discharge, may be suspended immediately from the University for breach of discipline.

Co-operative education is a synthesis of two educational themes — the academic theme and the theme of organized practical training in the area of career interest. These two themes, when carried on concurrently, give depth and meaning to the formative years of learning. The numerous industrial and busi-
ness firms, as well as many other institutions and organizations that co-operate with the University in providing an opportunity for students at Waterloo, have entered a most serious undertaking to help prepare young men and women for fruitful careers. These companies and institutions exemplify an enlightened view of society's responsibility for preparing the coming generations of leaders. Students feel that industry and society are indeed interested in their development and this confidence can induce a reciprocal determination to strive and excel in their studies as well as in their introductory training.

At Waterloo, students entering a co-operative programme feel they are not merely "at school," but are already launched in their careers.

Thus in co-operative education, the University and society, through its numerous institutions, co-operate to produce a richer educational experience for university undergraduates. The task of the University is to engage their minds in demanding and fundamental studies, while the role of those who co-operate with the University is to engage their minds and youthful enthusiasm in the complementary discipline of well-ordered work experience.

It is this concept that forms the basic philosophy and underlying principle of co-operative education.

It is the Department of Co-ordination and Placement that provides the student with assistance and counselling necessary to ensure proper integration of the academic and industrial phases of his education.

Industrial Advisory Council for the Co-operative Engineering Programme

The Industrial Advisory Council is composed of delegates from companies interested in engineering education. The Council acts in an advisory capacity presenting industry's viewpoint to the University on the programming of the co-operative course at Waterloo as it affects the relations of the University and its students with industry.

Union Carbide Canada Limited
Dominion Textile Company Limited
Northern Electric Company Limited
Link-Belt Limited
Anthes Imperial Limited
Air Canada
Aluminum Company of Canada Limited
Ball Brothers Limited

Mr. G. O. Loach  
Chairman
Mr. K. C. F. Mills  
Past-Chairman
Mr. J. B. Hutchinson  
Vice-Chairman
Mr. J. W. Lear  
Vice-Chairman
Mr. C. H. Watson  
Secretary
Mr. J. T. Dyment  
Mr. H. J. Baker  
Mr. L. J. Fskritt

280
Beatty Brothers Limited
The Bell Telephone Co. of Canada
Canadian General Electric Co. Ltd.
Canadian Westinghouse Co. Ltd.
Coulter Copper & Brass Co. Ltd.
Cyanamid of Canada Limited
Dupont of Canada Limited
Fiberglas Canada Limited
City of Hamilton
Hawker Siddeley Canada Limited
John Inglis Company Limited
International Harvester of Can. Ltd.
Kaufman Footwear Industries Ltd.
Kimberly-Clark Pulp & Paper Co. Ltd.
Noranda Mines Limited
C. C. Parker and Associates
The Procter & Gamble Co. of Can. Ltd.
Proctor and Redfern
Pigott Construction Company Limited
Shell Canada Limited
The Steel Company of Canada Limited
Woods, Gordon and Company

Mr. K. P. Noxon
Mr. J. T. Fisher
Mr. W. F. McMullen
Mr. H. J. Simmons
Mr. W. R. Coulter
Mr. H. B. Van Hartesveldt
Dr. H. R. L. Streight
Mr. A. J. Fisher
Mr. W. A. Whetcn
Mr. W. D. Walker
Mr. H. B. Style
Mr. H. F. Schuell
Mr. W. H. Bechtel
Mr. C. C. Wright
Mr. R. P. Riggin
Mr. C. C. Parker
Mr. J. B. Bodtker
Mr. A. Staig
Mr. D. H. Stevens
Mr. H. L. Hinchcliffe
Mr. C. P. Layard
Mr. H. P. Connor

Companies Employing Co-operative Honours Mathematics Students

Aluminum Company of Canada, Limited
Automatic Electric (Canada) Limited

Bata International Centre
The Bell Telephone Company of Canada
The British American Oil Company Limited

Canadair Limited
The Canada Life Assurance Company
Canada Packers Limited
Canadian Canners Limited
Canadian General Electric Company Limited
Canadian General-Tower Limited
Canadian Imperial Bank of Commerce
Canadian Kodak Co., Limited
Canadian National Railways
Canadian Tire Corporation Limited
Canadian Westinghouse Company Limited
Cockshutt Farm Equipment of Canada Ltd.
Confederation Life Association
The Consumers Gas Co.
Co-operators Insurance Association
Crown Life Insurance Co.
DeHavilland Aircraft of Canada Ltd.
Dominion Life Assurance Company
Dominion Stores Limited
Dominion Textile Company Limited
Domtar Consumer Products Ltd.
Electric Reduction Company of Canada, Ltd.
The Empire Life Insurance Company
The Excelsior Life Insurance Company
Firestone Tire & Rubber Company of Canada, Ltd.
Ford Motor Company of Canada, Limited
Galt Metal Industries Limited
General Foods Limited
General Motors of Canada, Limited
Global Life Insurance Company
B. F. Goodrich Canada Limited
The Goodyear Tire & Rubber Company of Canada, Limited
Government of Canada:
    Central Data Processing
    Dept. of Agriculture
    Dept. of Transport
    Dominion Bureau of Statistics
    National Energy Board
Honeywell Controls Limited
The Hydro-Electric Power Commission of Ontario
The Imperial Life Assurance Company of Canada Limited
Imperial Oil Limited
International Business Machines Company Limited
International Harvester Company of Canada, Limited
KCS Limited
John Labatt Limited
London Life Insurance Company
The Manufacturers Life Insurance Company
Massey-Ferguson Limited
McKinnon Industries Ltd.
The Mercantile and General Reinsurance Company, Limited
The Mutual Life Assurance Company of Canada
The National Life Assurance Company of Canada
North American Life Assurance Company
Northern Electric Company Limited
The Northern Life Assurance Company

282
Northern Telephone Limited
The Bank of Nova Scotia

Province of Ontario:
   Dept. of Highways
Polymer Corporation Limited
H. K. Porter Company Canada Limited
The Procter & Gamble Company of Canada, Limited
The Prudential Assurance Company Limited
Pulp & Paper Research Institute of Canada

Rio Algom Mines Limited

Shell Canada Limited
Simpsons-Sears Limited
The Robert Simpson Company Limited
Sklar Furniture Company
The Sovereign Life Assurance Company of Canada
The Steel Co. of Canada, Limited
Sun Life Assurance Company of Canada
Sun Oil Company Limited

Texaco Canada Limited
City of Toronto, Finance Dept.
The Toronto Stock Exchange

Union Gas Co. of Canada, Limited
United Aircraft of Canada Limited
United Co-operatives of Ontario
Univac-Canada, Division of Remington-Rand Limited

Westmount Life Insurance Company
The Workmen's Compensation Board

Companies Employing Co-operative Engineering 
and Applied Physics Students

Abex Industries of Canada Limited
Abitibi Power and Paper Company Limited
H. G. Acres & Company Limited
Aerovox Canada Limited
Aiken & MacLachlan Limited
Air Canada
The Algoma Steel Corporation, Limited
Allen-Bradley Canada Limited
Allied Chemical (Canada) Limited, Brunner Mond Division
Aluminum Company of Canada, Limited
Aluminum Laboratorics Limited
American-Standard Products (Canada) Limited
Anaconda American Brass Limited
Andrew Antenna Company Limited
Angelstone Limited
The Anthes-Imperial Company Limited
Atomic Energy of Canada Limited
Aunor Gold Mines Limited
Automatic Electric (Canada) Limited
Automotive Hardware Limited
Aviation Electric Limited
Avon Products of Canada Limited

Babcock-Wilcox and Goldie-McCulloch Limited
Bailey Meter Company Limited
Ball Brothers Limited
Barnes Electric Company Limited
Barringer Research Limited
Bata Shoe Company of Canada Limited
Bathurst Containers Limited
Beatty Bros. Limited
Beaver Construction Company
Bedarco Limited
Beer Precast Concrete Limited
The Bell Telephone Company of Canada
Bendix-Eclipse of Canada Limited
Black Clawson-Kennedy Ltd.
Black & McDonald Limited
Blackstone Industrial Products Limited
Black, Shoemaker & Robinson O.L.S.
Blacktop Paving Company Limited
H. Boehmer & Company Limited
W. H. Bonus & Associates Ltd.
The Borden Chemical Company (Canada) Ltd.
Borg Fabrics Limited
Bowmar, Canada Limited
S. F. Bowser Company Limited
Brampton, Town of
Brant, County of
Brantford, The Corporation of the City of
Brantford Trailer & Body Limited
The British American Oil Company Limited
British American Research & Development Company
British Motor Corporation of Canada Limited
Brown & Root Limited
Building Products of Canada Limited
Burgess Battery Company — Division of Servel (Canada) Limited
Burlington, Corporation of the Town of
Butts Ross & Associates
CAE Industries Limited
Calvert Distillers Limited
Campbell Soup Company Ltd.
Canada Barrels & Kegs, Limited
Canada Cement Company, Limited
Canada and Dominion Sugar Company Limited
Canada Foundries & Forgings, Limited
Canada Iron Foundries, Limited — Electrical Division
Canada Machinery Corporation, Limited
The Canada Metal Co., Limited
Canada Packers Limited
Canada Sand Papers Limited
Canada Starch Company Limited
Canada Vitrified Products Limited
Canadair Limited
Canadian Admiral Corporation, Ltd.
Canadian Bird Equipment Ltd.
The Canadian Blower & Forge Company Limited
Canadian Brass Limited
Canadian Broadcasting Corporation
The Canadian Coleman Company, Limited
Canadian Controllers Limited
Canadian Copper Refiners Limited
Canadian Electrolytic Zinc Company Limited
Canadian Filters Limited
Canadian General Electric Company Limited
Canadian General-Tower Limited
Canadian Hanson & Van Winkle Company Ltd.
Canadian Industries Limited
Canadian Ingersoll-Rand Company Limited
Canadian International Paper Company
Canadian Johns-Manville Co., Limited
Canadian Marconi Company
Canadian National Railways
Canadian National Telecommunications
Canadian Pacific Railway Company.
Canadian Pacific Telecommunications
Canadian Refractories Limited
Canadian SKF Company Limited
Canadian Standards Association
Canadian Steelcase Co., Limited
Canadian Vickers Limited
Canadian Westinghouse Company Limited
Carter Bros. (Waterloo) Ltd.
Catalytic Construction of Canada Limited
Chatham, City of
Chicago Rawhide Products Canada Limited
Chinook Chemicals Corporation Limited
Chrysler Canada Ltd.
Clare Brothers Limited
C. P. Clare Canada Ltd.
Cobalt Refinery Limited
Collingwood Shipyards — Division of Canadian Shipbuilding &
Engineering Limited
Columbian Carbon (Canada) Ltd.
Columbus McKinnon Limited
Combustion Engineering-Superheater Ltd.
Computing Devices of Canada Limited
Concrete Pipe Limited
The Consolidated Mining and Smelting Company of Canada Limited
Consolidated Paper Corporation Limited
Consolidated Sand & Gravel Limited
The Consumers’ Gas Company
Continental Can Company of Canada Limited
Cooper-Bessemer of Canada Ltd.
Coulter Copper & Brass Co., Limited
Crane Packing Company, Limited
Crowe Foundry Limited
CTS of Canada, Ltd.
Cutler-Hammer Canada Limited
Cyanamid of Canada Limited

Dahmer Steel Limited
Damas L. Smith Limited
Daystrom, Limited
Dearborn Chemical Company Ltd.
John Deere Welland Works
The De Havilland Aircraft of Canada, Limited
De Laval Company Limited
De Leuw, Cather & Company of Canada, Limited
M. M. Dillon & Company Limited
P. D. Dirksen Limited
Dodge Construction Company Limited
Dominion Bridge Company Limited
Dominion Chain Limited
Dominion Die Casting Limited
Dominion Electrohome Industries Limited
Dominion Foundries and Steel, Limited
Dominion Road Machinery Co., Limited
Dominion Rubber Company Limited
Dominion Textile Company Limited
Domtar Chemicals Limited
Domtar Construction Materials Ltd.
Domtar Limited
Domtar Newsprint Limited
Domtar Packaging Limited
Domtar Pulp & Paper Limited
Donald Inspection Limited
Dosco Steel Limited
Dravo Corporation
Dryden Chemicals Limited
Dryden Paper Company Limited
Dufresne Engineering Company Limited
Dunker Construction Limited
Dunlop Research Centre
Du Pont of Canada Limited

Eastern Steel Products Company — Div. of Turnbull Elevator Limited
Eaton Automotive Canada Limited
The E. B. Eddy Company
Eldorado Mining and Refining Limited
Electrical Bureau of Canada
Electric Reduction Company of Canada, Ltd.
Emco Limited
Enelco Limited
Etobicoke Township Hydro-Electric Commission
Ex-Cell-O Corporation of Canada, Limited

Fairgrieve & Son, Limited
Falconbridge Nickel Mines Limited
The Falk Corporation of Canada Limited
Ferranti-Packard Electric Limited
Fiberglas Canada Limited
Firestone Tire & Rubber Company of Canada Limited
Fischer & Porter (Canada) Limited
Fisher Governor Company of Canada Limited
Ford Motor Company of Canada, Limited
Foster Wheeler Limited
The Foundation Company of Canada, Limited
Foxboro Company, Limited
Frankel Structural Steel Limited
Fraser-Brace Engineering Company, Limited
The Frontier College
Fruehauf Trailer Company of Canada Limited

John Gaffney Construction Company Limited
Galt, City of
Galt Metal Industries Limited
Gamma Engineering Ltd., Consulting Engineers
Gaspe Copper Mines Limited
Genaire (1961) Limited
General Concrete Ltd.
General Foods Limited
General Motors of Canada, Limited
Giffels Associates Limited
B. F. Goodrich Canada Limited
The Goodyear Tire & Rubber Company of Canada, Limited
Gore & Storrie Limited
Government of Canada:
  Department of National Defence
  Department of Public Works
  Department of Transport
W. R. Grace & Co. of Canada Ltd.
A. P. Green Fire Brick Co. Ltd.
Gummed Papers Limited

Hallnor Mines, Limited
Hamilton, City of
Hamilton Gear and Machine Company — Division of Turnbull Elevator Ltd.
J. Harris & Sons Limited
Hawker Siddeley Canada Limited
Hayes Steel Products Limited
H. J. Heinz Company of Canada Ltd.
Hilroy Envelopes & Stationery Limited
Honeywell Controls Limited
S. W. Hooper and Co. Ltd.
Horton Steel Works Limited
James Howden & Parsons of Canada Limited
Hussman Refrigerator Company Limited
The Hydro-Electric Power Commission of Ontario

Imperial Oil Enterprises Ltd.
Indesco Limited
Interchem Canada Limited - Ault & Wiborg Division
International Business Machines Company Limited
International Cellulose Research Limited
International Harvester Company of Canada, Limited
International Nickel Company of Canada, Limited
International Systems Limited
Iron Ore Company of Canada
I-T-E Circuit Breaker (Canada) Limited — Bulldog Electric Products Division

Jeffrey Manufacturing Company Limited
Jerrold Electronics (Canada) Limited
Johnson & Johnson Limited
S. C. Johnson & Son, Limited
Jones & Laughlin Steel Corporation — Adams Mine
Joy Manufacturing Company (Canada) Limited

Kaufman Footwear Limited
Kayson Plastics & Chemicals Limited
Keates Organ Company Limited
Kellogg Company of Canada, Limited
The Kendall Company (Canada) Limited
Kilborn Engineering Limited
Kimberly-Clark of Canada Limited
Kimberly-Clark Pulp & Paper Company Limited
Kitchener, City of
Kitchener Electronic Industries Limited
Konvey Construction Company Limited
Kruschen & Dailey
Kuntz Electroplating Limited
The KVP Company Limited

John Labatt Limited
Lake Ontario Steel Company
Laughlin, Wyllie & Ufnal, Consulting Engineers
Legatt Aircraft Limited
Leigh Instruments Limited
Lennox Industries (Canada) Limited
Lever Brothers Limited
Link-Belt Limited
Link-Belt Speeder (Canada) Limited
Litton Systems (Canada) Limited
Logan Contracting Limited
London, City of
London Steel Industries
Looby Construction Ltd.

McCavour Developments Limited
W. A. McDougall Limited
McGill University — Space Research Institute
McGrath Engineers
McIntyre Porcupine Mines, Limited
A. M. MacKay & Associates Limited
Arthur G. McKee & Company of Canada Ltd.
McKinnon Industries Limited
James F. MacLaren Limited
Mansfield-Denman General Limited
Marshall Macklin Monaghan Limited, O.L.S.
Marsland Engineering Limited
Massey-Ferguson Brantford Limited
Massey-Ferguson Industries Limited
Mathews Conveyor Company Limited
Mattagami Lake Mines Limited
Minnesota Mining & Manufacturing of Canada Limited
O. G. Moffat Limited
Molson's Brewery (Ontario) Limited
Montreal Engineering Company Limited
Murray Printing & Gravure Limited

National Sewer Pipe Limited
National Sound Services Limited
National Steel Car Corporation Limited
Naugatuck Chemicals — Division of Dominion Rubber Company Limited
Niagara Falls, City of
R. H. Nichols Co. Limited
Noranda Mines, Limited
Northern Electric Company Limited
Northern Telephone Limited
North York, Township of
Norton Company

Oakville, Town of
Oakville, Public Utilities Commission of
W. H. Olsen Manufacturing Company Limited
Ontario Northland Communications
The Ontario Paper Company Limited
Ontario Water Resources Commission
Orchans Mines Limited

Page-Hersey Tubes, Limited
Pamour Porcupine Mines, Limited
C. C. Parker and Associates Limited, Consulting Professional Engineers
John B. Parkin Associates
Peterborough, City of
W. R. Petri, P.Eng., Consultant
Philips & Roberts Limited, Consulting Engineers
Geno. Pic Associates Limited
Pickle Crow Gold Mines Limited
Pigott Construction Company Limited
Pioneer Electric Eastern Limited
Pioneer Saws Ltd.
Jos. F. M. Poelmann & Associates Limited
Polymer Corporation Limited
H. K. Porter Company (Canada) Limited
Potter & Brumfield — Division of AMF Canada Limited
The Powers Regulator Company of Canada, Limited
Powertronic Equipment Limited
Pre-Con Murray Limited
Prestolite Limited — Battery Division
Preston, Town of
Price Brothers & Company, Limited
Procor Limited
The Procter & Gamble Company of Canada, Limited
Proctor & Redfern, Consulting Engineers
Pro-Eco Limited
Province of Ontario - Department of Highways
Department of Mines
Provincial Gas Company Limited
Purolator Products (Canada) Limited
Pye Electronics Limited

Quemont Mining Corporation, Limited
Quist & Associates, Consulting Engineers

Ralston-Purina Company of Canada Limited
Raytheon Canada Limited
RCA Victor Company, Ltd.
Read Voorhees & Associates, Ltd.
Redfern Construction Company Limited
Richards-Wilcox Company — Division of General Products Mfg. Corp. Ltd.

Rio Algom Mines Limited
Wm. Roberts Electric Ltd.
P. L. Robertson Manufacturing Co. Limited
E. S. & A. Robinson (Canada) Limited
Roelofson Elevator Company — Div. of Montgomery Elevator Co. Ltd.
Roof Engineering and Inspection Company Ltd.
B. M. Ross and Associates Limited, Consulting Engineers
Ross Division — Midland-Ross of Canada Limited
Royal Military College of Canada

St. Lawrence Cement Co.
The St. Lawrence Seaway Authority
St. Mary's Cement Co., Limited
Samsonite of Canada Limited
L. J. R. Sanders Company Limited
Sandwell and Company Limited
F. Schaeffer & Associates Limited
Schell Industries Ltd.
J. M. Schneider Limited
Joseph E. Seagram & Sons Limited
Sehl Engineering Limited
Shawinigan Chemicals Limited
Sheldons Engineering Limited
Shell Canada Limited
M. V. Shore & Associates
Shore & Moffat and Partners, Architects & Engineers
Simplicity Products Ltd.
Sinclair Radio Laboratories Ltd.
Smith & Stone Limited
Aden B. Snyder Electric Limited
Spruce Falls Power & Paper Co., Limited
Square D Company Canada Limited
Standard Paving & Materials Ltd.
Standard Tube and T. I. Limited
The Steel Company of Canada, Limited
Stephens-Adamson Mfg. Co. of Canada, Limited
Stone & Webster Canada Limited
Studebaker of Canada, Limited
Sudbury, City of
Sun Oil Company Limited
Sunshine Office Equipment Limited
Surveyor, Nenniger & Chenevert, Consulting Engineers
Sutcliffe Company, Consulting Engineers
Swansea Construction Company Limited
Swift Canadian Co. Limited
Taylor Electric Mfg. Co., Limited
Taylor Woodrow Limited
Texaco Canada Limited
Texas Instruments Inc.
Thompson Products Limited
Thomson (Canada) Rivet Company Limited
Timberland-Ellicott Limited
Toronto, City of - Board of Education
Toronto Foundry Limited
Toronto, Municipality of Metropolitan - Dept. of Works
Toronto Transit Commission
Trans-Canada Pipe Lines Limited
Triodetric Structures, Division of Fentiman & Sons Ltd.
W. A. Trow & Associates Limited
Union Carbide Canada Limited
Union Gas Company of Canada, Limited
United Aircraft of Canada Limited
Unitel Limited
Universal Plumbing & Heating Company (1961) Limited
James A. Vance Construction Limited
Varian Associates of Canada Ltd.
Versafood Services Limited
Vickers-Sperry of Canada Ltd.
Wabush Mines
Warnock-Hersey Company Ltd.
Waterloo, City of
Waterloo Co-Op Residences Inc.
Waterloo, County of
The Weatherhead Co. of Canada, Ltd.
Jervis B. Webb Company of Canada, Ltd.
Welland, County of
Weston, Town of — Public Utilities Commission
Willroy Mines Limited
The W. C. Wood Company Limited
General Information
General Information

University Colours and Coat of Arms

The official colours of the University of Waterloo are gold, black and white. The coat of arms for the University of Waterloo as adopted in October, 1961, is:

**Arms:** Or, a chevron sable surmounted by a chevronell argent between three lions rampant gules.

**Crest:** Between two maple branches in saltire a trillium, displayed and leaved, all proper.

**Supporters:** Two laurel branches joined in saltire below the shield, proper.

**Motto:** Concordia Cum Veritate.

The University Mace

The symbolic theme may be described as follows:

The fundamental concept is unity amid diversity and tension in the creative intellectual process that strives to bring forth a new individual.

The design of the mace interprets this theme in the idiom of the life process: From the seed at the base of the stave the mace grows in unity and strength until it differentiates by a four-fold separation into diverse elements.
Residence, Housing Service, Bookstore

This four-fold diversity is significant because of the four faculties existing at this time and as well, of the four church-related colleges federated and affiliated with the University. These diverse elements together form a crown, and the points of the crown, while tending toward a union do not quite touch but remain as individuals suspended in tension and yet engaged in a deep harmony. This creative process is focussed not on the traditional spherical orb of static perfection but rather on an elliptical silver ovum — the egg-shaped symbol of creativity — the marvelous potential of a new individual life.

Residence

Students in all faculties are eligible to apply for residence in Conrad Grebel College, Renison College, St. Jerome’s College, St. Paul’s College or the University Residence Village.

Conrad Grebel College (Mennonite) offers residence accommodation for sixty-five men and forty women.

Renison College (Anglican) offers residence accommodation for ninety-eight men and eighty women.

St. Jerome’s College (Roman Catholic) have available a men’s residence with accommodation for one hundred students and a women’s residence with accommodation for fifty-five students under the supervision of the School Sisters of Notre Dame.

St. Paul’s United College offers accommodation for one hundred men and fifty women.

The University of Waterloo Residence Village (non-denominational) offers accommodation for 669 men and 267 women. Approximately forty-five residents are accommodated in each of twenty houses surrounding the Village Square and Dining Hall complex. Each house is supervised by a Resident Don, and each six houses by a Tutor. A house contains three floors. In addition to the usual facilities, each floor has a lounge and a kitchenette.

Application forms may be obtained from the Registrar, University of Waterloo.

Housing Service

The Housing Office provides addresses of private homes to students wishing to live off-campus. These are not inspected or supervised by the University. Freshman students must bring with them proof of University admission when they apply for assistance. All inquiries must be made in person between the hours of 9:00 a.m. and 5:00 p.m., Monday to Friday. The Housing Office observes all legal holidays.

Bookstore

University of Waterloo students may purchase textbooks, stationery and engineering supplies at the University’s modern book store, located on the ground
floor of the Engineering Building. The book store is open week days from 9:00 a.m. to 5:00 p.m. throughout the year. During the fall and winter when extension courses begin, the book store is also open from 7:00 p.m. to 9:00 p.m. In addition to textbooks, reference materials, paper supplies and drawing materials, the University of Waterloo book store also features the largest display of quality paperbacks in Kitchener-Waterloo.

Department of University Extension

"Adult education is a vital requirement for everyone who would productively and constructively participate in the society of mankind. Adult education has the potential, not only of making it possible for individuals to develop into the kinds of persons they aspire to become, but also to guide and encourage the improvement of our society and its institutions"

Robert E. Sharer

One of the responsibilities of a University is to provide opportunities for continuing education for adults. In an atmosphere of directed study, within the environment of academic discipline, these opportunities can be fulfilled. Within this frame of reference the needs of our community, that can best be served by a University, are our first concern.

To help undertake this rapidly expanding task many community leaders provide advice, counsel and guidance from their experience. We have been fortunate in finding dedicated citizens who, fully supporting the concept of continuing education for adults, give freely of their time to help in the development of courses and programmes for the benefit of our citizens. The many and varied interests are carefully considered in the light of extending the resources of the University.

Conferences, Seminars and Workshops are designed to make the greatest use of the combined talents of scholars, business and community leaders. Because of the co-operative undergraduate programmes (for which the University is becoming widely known) the conferences and seminars co-sponsored with off-campus organizations and associations are normally scheduled between 1st May and 1st September when the air-conditioned lecture spaces and the residence facilities are more generally available for residential adult education. In the special areas of business, in which most professional men have not the time for attaining academic standing towards a degree, the "updating" and "refresher" approaches recognize and complement their adult professional experience. Our present programmes have been designed with this in mind and reflect this point of view in the imaginative development of several new courses to meet the content and format most suitable for business and professional needs.

296
The University Libraries

One of the exciting emphases in which a growing awareness is manifesting is in the humanities. The appreciation for non-vocational education is becoming a consuming interest throughout our community. Much has been both written and said about the concern that it is no longer sufficient for forward thinking citizens to be just professionally qualified, or to have been concerned only with practical matters. Today's citizen sharing his time between church, home and community activities, is turning increasingly towards those opportunities that a University can provide in greater understanding of our need to participate and assume a greater role in society and its institutions.

Administrative services are available to academic departments wishing to present special opportunities to secondary school teachers and adult students, professional associations or other groups and the general public through lectures, seminars, conferences, workshops, intensive short courses and University orientation programmes.

Courses not fully developed at the time of the publication of the Calendar will be advertised in sufficient time to acquaint the public.

The Department does not offer correspondence courses.

Qualified adult students wishing to take courses for which credits can be accumulated towards a University degree can find many offerings by several academic departments and Faculties. Enquiries respecting eligibility, admission, fees, etc., should be made to the Office of the Registrar, University of Waterloo, located in the Arts Library Building.

Full details of all Extension courses, programmes and other offerings are set forth in the University Extension Calendar. All previously registered students will receive a copy in the mail. Further details or information is available by writing to the Director, Department of University Extension, University of Waterloo, Waterloo, Ontario.

The University Libraries

There are two centres for library service and study on the campus. The beautiful new $2,525,000 Arts Library Building was officially opened in October, 1965 and provides immediate accommodation on the second (main) floor and third floor for 175,000 volumes in the Humanities and Social Sciences, as well as seating space for 400 readers and quarters for the library administration and all technical services. University administrative and faculty offices are being housed temporarily on other floors of the library building. Future expansion of the building will provide ten floors with a total area of approximately 167,000 square feet, to accommodate 2000 readers and 800,000 volumes.

The Engineering and Science Library has temporary quarters on the ground floor of the west wing of the Engineering Building. There you will find 50,000 volumes of books and bound periodicals in Science and Technology, 1200 current journals, and a good selection of the important reference materials so
essential in a modern library of this kind. A permanent Engineering, Science and Mathematics Library Building is being planned.

Our total library holdings number more than 150,000 volumes of books and periodicals, 2000 current periodical subscriptions, and a growing collection of pamphlets, phonorecords, microfilms and microcards. The collection is now increasing at the rate of 50,000 volumes per year.

A Library Handbook is issued to all students explaining the arrangement of library materials, the classification system, circulation procedures and general rules and regulations. Members of the library staff will be happy to assist students to make the best possible use of the library collections and facilities.

**Student Discipline**

The University of Waterloo is a community of men and women who have come together to enjoy the privileges and to accept the responsibilities of University life. The traditional privileges of a University are freedom of inquiry and freedom of expression. To maintain these freedoms it is the obligation of all students to adhere to a standard of responsible social behaviour that shall not reflect discredit upon the University. All students are reminded that they are bound to live in accordance with the laws of the community. Specifically this means respect for University regulations, personal liberty and civil law.

Students are subject to University regulations governing their behaviour at all times while remaining members of the University. Regulations and infractions thereof may be reviewed by a President's Committee on Student Discipline and University Regulations. The members of this committee include University officers, faculty and students.

**International Student's Association**

The organization is open to all students including Canadians, both graduate and undergraduate. The purpose: to promote intellectual, cultural and social activities; foster international co-operation and understanding; and assist in the orientation of students from other countries. Monthly meetings are held. International Cuisine Dinners and International Song and Dance Evening are part of the Association's program. Trips of interest to the members are organized. Membership fee is $1.00 per year.

**Health Services**

**Health Centre** - The Health Services offer a first-aid and medical care centre on campus with Registered Nurses in attendance Monday through Friday from eight-thirty to five. The University Physician is available for consultation on campus at regular hours daily.
The University Counselling Services

Health Insurance - Undergraduate students are covered from the date of registration by a University Health Insurance Plan. Undergraduate students who do not wish this insurance and who can show proof of adequate coverage elsewhere may request a refund of the premium if application for premium refund is made within three weeks after registration.

Arts and Science students are insured from date of registration for one year or until withdrawal from the course. Co-operative students are covered from date of each registration for a period including their subsequent work periods. Coverage ceases upon withdrawal from the course.

Graduate students who wish to participate in this insurance plan must make application at registration.

Further information about the University's Health Insurance Plan may be obtained from the Health Services.

The University Counselling Services

The Counselling Centre provides the services of qualified psychologists for all students desiring help in the solution of personal problems. The student can bring any problem which he or she has, whether it be difficulty in studying, worrying about examinations, problems of social or family relationships, boy-girl problems, difficulties concerning vocational choice, feelings of tension or depression, or a general loss of interest and sense of dissatisfaction. Problems of this kind are common among college students, but this does not mean that it is necessary to be resigned to them or to continue without solving them.

Counselling service is intended primarily for "normal" students who have within themselves the resources to solve their problems with some assistance. Students who may be suffering from mental illness will of course also be seen, but at their request psychiatric appointments would usually be arranged for them through the University Health Services. The primary goal in coming to the Centre is to gain increased information and understanding of oneself through counselling and the use of psychological or aptitude tests where this is desirable. There is a common misunderstanding that making use of counselling facilities is a sign of personal weakness. Research has shown, however, that university graduates who had made use of counselling, during their undergraduate years, were on the average better adjusted, happier and more respected in their present occupations. Another misapprehension is that the counsellor will solve the student's problem and give him appropriate advice. In fact, the counsellor's job is to assist the student in talking out his or her feelings and situation in order to discover the interrelationships among the various factors involved, so that the student himself may find the solution or line of action that is best for him. In this way, counselling can serve to strengthen both the ability to make decisions realistically and individual initiative.
In order that students may benefit from counselling, it is necessary that they should feel free to discuss even the most personal matters. For this reason, anything that is said during counselling sessions and even the names of students who come to the Counselling Centre are kept in complete confidence. If for a very good reason it becomes necessary to communicate with the student's home or the university administration, this would have to be discussed with the student before it could be done. A doctor or other professional person approaching the Counselling Services for information concerning a student who is now under his care will be required to produce a form signed by the student himself authorizing the release of confidential information.

The Centre is prepared to provide informal consultation to members of the university faculty, or administrative staff, but without divulging whether a student has or has not been to the Centre for counselling.

Appointments can be made by contacting the secretary of Counselling Services, or any one of the counsellors. Appointments must be made by students voluntarily, although this might be done on the advice of a member of the college community to the student.

Federation of Students

"When a multitude of young persons come together and freely mix with each other, they are sure to learn one from another even if there is no one to teach them; the conversation of all is a series of lectures to each, and they gain for themselves new ideas and views, fresh matter of thought, and distinct principle for judging and acting, day by day."

Newman

The complementary education received from participation in extra-curricular activities, in many cases, has as significant, beneficial and lasting effect on students as formal curricular education. At the University of Waterloo the opportunity to participate in such activities is provided to those who wish to take advantage of it by the Federation of Students and its various agencies. All students of the University of Waterloo are members of the Federation of Students. The Constitution of the Federation of Students which guarantees certain rights and privileges to students was approved by the Board of Governors of the University on the recommendation of the Student Council after a campus-wide referendum.

Objects and Purpose. The "Objects and Purpose" of the Federation are:

1. "The promotion of the welfare and interests of the students of the University of Waterloo.

2. The promotion and co-ordination of student participation in athletic, cultural and social activities.

3. The maintenance of communication between the student body and the authorities of the University.
4. To represent members of the Federation in matters affecting the common interest.

5. To encourage inter-university co-operation and communication."

The Students’ Council. Twenty-five elected members and officers make up the Students’ Council which is the governing body of the Federation. Members representing all faculties, societies and colleges are included.

The functions of the Students’ Council include: upholding the “Objects and Purpose” of the Federation, administration and control of finances, and operation and control of all Boards and Committees of the Council. Almost all of the social, cultural and athletic activities of the student body are managed by the Students’ Council as well as off-campus representation of the student body.

Organization. The activities of the Students’ Council are carried out by its various boards and committees which are directed by a student chairman.

The Executive Board. The Executive Board is composed of the principal officers of the Students’ Council including the President, Vice-President, Treasurer, and all Board Chairmen. The Board controls day-to-day administration, finance, and recommends policy to the Students’ Council. It also co-ordinates the activities and programmes of all other Boards and provides liaison between them.

The Creative Arts Board. The Creative Arts Board, whose membership includes students and also faculty and staff, provides cultural programmes and activities in music, art, drama and films. Performing and interest groups in
each area are supported and assisted by this Board, and its three professional directors of music, drama and art. In addition, a series of professional attractions are selected by the Board for presentation throughout the academic year. Groups sponsored by the Creative Arts Board include, in drama: St. Aethelwold's Players, Renison Players Guild and the University Drama Group; in music: Chamber Orchestra, Concert Band, Dance Band, Marching Band, Madrigal Singers, Glee Club, and the Opera Chorus; in art: Gallery Exhibitions and lecture series; and, in film: International Film Series and Noon-Hour Film Series.

The Board of External Relations. The Board of External Relations represents the Federation in activities, programmes and organizations which are external to the campus of the University of Waterloo and in which participation is desirable. Federation policy concerning local, national and international affairs is formulated and promulgated by the Board through its four commissions — Representation, Information and Services, International Affairs and Domestic Affairs.

Selected students representing the Federation attend a variety of conferences and seminars of many organizations including those of the Canadian Union of Students (C.U.S.), the Ontario Region of the Canadian Union of Students (O.R.C.U.S.), the Seminar on International Student Affairs (S.I.S.A.), the World University Service (W.U.S.), National Conference, the International Affairs Conference, the Canadian Union of Students Overseas (C.U.S.O.) Conference, the Student United Nations Associations in Canada Conference (S.U.N.A.C.), and the Conference on Inter-American Student Projects (C.I.A.S.P.).

Services provided by the Board have included travel services, the student discount service, the conduct of surveys and the promotion of C.U.S. Life Insurance.

The Board of Publications. The Board of Publications is responsible for all student publications. Its activities can provide experience in all aspects of journalism and publishing as well as advertising and general business experience. Its major publications include:

- Coryphaeus — the weekly student newspaper;
- Compendium — the University yearbook;
- Volume ’63 — a biannual poetry magazine;
- Jabberwocky — a biannual literary magazine;
- Focus — an annual engineering journal and review;
- Student Directory — an annual campus directory;
- Events Calendar — an annual calendar of university events;

The Board of Student Activities. The Board of Student Activities co-ordinates and supervises all campus-wide programmes including Orientation, Homecoming, Winter Festival, Graduation Ball, House of Debates, and the Federation Lecture Series. In addition, the Board assists the operation of each campus club and society.
There is a wide variety of organizations, some of which are listed below:

**Societies**
- Arts, Engineering, Science.

**Course Clubs**
- Biology, Chemical Engineering, Civil Engineering, French, Geography, German, Mathematics and Physics, Mechanical Engineering, Philosophy, Politics, Russian.

**Political**
- Liberal, New Democratic, Progressive Conservative, Communist.

**Professional**
- American Society of Mechanical Engineers (ASME), Chemical Institute of Canada (CIC), Engineering Institute of Canada (EIC), Institute of Electrical & Electronic Engineers (IEEE).

**Religious**
- Inter-Varsity Christian Fellowship (IVCF), Newman, Student Christian Movement (SCM).

**Service**
- Circle K.

**Special Interest**
- Chess, Curling, Folk Song, International Folk Dance, International Students Association (ISA), Radio Broadcast, Amateur Radio, Ski, Flying, Judo, Stereo, Student Wives, Ukrainian, Muslim Students Association (MSA), Rowing, Tiddlywinks, Women's Athletics, Friends of S.N.C.C.

**Judicial Committee.** The Judicial Committee of the Federation serves as a student court and determines such matters as student suits, breach of Federation rules, the constitutionality of student government actions and matters referred to it by other authorities. The five justices who are graduate or senior students receive the support of university and civic officials in many areas of student self-discipline.

Persons wishing more information on any aspect of Federation activities are advised to write

The Federation of Students,
University of Waterloo,
Waterloo, Ontario, Canada

**Placement Service**

A Placement Service for graduates seeking permanent employment and undergraduates seeking summer employment is operated by the Department of Coordination and Placement, which is located on the 6th floor of the Arts Library Building. It is customary for employers to interview graduating students on the campus during a three week period beginning the third week of January. This service is available to students of all faculties.
The Canadian Officers' Training Corps (C.O.T.C.)

1. The Canadian Officers' Training Corps offers undergraduates an opportunity to qualify for commissions in the Canadian Army, either Active or Reserve, through a training programme especially designed to meet their requirements.

2. Students are eligible who are:

(a) British subjects or Canadian citizens between the ages of seventeen and twenty-five.

(b) Of a physical standard suitable for the Canadian Army Active Force.

(c) Following a course of study leading to a recognized degree.

3. Training provided is in two parts:

(a) Two hours a week of theoretical training in military subjects during the academic year.

(b) Twelve to fifteen weeks of practical training during the summer.

4. Students accepted for C.O.T.C. training are granted the rank of Officer Cadet and at the end of two years training are commissioned as Second Lieutenants. They are eligible for pay according to their rank ($250.00 a month) for every full day of military duty. For this purpose, four hours of lectures during the academic year count as one day's duty; each day spent at summer camp, to a maximum of fifteen weeks, also counts.

Students wishing to apply for C.O.T.C. training should present themselves to:

R. J. Walsh
Department of Co-ordination and Placement
before November 1, after which no applications will be considered.

Regular Officers Training Plan (R.O.T.P.)

Under the R.O.T.P., undergraduates who are successful applicants are enrolled as Officer Cadets.

Applicants must be Canadian citizens or British subjects, single and under twenty-one at the commencement of their university or college training. If application is made prior to entry at university or college, it should be sent in writing to:

R.O.T.P. Selection Board.
National Defence Headquarters,
OTTAWA, Ontario.

If application is delayed until after admission to university, it should be sent to:

Canadian Armed Forces Recruiting Centre,
King Street,
KITCHENER, Ontario.
Regular Officers Training Plan

For successful applicants, the cost of tuition and other essential fees, will be borne by the Department of National Defence. The scale of pay and allowances under this plan is:

(a) During the first three academic years, pay of $78.00 a month and subsistence of $65.00 a month for a total of $143.00 a month. During the fourth and, if applicable, fifth academic years, pay is increased to $83.00 per month. In addition to this an allowance of $75.00 a year will be provided for the purchase of books and instruments.

(b) During the period of practical summer training, pay of $78.00 a month with food and lodging provided.

Cadets will be issued with standard service uniforms and equipment. Free medical and dental care and annual leave with full pay will be received throughout the entire training period.

On successful completion of academic and military training, Cadets will be promoted to Commissioned Officer rank in the Regular Force. The privilege of release, if desired, will be honoured after four years' service as a commissioned officer.

Note: Because of the requirements of four years' service in the Regular Force, students participating in the R.O.T.P. will not be able to undertake graduate work immediately. However, if the field of graduate study is one of direct benefit to the armed forces, graduate work may be authorized immediately upon graduation.
Scholarships
Prizes
and
Financial Aid
Undergraduate Scholarships

University of Waterloo National Scholarships

Four University of Waterloo National Scholarships are offered annually to students displaying exceptional academic ability. One award will be granted to a student from each of the following regions: the Maritime Provinces, Quebec, Ontario, the Western Provinces. Holders of these scholarships will receive the title of “University National Scholar” and will be so listed in University publications. Awards will be made by the Scholarships Committee under the following general conditions:

(a) Applicants must have attained a minimum average of 90% in the Ontario Grade XIII papers, or equivalent, required for admission to their particular faculty. A maximum of two Grade XIII papers, written in Grade XI and/or Grade XII in addition to taking the full Grade XI or Grade XII programme may be counted as part of the papers required for a Scholarship, provided that a full programme of papers is written and passed in Grade XIII year.

(b) The annual value of this award shall be the cost of tuition and incidental fees, as well as an additional $1,000 for the duration of the undergraduate course provided that, in the opinion of the awarding committee, the scholar maintains a sufficiently high academic standing.

(c) A University National Scholar is eligible to hold additional awards.

University of Waterloo Tuition Scholarships

University of Waterloo Tuition Scholarships are awarded annually to students of high academic achievement who are applying for entry to any faculty of the University, and to students proceeding to advanced years. Scholarship holders will receive the title of “University Scholar” and will be so listed in University publications.

Awards will be made by the Scholarships Committee under the following general conditions:

(a) Students entering the First Year must have attained a minimum average of 80% in the Ontario Grade XIII papers required for admission to their particular faculty.

A maximum of two Grade XIII papers, written in Grade XI and/or Grade XII in addition to taking the full Grade XI or Grade XII programme may be counted as part of the papers required for a Scholarship, provided that a full programme of papers is written and passed in the Grade XIII year.

(b) Students entering advanced years must have attained a minimum average of 80% in the final examinations of the preceding academic year.

(c) University of Waterloo Tuition Scholarships shall be renewable annually provided that, in the opinion of the awarding committee, the scholar maintains a sufficiently high academic standing.
Scholarships, Prizes, and Financial Aid

(d) The value of the Scholarship shall be the value of the tuition fee and incidental fees of the holder. Residence fees are not included.

National and University Scholars

The following students have been named University National and University Scholars for the 1965-66 academic year.

University National Scholars

Bonnie Ann Barton  Scarborough, Ontario  Arts II
Richard Lawrence Ferch  Fort William, Ontario  Science II
John Joseph Koval  Sarnia, Ontario  Science I
James Keith Lindsey  Mono Road, Ontario  Science II
Joseph Michael Meaden  Fort William, Ontario  Science I
Richard Bruce Powell  Niagara Falls, Ontario  Engineering I
Ian Timothy Turner  Port Arthur, Ontario  Science I

University Scholars

Barry Grant Adams  Paris, Ontario  Engineering I
Brian Perry Agar  Chatham, Ontario  Arts I
John Herman Ahrens  Galt, Ontario  Science II
James Ellsworth Alexander  Port Arthur, Ontario  Engineering II
Lynn Charlotte Allen  Willowdale, Ontario  Science I
David George Allison  North Bay, Ontario  Science I
Trevor William Anderson  Clarkson, Ontario  Engineering III
William John Andres  Waterloo, Ontario  Engineering III
Janice Mary Arthur  Galt, Ontario  Arts II

Ailey Bailin  Toronto, Ontario  Arts I
Robert James Balahura  Kitchener, Ontario  Science III
James Robert Barney  Fort William, Ontario  Engineering II
James Bernard Bart  Stratford, Ontario  Arts I
Brent Douglas Beach  Ottawa, Ontario  Science II
Wilfred Elworth Bean  New Hamburg, Ontario  Arts II
Ronald Cecil Bender  Matheson, Ontario  Science II
David Ross Bertran  Fort Erie, Ontario  Engineering III
Frank Peter Bilewicz  St. Catharines, Ontario  Arts II
Dorothy Christine Black  Rexdale, Ontario  Arts II
Frederick -Paul Blackstein  Toronto, Ontario  Engineering IV
Brian Robin Blackwell  Caledonia, Ontario  Engineering I
Nancy Patricia Bloomfield  Barrie, Ontario  Arts I
Thomas David Bobier  Barrie, Ontario  Science II
Peter Bocchinfuso  Thorold, Ontario  Engineering IV
John William Boland  Smith Falls, Ontario  Science I
David Michael Borth  Kitchener, Ontario  Engineering IV
Ralph Thomas Boughner  Simcoe, Ontario  Engineering I
Dianne Margaret Boyle  
London, Ontario  
Arts II

Jorma Gunnar Braks  
Toronto, Ontario  
Engineering III

Lynne Maureen Bricker  
Kitchener, Ontario  
Arts I

Laurie Ernest Bridger  
Port Credit, Ontario  
Science II

Diane Sarah Broughton  
Dorion, Ontario  
Science I

Russell William Brown  
Downsview, Ontario  
Engineering II

John Wheelwright Browne  
Waterloo, Ontario  
Arts IV

Ernie Ralph Brubacher  
Waterloo, Ontario  
Engineering II

Sanford Roger Brubacher  
Scarborough, Ontario  
Arts I

Jack Allan Bryant  
Hensall, Ontario  
Engineering II

David Keith Buchanan  
Scarborough, Ontario  
Science I

Andris Buivids  
Markham, Ontario  
Arts I

Kristine Hazel Burkholder  
Port Arthur, Ontario  
Science IV

Forbes John Burkowski  
Ottawa, Ontario  
Arts I

Heather Jean Burrell  
Harriston, Ontario  
Science III

James Keith Burrows  
Port Carling, Ontario  
Arts I

Sandra Dawn Burt  
Guelph, Ontario  
Engineering III

David John Busch  
Preston, Ontario  
Arts I

Kenneth Wayne Butcher  
Downsview, Ontario  
Science II

Lynda Joan Byrne  
Fort William, Ontario  
Engineering II

Lorne Daniel Byzyna  
Willowdale, Ontario  
Engineering I

Ian Stewart Calvert  
London, Ontario  
Engineering II

Augustine Bertina Cammaert  
St. Catharines, Ontario  
Arts II

John Wayne Campbell  
Shedden, Ontario  
Engineering II

Keith Lester Carr  
Toronto, Ontario  
Science I

Maria Elisa Castellarin  
Newmarket, Ontario  
Engineering III

Peter Joseph Catania  
New Hamburg, Ontario  
Engineering III

Robert Bruce Cavanagh  
Embro, Ontario  
Engineering III

Douglas Stewart Chafee  
Port Credit, Ontario  
Arts I

William Arthur Chambers  
Guelph, Ontario  
Arts III

James Edward Chase  
Kitchener, Ontario  
Science I

Michael Patrick Chatterson  
Chippawa, Ontario  
Science II

Frank Stephen Cherry  
Kitchener, Ontario  
Science II

James William Cisarchuk  
Kitchener, Ontario  
Arts I

Edward Brian Clark  
Port Credit, Ontario  
Engineering I

Kenneth David Clarke  
Downsview, Ontario  
Science II

Stephen Harold Clodman  
Scarborough, Ontario  
Arts II

Donald Edward Clow  
Durham, Ontario  
Arts I

James Peter Cluchey  
Thorold, Ontario  
Engineering III

Angelo Colavecchia  
Thamesford, Ontario  
Engineering III

William Alfred Cole  
Willowdale, Ontario  
Science I

Rodney Harold Cooper  
Toronto, Ontario  
Engineering IV

Michael Stuart Corlett  
Walkerton, Ontario  
Arts III

Carl John Cuneo  
Picton, Ontario  
Science I

William Harry Cunningham  
Ingersoll, Ontario  
Arts III

Gail Patricia Cuthbert  
Brantford, Ontario  
Science I

Myrna Janet Davis  
Willowdale, Ontario  
Engineering I

310
<table>
<thead>
<tr>
<th>Name</th>
<th>College, Location</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Douglas Norman Deeth</td>
<td>Clarkson, Ontario</td>
<td>Engineering I</td>
</tr>
<tr>
<td>Ian Gordon Dennett</td>
<td>King, Ontario</td>
<td>Engineering II</td>
</tr>
<tr>
<td>Frederick Theodore Dennis</td>
<td>Port Arthur, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Keith Depooter</td>
<td>Port Lambton, Ontario</td>
<td>Engineering III</td>
</tr>
<tr>
<td>Robin Michael Dodson</td>
<td>Guelph, Ontario</td>
<td>Engineering IV</td>
</tr>
<tr>
<td>Martin Edward Donnelly</td>
<td>Port Arthur, Ontario</td>
<td>Engineering III</td>
</tr>
<tr>
<td>Wayne Morice Doran</td>
<td>Southampton, Ontario</td>
<td>Arts III</td>
</tr>
<tr>
<td>Martha Christine Gisela Dorrance</td>
<td>Seaforth, Ontario</td>
<td>Engineering II</td>
</tr>
<tr>
<td>Denis Joseph Dorval</td>
<td>Fort William, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Daniel Ernest Dover</td>
<td>Brantford, Ontario</td>
<td>Arts II</td>
</tr>
<tr>
<td>Eric Henry Drumm</td>
<td>Burlington, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Danielle Marie Dubuc</td>
<td>Ottawa, Ontario</td>
<td>Science III</td>
</tr>
<tr>
<td>Keith Gordon Duncan</td>
<td>Burlington, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Kenneth Arthur Dunn</td>
<td>St. Catharines, Ontario</td>
<td>Science III</td>
</tr>
<tr>
<td>Kathryn Mary Durie</td>
<td>Owen Sound, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Gregory William Durward</td>
<td>Etobicoke, Ontario</td>
<td>Engineering I</td>
</tr>
<tr>
<td>Mary Louise Eaglesham</td>
<td>Guelph, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>John Allan Edgecombe</td>
<td>Markham, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>John Richard Elliott</td>
<td>Port Arthur, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>John Richard English</td>
<td>Platts ville, Ontario</td>
<td>Arts III</td>
</tr>
<tr>
<td>John William English</td>
<td>Shannonville, Ontario</td>
<td>Engineering I</td>
</tr>
<tr>
<td>John Ernest Ericson</td>
<td>Toronto, Ontario</td>
<td>Engineering I</td>
</tr>
<tr>
<td>Murray David Etherington</td>
<td>Drumbo, Ontario</td>
<td>Engineering I</td>
</tr>
<tr>
<td>Jeffrey Taylor Evans</td>
<td>Guelph, Ontario</td>
<td>Science IV</td>
</tr>
<tr>
<td>Robert Alexander Fisher</td>
<td>Milton, Ontario</td>
<td>Science III</td>
</tr>
<tr>
<td>Barbara Cecile Foell</td>
<td>Elmira, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Douglas Leonard Forkes</td>
<td>Collins Bay, Ontario</td>
<td>Science II</td>
</tr>
<tr>
<td>Wayne Anthony Fowler</td>
<td>Chatham, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Paul Norman Freeman</td>
<td>Willowdale, Ontario</td>
<td>Science II</td>
</tr>
<tr>
<td>Judith Louise Fletcher</td>
<td>Ottawa, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>David Earl Gabel</td>
<td>Kitchener, Ontario</td>
<td>Science IV</td>
</tr>
<tr>
<td>Eldon James Gardner</td>
<td>London, Ontario</td>
<td>Arts II</td>
</tr>
<tr>
<td>Naomi Jean Garton</td>
<td>Sarnia, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Phyllis Elizabeth Gatcke</td>
<td>Kitchener, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Beverly Ann Gibson</td>
<td>Oshawa, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Robert Leighton Gilbert</td>
<td>Thamesford, Ontario</td>
<td>Engineering II</td>
</tr>
<tr>
<td>William Robert Gillan</td>
<td>Ottawa, Ontario</td>
<td>Engineering I</td>
</tr>
<tr>
<td>Karl Joseph Gmach</td>
<td>Kitchener, Ontario</td>
<td>Science III</td>
</tr>
<tr>
<td>Keith William Golem</td>
<td>Chesley, Ontario</td>
<td>Arts II</td>
</tr>
<tr>
<td>Robert James Goodall</td>
<td>Port Dover, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Barry Edward Goodison</td>
<td>Toronto, Ontario</td>
<td>Arts II</td>
</tr>
<tr>
<td>Arthur Grant Gordon</td>
<td>Dundas, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Michael John Gordon</td>
<td>Guelph, Ontario</td>
<td>Engineering II</td>
</tr>
<tr>
<td>Lindsay Ernest Gorrell</td>
<td>Port Elgin, Ontario</td>
<td>Engineering II</td>
</tr>
<tr>
<td>Edward Bruce Gould</td>
<td>Beeton, Ontario</td>
<td>Engineering II</td>
</tr>
<tr>
<td>Edward George Grabb</td>
<td>Chatham, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Name</td>
<td>City</td>
<td>Major</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-----------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Alexander Steven Graham</td>
<td>Ottawa, Ontario</td>
<td>Engineering II</td>
</tr>
<tr>
<td>John Douglas Graham</td>
<td>Peterborough, Ontario</td>
<td>Engineering II</td>
</tr>
<tr>
<td>Melville Arthur Graham</td>
<td>Owen Sound, Ontario</td>
<td>Engineering IV</td>
</tr>
<tr>
<td>Donald William Gregory</td>
<td>Lively, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Alvin Samuel Grove</td>
<td>Markham, Ontario</td>
<td>Engineering II</td>
</tr>
<tr>
<td>Peter John Guest</td>
<td>Melbourne, Australia</td>
<td>Engineering IV</td>
</tr>
<tr>
<td>James Francis Hackl</td>
<td>Scarborough, Ontario</td>
<td>Engineering IV</td>
</tr>
<tr>
<td>Thomas Allan Hamilton</td>
<td>Downsview, Ontario</td>
<td>Engineering I</td>
</tr>
<tr>
<td>Judith Ann Hartley</td>
<td>Princeton, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Bert Lennard Hartnell</td>
<td>Rainy River, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>William Gerald Haslam</td>
<td>Ancaster, Ontario</td>
<td>Arts II</td>
</tr>
<tr>
<td>Constance Virginia Hauck</td>
<td>Waterloo, Ontario</td>
<td>Arts II</td>
</tr>
<tr>
<td>David John Hawkins</td>
<td>Guelph, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Ross Beverly Hebner</td>
<td>Midland, Ontario</td>
<td>Engineering IV</td>
</tr>
<tr>
<td>Christopher Robert Heft</td>
<td>Beaconsfield, Quebec</td>
<td>Engineering II</td>
</tr>
<tr>
<td>Robert James Henderson</td>
<td>Owen Sound, Ontario</td>
<td>Engineering III</td>
</tr>
<tr>
<td>Charles Herder</td>
<td>Whitby, Ontario</td>
<td>Arts II</td>
</tr>
<tr>
<td>Frederick Irvin Hill</td>
<td>Elora, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Kathleen Ann Hodgson</td>
<td>Waterloo, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Henry Hugh Hogg</td>
<td>Chatsworth, Ontario</td>
<td>Engineering III</td>
</tr>
<tr>
<td>John William Hoicka</td>
<td>Etobicoke, Ontario</td>
<td>Science II</td>
</tr>
<tr>
<td>Marjorie Grace Holder</td>
<td>Ancaster, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Paige Marie Holland</td>
<td>Preston, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>David Andrew Hook</td>
<td>Camp Borden, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Herbert Horn</td>
<td>Waterloo, Ontario</td>
<td>Engineering I</td>
</tr>
<tr>
<td>Barbara Joan Howard</td>
<td>Stouffville, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Michael Frank Howard</td>
<td>Richmond Hill, Ontario</td>
<td>Science II</td>
</tr>
<tr>
<td>Manfred Henry Hubert</td>
<td>Toronto, Ontario</td>
<td>Science II</td>
</tr>
<tr>
<td>Paul William Humphries</td>
<td>Malton, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Brian Ernest Iler</td>
<td>Guelph, Ontario</td>
<td>Engineering II</td>
</tr>
<tr>
<td>Stephen Walter Ircland</td>
<td>Chippawa, Ontario</td>
<td>Arts II</td>
</tr>
<tr>
<td>Lee Owen James</td>
<td>Fort William, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Thomas Arthur Jensen</td>
<td>Ottawa, Ontario</td>
<td>Engineering I</td>
</tr>
<tr>
<td>Michael David Johnson</td>
<td>Kirkland Lake, Ontario</td>
<td>Science IV</td>
</tr>
<tr>
<td>Bouwe Jonkman</td>
<td>Sarnia, Ontario</td>
<td>Engineering II</td>
</tr>
<tr>
<td>John David Kalbfleisch</td>
<td>Goderich, Ontario</td>
<td>Science IV</td>
</tr>
<tr>
<td>Kevin Keats</td>
<td>Brantford, Ontario</td>
<td>Engineering IV</td>
</tr>
<tr>
<td>Barbara Esther Kellerman</td>
<td>Waterloo, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Alex Henry Kennedy</td>
<td>Willowdale, Ontario</td>
<td>Science II</td>
</tr>
<tr>
<td>John Peter Killing</td>
<td>London, Ontario</td>
<td>Engineering II</td>
</tr>
<tr>
<td>Richard William Kimpel</td>
<td>Galt, Ontario</td>
<td>Arts II</td>
</tr>
<tr>
<td>William Richard Kinread</td>
<td>Fonthill, Ontario</td>
<td>Science II</td>
</tr>
<tr>
<td>Michael John Kirby</td>
<td>Guelph, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>John Lewis Knapp</td>
<td>Waterloo, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Manfred Koehler</td>
<td>Kitchener, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Scholarship Recipients</td>
<td>Locations</td>
<td>Majors</td>
</tr>
<tr>
<td>-------------------------------------------------------------</td>
<td>---------------------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Nicholas Kouwen</td>
<td>Hamilton, Ontario</td>
<td>Engineering IV</td>
</tr>
<tr>
<td>Andrew Koziar</td>
<td>St. Catharines, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Constance Kitty Kozluk</td>
<td>Downsview, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Ole Falk Kristensen</td>
<td>Windsor, Ontario</td>
<td>Engineering I</td>
</tr>
<tr>
<td>William Herbert Kuehnbaum</td>
<td>Weston, Ontario</td>
<td>Arts II</td>
</tr>
<tr>
<td>William Oliver Kummer</td>
<td>Preston, Ontario</td>
<td>Arts III</td>
</tr>
<tr>
<td>John David Kuntz</td>
<td>Waterloo, Ontario</td>
<td>Arts IV</td>
</tr>
<tr>
<td>Roger Lafleur</td>
<td>St. Paul, Alberta</td>
<td>Engineering II</td>
</tr>
<tr>
<td>Keng Thye Lai</td>
<td>Singapore, Malaysia</td>
<td>Engineering III</td>
</tr>
<tr>
<td>Dolf Landheer</td>
<td>Toronto, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Willie Edward Laurila</td>
<td>Timmins, Ontario</td>
<td>Engineering II</td>
</tr>
<tr>
<td>Jens Laursen</td>
<td>Ottawa, Ontario</td>
<td>Engineering II</td>
</tr>
<tr>
<td>Miles Alexander Lauzon</td>
<td>Niagara Falls, Ontario</td>
<td>Engineering I</td>
</tr>
<tr>
<td>Jerald Franklin Lawless</td>
<td>Kirkland Lake, Ontario</td>
<td>Science IV</td>
</tr>
<tr>
<td>Jennifer Gaye Lawrence</td>
<td>Toronto, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>William Harold Scott Lawson</td>
<td>Cobourg, Ontario</td>
<td>Engineering II</td>
</tr>
<tr>
<td>David Richard Leeder</td>
<td>Petawawa, Ontario</td>
<td>Science II</td>
</tr>
<tr>
<td>David John Leffen</td>
<td>Scarborough, Ontario</td>
<td>Engineering III</td>
</tr>
<tr>
<td>James Robert Lesauvage</td>
<td>Heron Bay, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Charles Peter Lewis</td>
<td>Bright, Ontario</td>
<td>Arts IV</td>
</tr>
<tr>
<td>Larry Clifford Lipskie</td>
<td>Kitchener, Ontario</td>
<td>Arts IV</td>
</tr>
<tr>
<td>Barbara Jean Loty</td>
<td>Guelph, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Felix Makau Luti</td>
<td>Kitui, Kenya</td>
<td>Engineering III</td>
</tr>
<tr>
<td>Pentti Arthur Luukkonen</td>
<td>Sudbury, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>John Alan MacDonald</td>
<td>Kitchener, Ontario</td>
<td>Science III</td>
</tr>
<tr>
<td>Alexander Hugh MacGregor</td>
<td>Brampton, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Elizabeth Blair MacIvor</td>
<td>Port Elgin, Ontario</td>
<td>Arts II</td>
</tr>
<tr>
<td>Ritchie Jock MacKay</td>
<td>Scarborough, Ontario</td>
<td>Science III</td>
</tr>
<tr>
<td>Robert Lorne MacKinnon</td>
<td>Dobbinton, Ontario</td>
<td>Arts IV</td>
</tr>
<tr>
<td>John Ernest Madgett</td>
<td>Toronto, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>John Dennis Marlou</td>
<td>Rexdale, Ontario</td>
<td>Engineering II</td>
</tr>
<tr>
<td>Loraine Dolores Marrett</td>
<td>Toronto, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Stanley James Martin</td>
<td>Atwood, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Sandra June Mathers</td>
<td>Scarborough, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Dwight Everett Matthews</td>
<td>Port Arthur, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Edwin Ronald McCaig</td>
<td>Uxbridge, Ontario</td>
<td>Arts II</td>
</tr>
<tr>
<td>Lynda Ann McBride</td>
<td>Brampton, Ontario</td>
<td>Science III</td>
</tr>
<tr>
<td>James Arthur McConnell</td>
<td>Scarborough, Ontario</td>
<td>Arts II</td>
</tr>
<tr>
<td>William David McCready</td>
<td>Guelph, Ontario</td>
<td>Arts IV</td>
</tr>
<tr>
<td>Alexander Montgomery McDonald</td>
<td>Agincourt, Ontario</td>
<td>Engineering III</td>
</tr>
<tr>
<td>Paul Douglas McDonald</td>
<td>Toronto, Ontario</td>
<td>Engineering I</td>
</tr>
<tr>
<td>Gordon Leslie McFaul</td>
<td>Winnipeg, Manitoba</td>
<td>Science I</td>
</tr>
<tr>
<td>Michael William McGrath</td>
<td>Bay Ridges, Ontario</td>
<td>Engineering I</td>
</tr>
<tr>
<td>Carson Bruce McIntosh</td>
<td>Williamsburg, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Robert Lawrence McKee</td>
<td>Willowdale, Ontario</td>
<td>Engineering I</td>
</tr>
<tr>
<td>Judith Mindel McKenzie</td>
<td>Fort William, Ontario</td>
<td>Arts II</td>
</tr>
<tr>
<td>Ross Curdel McKenzie</td>
<td>Willowdale, Ontario</td>
<td>Science II</td>
</tr>
</tbody>
</table>

313
## Scholarships, Prizes, and Financial Aid

<table>
<thead>
<tr>
<th>Name</th>
<th>City, Province</th>
<th>Faculty or Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ross Laverne Prentice</td>
<td>Uxbridge, Ontario</td>
<td>Science III</td>
</tr>
<tr>
<td>Robert Lorne Probert</td>
<td>Belleville, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Andreas Prozes</td>
<td>Georgetown, Ontario</td>
<td>Arts II</td>
</tr>
<tr>
<td>Patricia Anne Quehl</td>
<td>Waterloo, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Janet Dallas Ransom</td>
<td>Richmond Hill, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Lois Mae Rayment</td>
<td>Peterborough, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Irene Redekopp</td>
<td>St. Catharines, Ontario</td>
<td>Science II</td>
</tr>
<tr>
<td>Philip Owen Redfern</td>
<td>Kitchener, Ontario</td>
<td>Engineering II</td>
</tr>
<tr>
<td>Robert Laurence Redman</td>
<td>Toronto, Ontario</td>
<td>Engineering III</td>
</tr>
<tr>
<td>Lorence John Reed</td>
<td>Harriston, Ontario</td>
<td>Engineering II</td>
</tr>
<tr>
<td>Thomas Christopher Reid</td>
<td>Brampton, Ontario</td>
<td>Engineering I</td>
</tr>
<tr>
<td>Gordon Ross Reier</td>
<td>New Dundee, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>William Lynn Renwick</td>
<td>Fort Frances, Ontario</td>
<td>Engineering III</td>
</tr>
<tr>
<td>William Roy Richardson</td>
<td>Ridgeway, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Carol Jean Robbins</td>
<td>Camp Borden, Ontario</td>
<td>Arts II</td>
</tr>
<tr>
<td>Carolyn Elizabeth Roberts</td>
<td>Burlington, Ontario</td>
<td>Arts II</td>
</tr>
<tr>
<td>William Roberts</td>
<td>Guelph, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>David Robins</td>
<td>Thorold, Ontario</td>
<td>Engineering III</td>
</tr>
<tr>
<td>James Edward Robinson</td>
<td>Auburn, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Jane Elizabeth Robinson</td>
<td>Toronto, Ontario</td>
<td>Science II</td>
</tr>
<tr>
<td>John Michael Robinson</td>
<td>Don Mills, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>John Paul Robinson</td>
<td>St. Catharines, Ontario</td>
<td>Arts II</td>
</tr>
<tr>
<td>Robert Rosehart</td>
<td>Tillsonburg, Ontario</td>
<td>Engineering III</td>
</tr>
<tr>
<td>Helmut Karl Roth</td>
<td>Mono Road, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Ronald Neil Rourke</td>
<td>Brantford, Ontario</td>
<td>Engineering I</td>
</tr>
<tr>
<td>Dorothy Dianne Rumble</td>
<td>St. Catharines, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>David MacElroy Rupar</td>
<td>Sarnia, Ontario</td>
<td>Science II</td>
</tr>
<tr>
<td>James Robert Ruppel</td>
<td>Elmira, Ontario</td>
<td>Arts II</td>
</tr>
<tr>
<td>Douglas Howard Russell</td>
<td>Rexdale, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>George Thomas Russell</td>
<td>Oshawa, Ontario</td>
<td>Engineering I</td>
</tr>
<tr>
<td>Adrian Ryans</td>
<td>Downsview, Ontario</td>
<td>Engineering III</td>
</tr>
<tr>
<td>Maman Jimoh Sadiku</td>
<td>Okene, Nigeria</td>
<td>Engineering II</td>
</tr>
<tr>
<td>Barbara Anne Samson</td>
<td>Waterloo, Ontario</td>
<td>Arts III</td>
</tr>
<tr>
<td>Michael John Sandrin</td>
<td>Kirkland Lake, Ontario</td>
<td>Science III</td>
</tr>
<tr>
<td>Gerald Andrew Saunders</td>
<td>Brockville, Ontario</td>
<td>Engineering II</td>
</tr>
<tr>
<td>Gordon James Savage</td>
<td>Beamsville, Ontario</td>
<td>Engineering III</td>
</tr>
<tr>
<td>Ernest Sawatzky</td>
<td>Waterloo, Ontario</td>
<td>Engineering III</td>
</tr>
<tr>
<td>Jane Elizabeth Scherer</td>
<td>Galt, Ontario</td>
<td>Arts III</td>
</tr>
<tr>
<td>Ella Mae Schlenker</td>
<td>Crediton, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Donna Marie Schnarr</td>
<td>Waterloo, Ontario</td>
<td>Arts III</td>
</tr>
<tr>
<td>Heidi Schnegelsberg</td>
<td>Kitchener, Ontario</td>
<td>Arts II</td>
</tr>
<tr>
<td>Johannes Arie Schriel</td>
<td>Campbellville, Ontario</td>
<td>Science II</td>
</tr>
<tr>
<td>Stephen Richard Schroeter</td>
<td>Markham, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Albert Schut</td>
<td>Woodstock, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Lowell George Scott</td>
<td>Brighton, Ontario</td>
<td>Science II</td>
</tr>
<tr>
<td>Edward Herbert Sear</td>
<td>Hespeler, Ontario</td>
<td>Science II</td>
</tr>
</tbody>
</table>

315
<table>
<thead>
<tr>
<th>Name</th>
<th>City, Ontario</th>
<th>Faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharon Carolyn Searth</td>
<td>Kitchener, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>David Allen Sheppard</td>
<td>Sarnia, Ontario</td>
<td>Science II</td>
</tr>
<tr>
<td>Wayne Thomas Shier</td>
<td>Hanover, Ontario</td>
<td>Science IV</td>
</tr>
<tr>
<td>Carl Albert Silke</td>
<td>Pembroke, Ontario</td>
<td>Science II</td>
</tr>
<tr>
<td>Kathleen Jean Skelton</td>
<td>Kitchener, Ontario</td>
<td>Arts IV</td>
</tr>
<tr>
<td>Edward Laurence Skiba</td>
<td>Brantford, Ontario</td>
<td>Engineering II</td>
</tr>
<tr>
<td>David Charles Smart</td>
<td>Woodstock, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Glen Ronald Smith</td>
<td>Port Credit, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Penny Anne Smith</td>
<td>Sault Ste. Marie, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>William James Snodgrass</td>
<td>Burford, Ontario</td>
<td>Engineering II</td>
</tr>
<tr>
<td>Paul Dennis Snyder</td>
<td>Elmira, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Dino Andrew Spagnolo</td>
<td>Timmins, Ontario</td>
<td>Engineering III</td>
</tr>
<tr>
<td>Patricia Ruth Starkey</td>
<td>Gananoque, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Hans Stelzer</td>
<td>Westhill, Ontario</td>
<td>Engineering II</td>
</tr>
<tr>
<td>Joanne Elizabeth Stevens</td>
<td>Willowdale, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Carl Edward Stewart</td>
<td>Peterborough, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Margaret Catherine Stinson</td>
<td>Ariss, Ontario</td>
<td>Arts III</td>
</tr>
<tr>
<td>John Cameron Stirrat</td>
<td>Scarborough, Ontario</td>
<td>Engineering IV</td>
</tr>
<tr>
<td>Cornelius Daniel Stoffer</td>
<td>Owen Sound, Ontario</td>
<td>Engineering IV</td>
</tr>
<tr>
<td>Rae William Struthers</td>
<td>Blair, Ontario</td>
<td>Science II</td>
</tr>
<tr>
<td>Mary Ann Stribel</td>
<td>Kitchener, Ontario</td>
<td>Arts II</td>
</tr>
<tr>
<td>Pamela Kay Tallon</td>
<td>Oakville, Ontario</td>
<td>Science III</td>
</tr>
<tr>
<td>Norman Fredrik Taylor</td>
<td>Concord, Ontario</td>
<td>Science II</td>
</tr>
<tr>
<td>Douglas Bruce Tennant</td>
<td>Rexdale, Ontario</td>
<td>Arts II</td>
</tr>
<tr>
<td>Melvin Sutherland Ternan</td>
<td>Arthur, Ontario</td>
<td>Engineering III</td>
</tr>
<tr>
<td>Frederick Walter Tricker</td>
<td>Dresden, Ontario</td>
<td>Engineering III</td>
</tr>
<tr>
<td>David Bruce Trowbridge</td>
<td>Sarnia, Ontario</td>
<td>Engineering II</td>
</tr>
<tr>
<td>Murray Ian Turner</td>
<td>Agincourt, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Donald Norman Tyrrell</td>
<td>Willowdale, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Terrance Lee Umbach</td>
<td>Kitchener, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Heather Gail Urquhart</td>
<td>Midland, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Bruce Earl Uttley</td>
<td>Kitchener, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Cecil Van Bolhuis</td>
<td>Prairie Siding, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Cornelia Jacoba Vanderkooy</td>
<td>Simcoe, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Harry VanderVelde</td>
<td>Newmarket, Ontario</td>
<td>Arts II</td>
</tr>
<tr>
<td>Mary Anne Verdon</td>
<td>Waterloo, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Raymond John Vilbikaitis</td>
<td>St. Catharines, Ontario</td>
<td>Science I</td>
</tr>
<tr>
<td>Marilyn Vranch</td>
<td>Fort William, Ontario</td>
<td>Science II</td>
</tr>
<tr>
<td>Ronald Kenneth Walker</td>
<td>Downsview, Ontario</td>
<td>Engineering III</td>
</tr>
<tr>
<td>Thomas William Walker</td>
<td>Don Mills, Ontario</td>
<td>Engineering I</td>
</tr>
<tr>
<td>Pauline Winifred Watts</td>
<td>Burlington, Ontario</td>
<td>Arts IV</td>
</tr>
<tr>
<td>Thomas Wayne Watts</td>
<td>Downsview, Ontario</td>
<td>Science II</td>
</tr>
<tr>
<td>Gary Douglas Wedlake</td>
<td>Exeter, Ontario</td>
<td>Engineering II</td>
</tr>
<tr>
<td>Siegmund Paul Weigel</td>
<td>Kitchener, Ontario</td>
<td>Engineering III</td>
</tr>
<tr>
<td>Karl Walter Weber</td>
<td>Sudbury, Ontario</td>
<td>Arts I</td>
</tr>
<tr>
<td>Klaus Wensauer</td>
<td>Cooksville, Ontario</td>
<td>Engineering II</td>
</tr>
</tbody>
</table>
Scholarships, Prizes, and Financial Aid

John Frederick Westlake  St. Catharines, Ontario  Engineering III
William Romney White  Edmonton, Alberta  Arts I
Beverley Jean Wilkinson  Port Arthur, Ontario  Science IV
Frederick Clark Williams  Willowdale, Ontario  Engineering I
Hugh Cowie Williams  Burlington, Ontario  Science IV
Donna Hazel Wilman  Belleville, Ontario  Arts I
Vernon Eric Wilson  Humber Summit, Ontario  Engineering III
Mark Stanley Wolynetz  Kitchener, Ontario  Arts II
David Frederick Wood  St. Marys, Ontario  Engineering II
Herbert Archibald Woods  Mount Forest, Ontario  Engineering I
Diane Beverly Wray  Brantford, Ontario  Arts I
Robert Gerard Yule  Islington, Ontario  Science I
Charles Robert Zarnke  Waterloo, Ontario  Science IV

University of Waterloo Special Proficiency Scholarships

Any student who stands among the top one percent of Ontario students writing the annual Mathematical Association of America contest, the Canadian Association of Physicists contest, or other competitions of equivalent status conducted on a provincial or national scale will be invited to apply for University of Waterloo Special Proficiency Scholarships.

Awards will be made by the Scholarships Committee under the following general conditions:

(a) The amount of the scholarship shall be $3,000 ($600 in Year I, $800 in each of the three succeeding years), provided that, in the opinion of the awarding committee, the scholar maintains a sufficiently high academic standing.

(b) Selection from among the applicants shall be made by the committee in the light of achievement on the Ontario Grade XIII examinations. It is recommended that each applicant write the Ontario Grade XIII Problems paper, where applicable.

University of Waterloo First Year Scholarships

University of Waterloo First Year Scholarships are awarded annually to students entering the first year in any faculty, who have obtained an average of 75% in the Ontario Grade XIII papers required for admission to their particular faculty.

A maximum of two Grade XIII papers, written in Grade XI and/or Grade XII in addition to taking the full Grade XI or Grade XII programme may be counted as part of the papers required for a Scholarship, provided that a full programme of papers is written and passed in the Grade XIII year.

The value of the First Year Scholarships will be the cost of tuition and incidental fees for one year.

Applicants who attain an average of 80% will automatically be considered for University Tuition Scholarships.
The R. G. Stanton Scholarship in Mathematics and Physics

The R. G. Stanton Scholarship will be of an amount of $3,600 ($600 in the first year of the course, and $1,000 in each succeeding year), it is tenable so long as the student remains registered in the Mathematics option of the Mathematics and Physics course at the University of Waterloo, and maintains first-class honour standing in that course. The scholarship will be awarded to the candidate who, receiving an average of 75% on the Ontario Grade XIII papers required for admission, obtains the highest average on the four Mathematics papers (Algebra, Geometry, Trigonometry, Problems). The candidate must have an average of 90% or better on these four papers to qualify.

In case the successful candidate qualifies for another University of Waterloo Scholarship, the amount of the R. G. Stanton Scholarship will be decreased by the amount of the other Scholarship.

If no award is made in any one year, the amount may, at the discretion of the donor, be used to offer four scholarships of $900 ($300 in each of the second, third and fourth years) to deserving students who have shown high ability in Mathematics.

Association of Professional Engineers Entrance Award

The Association of Professional Engineers of the Province of Ontario provides a $500 Entrance Award to the student having the highest academic standing in the Grade XIII examinations and who is entering an accredited engineering course at the University of Waterloo.
Scholarships, Prizes, and Financial Aid

Association of Professional Engineers Undergraduate Scholarship
The Association of Professional Engineers of the Province of Ontario offers three annual scholarships of $250, one to the student in each of the first, second and third years in an accredited engineering course who has the highest average in the examinations of his year.

City of Waterloo Scholarship
The City of Waterloo is offering an entrance scholarship of $400 to a student, normally resident in the City of Waterloo, who has been accepted by the University of Waterloo for entrance into a course leading to a degree offered by the University.

The award is made by the Scholarships Committee and no application is necessary.

The basis on which the awards are made includes the following:
(a) excellence in academic achievement.
(b) indications that the scholar will achieve distinction in the intellectual, cultural, or social life of our society.

J. P. Bickell Foundation Scholarships
For the academic year 1966-67, the Trustees of the J. P. Bickell Foundation will provide twenty-four J. P. Bickell Foundation scholarships of $250 each to be awarded to qualified students in the Chemical Engineering Department in any of the second, third or fourth years of the course.

To be eligible for one of these scholarships a student must obtain an average of 75% in the previous term's examinations and maintain this standing throughout the course. The scholarship will be paid at the rate of $250 a term for up to six terms.

Awards will be made by the Scholarships Committee. No application is necessary.

E. L. Ruddy Scholarship
The E. L. Ruddy Company Limited is offering an annual scholarship of $250 to be awarded to a third or fourth year student registered in the Planning option of the Honours Geography programme. The student must have attained high academic standing and indicate an interest in planning. Application should be made to University Registrar.

Concordia Club Scholarship in German
A scholarship in the value of $300 will be awarded annually in the Faculty of Arts by the Kitchener-Waterloo Concordia Club to promote and encourage the study of German language and literature.
Canadian German Society Scholarship in German

A scholarship of $100 will be awarded annually in the Faculty of Arts by the Canadian German Society to an outstanding student majoring in German.

Kitchener-Waterloo Council of Friendship Scholarship Fund

The Kitchener-Waterloo Council of Friendship offers scholarships totalling $1,500 to first year students who were born in a non-English speaking country and are residents of the Kitchener-Waterloo school area. Further details may be obtained from the Office of the Registrar of the University of Waterloo or from your Secondary School.

Huron County Scholarship

Huron County Council is offering two $100 Scholarships to be awarded to the boy and girl from Huron County who obtain the highest standing regardless of what year in which he or she is registered. No formal application is necessary.

A. S. Eves Scholarship

This Scholarship which has a value up to $500 will be awarded annually to an engineering student in the final year who is specializing in Materials Science.

The award will be made by the Scholarships Committee on recommendation of the Faculty of Engineering.

Ukrainian Credit Union "Buduchnist" Scholarship in Ukrainian Studies

This Scholarship of $100 will be awarded annually to an outstanding full-time student who attains the highest academic standing in a Ukrainian course.

The British American Oil Company Limited Scholarships

Seven university entrance scholarships are awarded annually each valued at $1,000 per annum. Eligible are children of employees or annuitants of the British American Oil Company Ltd. and its subsidiary companies in Canada. Application forms should be requested directly from:

Director of Awards,
Association of Canadian Universities and Colleges,
75 Albert Street,
OTTAWA 4, Ontario.

Completed applications in triplicate are to be sent directly to the above address to arrive not later than June 1.
Scholarships, Prizes, and Financial Aid

Undergraduate Bursaries

Note: Second Class standing is normally required of applicants for bursary assistance.

Atkinson Charitable Foundation Bursaries

With the consent and approval of the Minister of Education for the Province of Ontario, a university bursary programme, sponsored by the Atkinson Charitable Foundation, became effective in June, 1953. Students with an average of at least 66% on subjects which the university requires for student admissions to the degree programme selected will be eligible for bursaries. Candidates must be residents of Ontario and be sponsored by their Secondary School principals. Final decision as to awards will be made by the university after investigation and assessment of applications. Bursaries will be granted to students of merit on the basis of $400.00 for students living away from home (in residence, or boarding while attending university), and $200.00 yearly for students residing within easy access to the university (where normal transportation costs do not exceed 75 cents daily). Applicants are free to select any course at one of the participating universities, provided such courses lead to a degree.

Atkinson Charitable Foundation “In Course” Bursaries

The Atkinson Charitable Foundation has established an “In Course” bursary programme in addition to the “Admission” bursary programme which the Foundation has supported since the 1953-54 academic year.

The “In Course” programmes gives assistance to students of merit and proven financial need beyond the first year. Awards are made only to students who are bonafide residents of the Province of Ontario. Further information and application forms may be obtained from the Office of the Registrar.

ATA Trucking Industry Educational Foundation Bursaries

The Automotive Transport Association Trucking Industry Educational Foundation was established in 1958 by a group of transport companies who decided to divert monies formerly spent in Christmas customer gift-giving to bursaries for deserving needy students. The funds are to be distributed to students in all faculties, who, because of extenuating circumstances, are deserving of financial help, and would not be in a position to continue their studies without some assistance.

Awards will be made by the Scholarships Committee. Application for a bursary should be made through the Office of the Registrar.

IBM—Thomas J. Watson Memorial Bursaries

The University of Waterloo has been invited to participate annually in the IBM—Thomas J. Watson Memorial Bursary Programme, established by the International Business Machines Company Limited.
The objective of the programme is to provide financial assistance to undergraduate students in need with good academic standing. This will apply to all years and faculties of the University. A bursary may be held concurrently with other awards provided that a definite need is established.

Bursaries will be awarded by the Scholarships Committee. Application may be made through the Office of the Registrar.

Dominion-Provincial Student-Aid Bursaries, Type A

Given by the Dominion and Provincial Governments, these bursaries have a maximum value of $250 to students attending university in the community in which they reside, and a maximum value of $500 to out-of-town students. They are intended “for students of good character, whose health and physical fitness are satisfactory to the Committee of Award, who meet the required academic standing, and who, without financial assistance, could not continue their studies.” To apply, the student should consult his Secondary School principal not later than June 30th.

Dominion-Provincial Student-Aid Bursaries, Type B

These bursaries are given by the Dominion and Provincial Governments for students in any course who have attained at least 66% standings in their previous year’s work, and who would find it impossible to continue their formal education without assistance. An applicant responsible for his own support shall have been a resident of Ontario for at least one year immediately prior to date of application. The parent or guardian of an applicant, other than an applicant responsible for his own support, shall have been a resident of Ontario for at least one year before the date of application. Application is to be made through the Office of the Registrar not later than October 8 for students beginning a new academic year in the Fall and by January 8 for students commencing in January.

The Minnesota Mining and Manufacturing of Canada Limited Bursaries

Two bursaries, to the value of $500 each, are offered annually by the Minnesota Mining and Manufacturing of Canada Limited. The bursaries may be awarded to any full-time undergraduate student at the University, who has a good academic record and is in need of financial assistance for continued studies.

Awards will be made by the Scholarships Committee. Application for bursary should be made to the Office of the Registrar.

University of Waterloo Student-Aid Fund

Beginning with the academic year 1961-62, students requiring financial assistance may apply for bursary aid through the University of Waterloo Student-
Scholarships, Prizes, and Financial Aid

Aid Fund. Awards will be made by the Scholarships Committee. Second Class standing is normally required of applicants for bursary assistance.

Application should be made prior to November 1. Students registered in co-operative programmes should apply within four weeks after registration. Application may be made on the forms provided by the Office of the Registrar.

Dominion Rubber Student Aid Plan

Beginning with the academic year 1961-62 the Dominion Rubber Co. Limited has included the University of Waterloo in its programme of aid to education. Awards will be made by the Scholarships Committee. A candidate must have completed at least one academic year, should establish a need for financial assistance and be willing to assume a moral obligation to repay to the university over a reasonable period at least twenty-five per cent of any funds received.

Further information and application forms may be obtained from the Office of the Registrar.

Litton Systems Bursary

A bursary, to the value of $500, is offered annually by Litton Systems (Canada) Limited. The bursary may be awarded to students in the Faculty of Engineering with preference being given to those in the electronic or electro-mechanical fields. It is intended to provide financial assistance to undergraduates in need and may be held concurrently with other awards where the need exists.

Awards will be made by the Scholarships Committee and the amount available may be apportioned among two or more students. Applications for a bursary should be made to the Office of the Registrar.

The St. Quentin Chapter I.O.D.E. Bursary

The St. Quentin Chapter I.O.D.E., Waterloo, offers an annual bursary of $100 to a second or third year student in the Faculty of Science, with preference being given to the son or daughter of a veteran.

Application should be made through the Office of the Registrar by October 15.

Ontario Culvert Bursary

One bursary, valued at $500 (i.e. $250 per academic term), is offered annually by the Ontario Culvert and Metal Products Company Limited. The bursary will normally be awarded to a student registered in Third or Fourth Year Civil Engineering who maintains a satisfactory academic standing.

Awards will be made by the Scholarships Committee. Application for a bursary should be made to the Office of the Registrar.
P. L. Robertson Manufacturing Co. Ltd. Bursary

A Bursary, to the value of $100 is offered annually by the P. L. Robertson Manufacturing Co. Ltd. The bursary is to be awarded to students in the Faculty of Engineering who are in need of financial assistance and who have satisfactory academic standing. Where the need exists the bursary may be held in conjunction with other awards.

The Scholarships Committee will award the bursary and application should be made to the Office of the Registrar.

J. P. Bickell Foundation Bursaries

The Foundation is making available a sum of money to be used in providing bursary assistance to Chemical Engineering students of good academic standing who need financial assistance.

Awards will be made by the Scholarships Committee. Application for a bursary should be made to the Office of the Registrar.

Waterloo Young Men's Club Bursary

A bursary to the value of $100 is offered by the Waterloo Young Men's Club to a full-time student who is a permanent resident of the City of Waterloo, who has a good academic standing and needs financial assistance.

Application should be made through the Office of the Registrar.

The Business and Professional Women's Club of Kitchener-Waterloo Bursary

The Business and Professional Women's Club offers a Bursary of $100 to a girl enrolled in an undergraduate course beyond the first year. Good academic standing and financial need are essential.

Application should be made on forms provided by the Office of the Registrar.

The Hydro-Electric Power Commission of Ontario Bursary

A bursary, of the value of $500, is offered annually by The Hydro-Electric Power Commission of Ontario to a student in second year in any of the following honours courses: Mathematics, Physics, Applied Science and Engineering. It is to be awarded to undergraduates with good academic standing who are in need of financial assistance. The bursary may be held concurrently with other awards where the need exists. Awards will be made by the Scholarships Committee. Applications should be made through the Office of the Registrar.

Huron County Bursary

Huron County Council has established a bursary fund at the University of Waterloo for students who attended High School in Huron County and whose
Scholarships, Prizes, and Financial Aid

home is in that County. The bursaries, offered annually, will be for an amount of $100 and will be awarded to full-time undergraduate students in any faculty of the University who have good academic records and who are in need of financial assistance to enable them to continue their studies.

Application forms may be obtained either from the High School Principal or from the Office of the Registrar at the University of Waterloo.

The Steel Company of Canada, Limited Bursary

The Steel Company of Canada is offering an admission bursary in the amount of $500 each year for four years to give financial assistance to students of superior ability who might not otherwise go to university because of lack of funds.

Applicants must be permanent residents of Canada and must have completed the final year's work for university entrance in one school year and have attained a minimum average mark of 66%.

The Stelco Bursary is not tenable with scholarships totalling in excess of $200 but may be held with other bursaries at the discretion of the university.

Application may be made by writing to the Office of the Registrar, University of Waterloo.

Lloyd C. Meyer Bursary

This bursary to the value of $300, is awarded annually to a student in the Faculty of Engineering who is in need of financial assistance and who has a satisfactory academic standing.

Application should be made through the Office of the Registrar.

Interprovincial Pipe Line Company Bursary

The Interprovincial Pipe Line Company Bursary Fund, of a total value of $2,500, has been established by Interprovincial Pipe Line Company to benefit students beyond the first year in any faculty who are in need of financial assistance in order to continue their studies.

Application for a bursary should be made through the Office of the Registrar.

Undergraduate Prizes

Association of Professional Engineers Gold Medal for Academic Achievement Award

The Association of Professional Engineers of the Province of Ontario makes this award to the student in the fourth year of an accredited engineering course,
who having received honours, has obtained the highest standing in the final examinations of the current academic year. Included with this award is a gift of technical books valued at approximately $50.00.

Faculty and Staff Prize

The University of Waterloo Faculty Association has established a fund to award prizes, of the value of $50 each, to the students who rank first in the final examinations of any non-graduating year of each Faculty. This is provided that the student attains a minimum of 80% in the final examinations, is not repeating his year, has no supplemental examinations, and carries a full course load.

An application is not required. The Faculty Association has the final decision in all cases.

The George Crabbe Prize for Creative Writing

This prize, open annually to all full-time students in all faculties, consists of $100 to be awarded, in whole or in part at the discretion of the judges, for superior creative writing in any of the following categories: short story, novella, one-act play, full-length play, poetry. Contestants should submit their manuscript or manuscripts, typed double space and in duplicate, to the Office of the Registrar by October 31. Each manuscript shall bear a pseudonym and shall be accompanied by a sealed envelope containing the real name of the person using the pseudonym.

The Joseph Addison Essay Prize

This prize, open annually to all full-time students in all faculties, consists of $100 to be awarded, in whole or in part at the discretion of the judges, for the best essay or essays on one or more of a number of themes to be set each year. The themes for 1967 are the following:

1. The effects of nationalism on literature.
2. Changing fashions in iconography.
3. The role of literature in the reform of manners.

Each essay, which may be no shorter than 2,000 words and no longer than 5,000, shall be on one of these themes, and should evince, in addition to a competent handling of the subject, the qualities of grace, clarity, and gentlemanly ease which characterize the essays of Joseph Addison. Contestants should submit their manuscript or manuscripts, typed double space and in duplicate, to the Office of the Registrar by January 31. Each manuscript must bear a pseudonym and must be accompanied by a sealed envelope containing the real name of the person using the pseudonym.
Scholarships, Prizes, and Financial Aid

The Bruce Wyler Kelly Memorial Prizes

These book prizes were established in 1960 by relatives and friends in memory of the late Bruce Wyler Kelly, the first Dean of Science at the University of Waterloo, 1958-1960. These prizes are awarded in the General Science Course at the end of the second year to two students, one registered with Biology as major subject and one registered with Chemistry as major subject. Qualifications are (a) a clear pass standing and (b) highest standing in Biology with a minimum of B standing, or highest standing in Chemistry courses taken with a minimum of B standing in the average of these courses.

Senior Physics Prizes

One or two Senior Physics prizes of $100 each will be awarded annually to the highest First Class Honour students registered in the Fourth Year Honours Physics or Applied Physics course.

On occasion, a Second Year prize may be awarded in lieu of one of the Senior Prizes.

Pennsylvania German Folklore Society of Ontario Prize in German

This prize of $50.00 will be awarded annually to the student in the Faculty of Arts, born in Canada, who has made the most progress in German during the year.

French Department Prize

The French Department Prize, of the value of $50 will be awarded annually to the student who in first year attains the highest mark in the prerequisite course for honours French. To qualify for the prize the student must enrol in the second year of an honours programme offered by the French Department.

The Bobby Bauer Memorial Award

Beginning with the academic year 1966-67, the Bobby Bauer Memorial Foundation will make one or more awards annually to students demonstrating outstanding proficiency in Hockey who qualify for admission to a full-time undergraduate course at a Canadian university.

Application should be made prior to August 31 on forms provided by the Foundation. A letter of reference from a person actively involved in Hockey must accompany each application.

Inquiries and applications should be sent directly to:

Bobby Bauer Memorial Foundation,
60 Victoria Street North,
Kitchener, Ontario.
Undergraduate Loans

Canada Student Loans Plan
This Plan, instituted by the Federal Government in 1964, was introduced to provide loans to supplement the resources of a student and/or the parents where, in the absence of such aid, a student would be unable to pursue a post-secondary education. A student should apply for a loan under this Plan for only the funds needed, over and above those from his own resources and/or those of his family, to enable him to continue his studies. The institution to which application is made will determine the amount of loan required in each case.

Borrowers under this Plan are required to repay principal and to pay interest, but no payments are required so long as the student is in full-time attendance at an eligible institution and for six months thereafter. Interest charges during this period are paid by the Federal Government who also guarantees the loan principal. After the interest-free period, repayment of principal and simple interest charges at 5% on the outstanding balance are required in regular monthly payments to the bank from the borrower. The maximum amount which may be advanced under this Plan to one student is $1,000 in one academic year. The maximum total indebtedness under this plan is $5,000.

Application should be made in the first instance to the Office of the Registrar. When a loan is approved, the institution will issue a Certificate of Eligibility which authorizes the student to make arrangements for the loan with any branch of any chartered bank in Canada.

The Adelaide Detweiler Student Loan Fund
This loan fund has been established by Mr. J. R. Detweiler in memory of his mother, Adelaide Detweiler, to provide short-term loans, interest free, to students who may be confronted with unexpected expenses during their academic year. Further information may be obtained and application may be made through the Office of the Registrar.

Ian Carr Loan Fund
This loan fund has been set up by the parents in memory of their son, a former student at the University of Waterloo. It is intended to provide short-term loans, interest free, to students who may be faced with unexpected expenses during their academic year.

Further information may be obtained, and application may be made, through the Office of the Registrar.

Student Emergency Loan Fund
Students' Council has set aside a sum of money to be used in assisting students by providing interest free, short-term loans. It is intended that this fund be used only when other avenues of obtaining assistance have been tried unsuccessfully.

Further information may be obtained from the Office of the Registrar.
Scholarships, Prizes, and Financial Aid

Kitchener-Waterloo Council of Friendship Loan Fund
Students in their final year may apply for loans up to $200 through the Office of the Registrar. These loans are interest free and should be repaid within two years after graduation.

Transportation Assistance
The Provincial Government makes grants to students residing in territorial districts towards the cost of transportation between the university and the applicant's home. The assistance is payable only towards the cost of one round trip in any school year.

Applications should be made through the Office of the Registrar before November 1 for students commencing a new academic year in the Fall, and before February 1 for students commencing in January.

Graduate Scholarships and Fellowships

University of Waterloo Teaching Fellowships
Various departments in the University offer Teaching Fellowships which allow a student to do elementary demonstrating, marking, and instruction while carrying on graduate work. These fellowships carry a stipend of $275 per month. Information concerning these departmental Fellowships may be obtained by applying directly to the department concerned.

Note: Some departments offer research assistantships which provide an opportunity for professional experience, and which may involve light instructional duties in addition to research. Application for these must be filed by March 1.

National Research Council Postgraduate Scholarships and Postdoctorate Overseas Fellowships
The National Research Council awards each year, in open competition, a number of postgraduate scholarships in science and engineering to assist students in undertaking graduate study and research leading to advanced degrees, and a limited number of postdoctorate fellowships for those wishing to add to their experience by specialized training abroad. These scholarships are open to men and women on equal terms, and are awarded on the basis of high scholastic achievement and evidence of capacity to do research.

Applications made on the approved form must be filed not later than January 15.

The Queen Elizabeth II Ontario Scholarships
In honour of the visit of Her Majesty Queen Elizabeth to Ontario in July, 1959, the Government of the Province established a fund to provide annually a number of postgraduate awards to be known as "The Queen Elizabeth II Ontario Scholarships." In 1956 six such Scholarships, each of the value of
$4,000 will be available in the fields of the humanities, social sciences and mathematics. Scholarships are intended for candidates nearing the completion of the Ph.D. degree.

Applications should be made prior to December 1, 1966.

Woodrow Wilson National Fellowship Foundation

The Woodrow Wilson National Fellowship Foundation offers 1,000 Fellowships annually for the first year of study in any qualified graduate school in the United States or Canada. The Foundation primarily supports candidates in the humanities and social sciences who wish to become college teachers.

A fellow receives $1,500 plus dependency allowances for wife and children. The Foundation also pays directly to the graduate school tuition and fees for the fellow.

A candidate must be nominated by a faculty member no later than October 31, 1966.

Imperial Oil Graduate Research Fellowships

Imperial Oil Limited in 1946 established for annual competition Graduate Research Fellowships, now five in number and having a value of $2,500 a year for a maximum of three years. A fellow may not hold concurrently other awards which annually total more than $1,500.

The fellowships are open to any graduate of any approved Canadian university and are offered for research leading to a Doctor’s degree in the fields of Pure and Applied, Natural and/or Exact Sciences, including Mathematics (3 fellowships), and Social Sciences and Humanities (2 fellowships).

Nominations of students for the fellowships shall be made by the University not later than March 1 of each year.

Consolidated Mining and Smelting Company Graduate Research Fellowships

The Consolidated Mining and Smelting Company Limited offers ten Graduate Research Fellowships annually for the academic years 1962-1966 for award at Canadian universities. At least five of these awards will be made to graduates undertaking study and research leading to an advanced degree at Western Canadian Universities (West of Ontario).

The Fellowships will be of the value of $2,200 and open to any Canadian citizen who is a graduate in Pure Science, Applied Science, or Agriculture. A Fellowship will normally be tenable for one year, however, application for a renewal of the award may be made in succeeding years.

The subject of research investigation to be carried out under the Fellowship programme shall be in the field of Pure or Applied Science bearing some re-
Scholarships, Prizes, and Financial Aid

in relationship to the technical interests of the Company, viz., Mining, Geology, Metallurgy, Chemistry, Chemical Engineering, Physics, Agriculture, and Electrical, Civil, and Mechanical Engineering.

Applications should be forwarded to the Director of Awards, Association of Universities and Colleges of Canada, 75 Albert Street, Ottawa 4, Ontario, not later than February 1 each year.

Steel Company of Canada Graduate Research Fellowship in Metallurgy

The Steel Company of Canada Limited offers four fellowships for research in Metallurgy of the value of $2,000 each.

The competition for these fellowships is open to permanent residents of Canada who are graduates of a Canadian university. A fellowship will normally be tenable for one year, but in special circumstances may be renewed for a second year.

Applications should be forwarded to the Director of Awards, Association of Universities and Colleges of Canada, 75 Albert Street, Ottawa 4, Ontario, not later than February 28, 1966.

The Athlone Fellowships

Her Majesty's Government in the United Kingdom has established a number of fellowships to be awarded annually to enable Canadian Engineering graduates to take postgraduate training in the United Kingdom. Additional fellowships are available for award to graduates who have already spent some time in industry. The fellowships, which are normally tenable for a period of two years, cover costs of transportation, fees and maintenance. Candidates must be Canadian citizens or British subjects normally resident in Canada and should preferably be less than twenty-seven years of age.

Further information may be obtained from the Dean of the Faculty.

Commonwealth Scholarship and Fellowship Plan

The Commonwealth Scholarship and Fellowship Plan aims at providing opportunities for Commonwealth students to pursue advanced courses in other Commonwealth countries. The scholarships are intended for men and women of high intellectual promise who may be expected to make a significant contribution to their own countries on their return from studies abroad. At present, graduate scholarships are available for study in the United Kingdom, Australia, New Zealand, Hong Kong, Malaya, Rhodesia and Nyasaland, Malta, India, Ceylon, East Africa, Nigeria and Pakistan, and the Canadian Government offers scholarships for other Commonwealth students to study in Canada. Awards will normally be made for a period of two academic years and will cover return transportation, tuition fees, a personal maintenance allowance, and a grant for incidental expenses. Deadline dates for receipt of applications vary according to each country.
Full information and application forms may be obtained from the Association of Universities and Colleges of Canada, 75 Albert Street, Toronto 4, Ontario.

Commonwealth Research Fellowships

In addition to the Commonwealth Scholarships which Canada already offers to other Commonwealth countries, awards to be known as Commonwealth Fellowships are now to be made.

Commonwealth Research Fellowships are intended to bring to Canada from universities and research centres of other countries of the Commonwealth, scholars of established reputation whose presence in Canadian universities is expected to be of benefit to themselves and to their countries as well as to their Canadian hosts. A Fellow will be free to do his own study and research and to engage in other activities for the purpose of building up his contacts with his Canadian colleagues during his stay in Canada. He will normally be attached to a single university during the period of his fellowship although his programme might include short visits to other institutions.

Up to three Fellowships in this category will be available for each academic year; however, a university may not make more than one nomination for any given year and may not be host to Research Fellows in two consecutive years.

Further information may be obtained from the Association of Universities and Colleges of Canada, 75 Albert Street, Ottawa 4, Ontario.

Province of Ontario Graduate Fellowships

Fellowships, up to the value of $1,500 for one academic year (8 months) or an amount not to exceed $2,000 for an academic year and the period between academic years (12 months), are offered by the Province of Ontario. The minimum prerequisite is an Ontario Honours B.A. or its equivalent. A Fellow pledges to give serious thought to a career in university teaching and during tenure he will undertake a full-time programme of graduate study. Fellowships are tenable only at Ontario universities and most awards will be made to candidates who are residents of Ontario.

Application is to be made on the prescribed form which may be obtained from the Office of the Registrar. Deadline date is February 15.

Frank H. Kortright, President, Canadian National Sportsmen’s Show Fellowship

The Canadian National Sportsmen’s Show offers a post-graduate fellowship to a student with a good academic background who wishes to do research in resources development and conservation within the framework of the graduate programme in Geography and Regional Planning. Application should be submitted to the Chairman of the Department of Geography.
Scholarships, Prizes, and Financial Aid

The Shore Fellowship in Environmental Design
This Fellowship in the amount of $500 was established in 1964, and is awarded to a full-time student registered as a candidate for the M.A.Sc. degree in the Department of Design.

Application should be made on the prescribed form which may be obtained from the Office of the Registrar.

The British American Oil Company Limited Graduate Fellowships
The British American Oil Company Limited offers five graduate fellowships to be awarded annually beginning in 1965-66, and, upon request, each may be renewed for further study, subject to the approval of the selection committee. Each fellowship is valued at $4,000; $3,000 to be paid to the successful candidate and $1,000 to the department of the university in which the Fellow is registered.

The Fellowships are open to any resident of Canada who is a graduate of a Canadian University which is a member of the National Conference of Canadian Universities and Colleges.

Graduate students in any field of study at member institutions of the National Conference of Canadian Universities and Colleges may apply for the awards. Applications are to be sent directly to the Director of Awards, Association of Universities and Colleges of Canada, 75 Albert Street, Ottawa 4, Ontario.

International Nickel Graduate Research Fellowship in Mathematics
The International Nickel Company of Canada, Limited provides a graduate research fellowship in Mathematics for annual competition at Canadian universities. The award has a possible tenure of two years and is valued at $3,000 annually.

The Fellowship is open to qualified students who have an honours degree (or its equivalent) in Mathematics, or who expect to meet this requirement during the academic year in which they are proposed as candidates for the award.

Application is made in letter form by the candidate's supervising professor to The International Nickel Company of Canada, Limited, 55 Yonge Street, Toronto 1, Ontario prior to February 28.

International Nickel Graduate Research Fellowships in Engineering and Science
The International Nickel Company of Canada, Limited provides a number of Graduate Research Fellowships in Engineering and Science for annual competition at Canadian universities. Each award has a possible tenure of three years, and is valued at $3,500 annually of which $3,000 is payable to the Fellow and $500 to the Department for materials and equipment to support the research.
The Fellowships are open to students who are proceeding to either the Master's or Doctor's degree and whose research will be concerned with basic science intrinsically related to the following specializations:

- Chemistry or Physics of Metals
- Geology (including Geophysics and Geochemistry)
- Metallurgy (both Physical and Extractive, including Mineral Dressing)
- Mining

Application is made in letter form by the candidate's supervising professor to The International Nickel Company of Canada, Limited, 55 Yonge Street, Toronto 1, Ontario, prior to February 14. Not more than one application (either new or renewal) will be considered annually from any one Department, and not more than three Fellowships will be tenable annually at any one university.

**Chemcell (1963) Limited Fellowships**

The Chemcell (1963) Limited has recently instituted a programme of Graduate Research Fellowships open to Canadian residents and graduates of a Canadian university or college in the fields of Chemistry, Engineering, Physics or Mathematics who wish to pursue graduate work in a Canadian university. Six awards, valued at $2,500 plus $1,000 to the relevant department of the receiving university will be made each year.

Further information and application forms may be obtained from the Director of Awards, Association of Universities and Colleges of Canada, 75 Albert Street, Ottawa 4, Ontario. Deadline date is March 1.

**Royal Commission for the Exhibition of 1851 - Science Research Scholarships**

Value £750 per annum; tenable ordinarily for two years; a candidate must be a citizen of the British Commonwealth, and under 26 years of age, except in very special circumstances. He must have been a student of science in a university for a period of not less than three years, and must have spent one full academic year ending not more than 12 months prior to the date of recommendation at the Institution by which he is recommended.

The record of a candidate's work must indicate high promise of capacity for advancing in science or its applications by original research. Evidence of this capacity, which is the main qualification for the Scholarship, is essential and should take the form of a full account by the candidate of the research work he has done. This may be either in the form of publications or of a thesis or of manuscript reports.

Further details concerning this award may be obtained from the Office of the Registrar.
XI

Governing Bodies
and Staff
The Board of Governors

Officers:
Ira G. Needles—Chairman
J. W. Brown—Secretary

Ex-Officio Members:
The Chancellor
The President
The Mayor of the City of Kitchener
The Mayor of the City of Waterloo
The Warden of Waterloo County

Members Appointed by the Lieutenant-Governor in Council:
William H. Evans, Toronto
Kenneth J. Shea, London

Elective Members:
Albert S. Ballingall, Brantford
J. D. Barrington, Toronto
A. A. Cumming, Toronto
George H. Dobbie, Galt
W. Dodge, Ottawa
Lewis Hahn, New Hamburg
Colonel H. J. Heasley, Waterloo
G. R. Henderson, Sarnia
P. R. Hilborn, Preston
A. R. Kaufman, Kitchener
R. Bruce Marr, Kitchener
Wm. W. McGrattan, Mimico
John F. Motz, Kitchener
Ira G. Needles, Waterloo
C. A. Pollock, Kitchener
W. M. Rankin, Toronto
A. I. Rosenberg, Kitchener
J. W. Scott, Kitchener
E. J. Shoemaker, Kitchener
J. Kenneth Sims, Kitchener
Dr. Hugh Templin, Fergus
James G. Thompson, London
J. P. R. Wadsworth, Toronto
C. N. Weber, Kitchener
Leo J. Whitney, Toronto

Vacancies—4
Senate

Officers

Chairman — The President and Vice-Chancellor
Vice-Chairman — The Academic Vice-President
Secretary — The Registrar

Ex-Officio Members

The Vice-Chancellor — J. G. Hagey, B.A., LL.D.
The Academic Vice-President — T. L. Batke, B.A.Sc., M.A.Sc., Ph.D.

The Principal of each Federated or Affiliated College
J. R. Finn, C.A., M.A., Ph.D. (President, St. Jerome's College)
J. W. Fretz, B.A., M.A., B.D., Ph.D. (President, Conrad Grebel College)
A. M. McLachlin, M.A., B.D. (Principal, St. Paul's United College)
A. W. Rccs, M.A. (Principal, Renison College)

The Dean of each Faculty of the University
N. H. High, B.S.A., M.S., Ph.D. (Dean of Arts)
D. T. Wright, B.A.Sc., M.S., Ph.D. (Dean of Engineering)
W. A. E. McBryde, M.A., Ph.D. (Dean of Science)
R. G. Stanton, M.A., Ph.D., F.S.S. (Dean of Graduate Studies)

The Academic Dean of each Federated College
Z. T. Ralston, C.R., M.A., Ph.D. (St. Jerome's College)
The Librarian — (Mrs.) D. E. Lewis, B.A., B.L.S.
The Chairman of the Board of Governors — I. G. Needles, B.A.
The Registrar — A. P. Gordon, B.A.
The Director of Extension — A. A. Beveridge, B.A.

Elective Members

Faculty Representatives:

To 1966
Z. Adamczewski, A.M., Ph.D. (Arts)
W. R. Drynan, B.A.Sc., M.S., Ph.D. (Engineering)
H. R. N. Eydt, M.Sc, Ph.D. (Science)
I. R. Dagg, M.S., Ph.D. (Graduate Studies)
To 1967

A. D. Nelson, A.B., A.M., Ph.D. (Arts)
A. N. Sherbourne, B.Sc., B.S., M.S., M.A., Ph.D. (Engineering)
G. N. Soulis, B.A.Sc. (Engineering)
H. B. N. Hynes, Ph.D., D.Sc., A.R.C.S. (Science)
W. F. Forbes, D.I.C., Ph.D., D.Sc. (Graduate Studies)
L. A. Cummings, A.B., M.A., Ph.D. (St. Jerome's)

To 1968

G. E. Cross, M.A., Ph.D. (Arts)
R. R. Krueger, M.A., Ph.D. (Arts)
J. S. Keeler, M.A.Sc. (Engineering)
H. G. McLeod, M.A., Ph.D. (Science)
M. C. Rochester, B.A., M.A., Ph.D. (Science)
P. G. Cornell, E.D., M.A., Ph.D. (Graduate Studies)
N. L. Choate, C.R., B.A., M.A. (St. Jerome's)

Alumni Representatives:

To 1966

B. W. Hansler, M.A.Sc.
W. Lammers, B.A.Sc.
W. N. Krasniuk, B.A. (St. Jerome's)

To 1967

P. Koch, M.A.Sc.
J. Kruuv, M.Sc.
C. W. McNamney, B.A. (St. Jerome's)

To 1968

C. L. Heck, B.A.Sc.
J. H. Shaw, B.A.Sc.
J. McKay, B.A. (St. Jerome's)

Secondary School Representatives:

To 1966

R. J. Hodd, B.A. (Kitchener-Waterloo Collegiate & Vocational Institute)
D. G. Kilmer, B.A., B.Comm.
(North Park Collegiate Institute, Brantford)

To 1967

A. I. Hunsberger, B.A., B.Paed. (Waterloo Collegiate Institute)
W. M. Prudham, B.A., B.Sc.
(Owen Sound Collegiate & Vocational Institute)

To 1968

J. C. Herbert, B.A. (Ingersoll District Collegiate Institute)
Administrative Offices

President

President and Vice-Chancellor - - J. G. Hagey, B.A., LL.D.
Director of Centre for Continuing Studies in Marketing
R. Barbour
Director of Development - - - - J. O. Hemphill
Director of Information Services - - J. D. Adams, B.A.

Vice-President, Academic

Vice-President, Academic - - T. L. Batke, B.A.Sc., M.A. Sc., Ph.D.
Research Assistant - Academic Planning
C. F. A. Beaumont, B.A., M.A.
Director, Audio-Visual Centre - - - - Geoffrey Downie

Faculty of Arts

Dean of Arts - - - - N. H. High, B.S.A., M.S., Ph.D.
Assistant to the Dean - - - - H. C. Mecredy, B.A.

Faculty of Engineering

Dean of Engineering - - D. T. Wright, B.A.Sc., M.S., Ph.D.
Assistant to the Dean - - E. L. Homes, B.Sc., M.A.Sc., Ph.D.

Faculty of Science

Dean of Science - - W. A. E. McBryde, B.A., M.A., Ph.D.
Assistant to the Dean - - R. V. McIntyre, B.A.

Faculty of Graduate Studies

Dean of Graduate Studies - - R. G. Stanton, B.A., M.A., Ph.D.
Assistant to the Dean - - W. R. Macnaughton, B.A., M.A.

Department of Physical and Health Education

Chairman - - - - D. J. Pugliese, B.A., B.P.E., Ed.M.

Computing Centre

Director - - - - J. W. Graham, B.A., M.A.
Associate Director - - D. D. Cowan, B.A.Sc., M.Sc., Ph.D.
Library

University Librarian - - - (Mrs.) Doris E. Lewis, B.A., B.L.S.
Director of Technical Services - - - (Mrs.) Margaret Beckman, B.A., B.L.S.
Head, Acquisitions Department - - - Conrad Reitz, B.A., Lib. Dip.
Head, Bibliographic Searching Department - - - Clinton D. Lawson, B.A., B.D., B.L.S.
Head, Cataloguing Department - - - Robert Bean, B.A., B.L.S.
Head, Reference Department - - - (Miss) I. M. Belle Grant, B.Sc., B.L.S., M.A.L.S.
Head, Circulation Department - - - (Miss) Elaine Reaman, A.T.C.M., B.A., B.L.S.

Registrar

Registrar - - - - - - - - A. P. Gordon, B.A.
Assistant Registrar, Admissions - - - - - - - C. T. Boyes, B.A.
Assistant Registrar, Records - - - - - - - B. Ingram, B.A.
Secondary School Liaison Officer - - - - - - - S. G. B. Robinson, B.A., B.Paed., L.L.D.
Assistant to the Registrar, Research Studies - - - - - B. A. Lumsden, B.A.
Supervisor of Examinations and Registration - - - - - J. P. Roos, B.A.
Awards Officer - - - - - - - - - K.-H. Wilms, B.A.

Student Affairs

Provost - - - - - - - - - W. G. Scott, B.A., M.A.
Warden of Student Village - - - - - - - - - A. N. Sherbourne, B.Sc., B.S., M.S., M.A., Ph.D.
Assistant Warden, Administration - Student Village - - - - - H. C. Vinnicombe to be appointed
Dean of Men - - - - - - - - (Mrs.) D. Walter, B.A., M.A.
Dean of Women - - - - - - - (Mrs.) H. Marsden, B.A., M.A.
Assistant Dean of Women - - - - - - - C. A. W. Totzke, B.A.
Director of Athletics - - - - - - - C. Preston, B.A., B.D., M.A., Ph.D.
Director of Counselling Services - - - - - - - (Mrs.) E. Beausoleil
Director of Housing Service - - - - - - - (Mrs.) E. Beausoleil
Coordinator of Overseas Student Activities - - - - - - - P. H. Gerster, B.A.
Business Manager - Federation of Students - - - - - - - - - P. Berg
Director of Creative Art Activities - - - - - - - P. Berg
Director of Music - - - - - - - A. Kuntz
Director of Drama - - - - - - - to be appointed
Director of Art - - - - - - - (Mrs.) N. L. Patterson, B.A.
Director of Women's Athletics - - - - - (Miss) R. Hodgkinson, B.P.H.E.

University Extension

Director - - - - - - - - - A. A. Beveridge, B.A.
Assistant Director - - - - - - - R. K. Macfarlane, B.A.
Administrative Offices

Vice-President, Administration

Vice-President, Administration

A. K. Adlington, B.A.

Secretary to the Board of Governors

Secretary

I. W. Brown, B.A.

Bookstore Manager

(Mrs.) Elsie Fisher

Food Services Manager

R. Mudie

University Press Supervisor

B. Kurschenska

Visual Aids & Bookings Supervisor

(Miss) Louise Bonson, B.A.

Business Office

Comptroller

A. B. Gellatly, B.A., C.G.A.

Accountant

A. Headlam, C.A.

Director of Systems & Procedures

A. Jordan, B.A.

Purchasing Agent

W. G. Deeks

Co-ordination and Placement

Director

A. S. Barber, P. Eng.

Assistant Director (Co-operative Engineering, Physics, Chemistry)

G. L. White, B.A.Sc., P. Eng.

Assistant Director (Co-operative Mathematics)


Co-ordinator (Co-operative Psychology)

R. J. Walsh, B.A.

Graduate Placement and Summer Employment

C. F. Burk, M.A.Sc., P. Eng.

Personnel Services

Director

E. S. Lucy, B.A.

Employment Supervisor

Bruce V. Gillson, B.A., M.A.

University Health Services

University Physician

(Mrs.) Helen Recsor, M.D.

University Nurse

(Mrs.) Phyllis Livingston, R.N.

University Nurse

(Mrs.) Sadie Wood, R.N.

Physical Plant and Planning

Director of Physical Plant and Planning


Assistant Director (Physical Plant)

A. T. Cairncross, B.Sc., P. Eng.

Assistant Director (Planning)

A. E. Lappin, P. Eng.
XII

Faculty
## Faculty

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbott, W. R.</td>
<td>Philosophy</td>
</tr>
<tr>
<td>Aczel, J.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Aczel, S. (Mrs.)</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Adamczewski, Z.</td>
<td>Philosophy</td>
</tr>
<tr>
<td>Ages, A.</td>
<td>French</td>
</tr>
<tr>
<td>Alpay, S.</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Andracki, S.</td>
<td>Political Science</td>
</tr>
<tr>
<td>Anthes, R. G.</td>
<td>Electrical Engineering</td>
</tr>
<tr>
<td>Appleyard, E. C.</td>
<td>Earth Sciences</td>
</tr>
<tr>
<td>Ariaratnam, S. T.</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>Armour, L.</td>
<td>Philosophy</td>
</tr>
<tr>
<td>Ashton, N. J.</td>
<td>Physical Education</td>
</tr>
<tr>
<td>Atkinson, G. F.</td>
<td>Chemistry</td>
</tr>
<tr>
<td>Aziz, R. A.</td>
<td>Physics</td>
</tr>
<tr>
<td>Badir, D. R.</td>
<td>Sociology and Anthropology</td>
</tr>
<tr>
<td>Bakos, G. A.</td>
<td>Physics</td>
</tr>
<tr>
<td>Balasubramanian, A.</td>
<td>Chemistry</td>
</tr>
<tr>
<td>Banks, R. K.</td>
<td>Psychology</td>
</tr>
<tr>
<td>Barcsay, T.</td>
<td>History</td>
</tr>
<tr>
<td>Barnes, C. R.</td>
<td>Earth Sciences</td>
</tr>
<tr>
<td>Barnes, D. S.</td>
<td>Psychology</td>
</tr>
<tr>
<td>Batke, T. L.</td>
<td>Chemical Engineering</td>
</tr>
<tr>
<td>Beaumont, C. F. A.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Behara, M.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Bennett, G. W.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Berman, G.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Binamé, J. J.</td>
<td>French</td>
</tr>
<tr>
<td>Bishop, E. R.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Bodnar, L. E.</td>
<td>Chemical Engineering</td>
</tr>
<tr>
<td>Boswell, F. W.</td>
<td>Physics</td>
</tr>
<tr>
<td>Bowers, K. S.</td>
<td>Psychology</td>
</tr>
<tr>
<td>Boyd, E. M. (Miss)</td>
<td>English</td>
</tr>
<tr>
<td>Bragg, G. M.</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Brisbin, D. A. (Mrs.)</td>
<td>Chemistry</td>
</tr>
<tr>
<td>Brodie, D. E.</td>
<td>Physics</td>
</tr>
<tr>
<td>Brundrett, E. W.</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Bruneau, A. A.</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Bryden, M. P.</td>
<td>Psychology</td>
</tr>
<tr>
<td>Brzustowski, T. A.</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Burgener, R. J. C.</td>
<td>Philosophy</td>
</tr>
<tr>
<td>Burnett, E. F.</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>Butler, R. J.</td>
<td>Philosophy</td>
</tr>
<tr>
<td>Butz, E. G.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Byars, W. I.</td>
<td>Chemistry</td>
</tr>
<tr>
<td>Byerley, J. J.</td>
<td>Chemical Engineering</td>
</tr>
<tr>
<td>Cadell, T. E.</td>
<td>Psychology</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capindale, J. B.</td>
<td>Chemistry</td>
</tr>
<tr>
<td>Carter, J. C. H.</td>
<td>Biology</td>
</tr>
<tr>
<td>Chaparos, N. J.</td>
<td>Design</td>
</tr>
<tr>
<td>Chen, S. H.</td>
<td>Physics</td>
</tr>
<tr>
<td>Choate, N. L., C.R.</td>
<td>Sociology and Anthropology</td>
</tr>
<tr>
<td>Church, J. W.</td>
<td>Design</td>
</tr>
<tr>
<td>Coates, D. E.</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Cohn, M. Z.</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>Corbett, J. M.</td>
<td>Physics</td>
</tr>
<tr>
<td>Constant, M. L.</td>
<td>Design</td>
</tr>
<tr>
<td>Cornell, J. M.</td>
<td>Psychology</td>
</tr>
<tr>
<td>Cornell, P. G.</td>
<td>History</td>
</tr>
<tr>
<td>Cowan, D. D.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Cowan, J. A.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Crapo, H. H.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Cross, G. E.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Csanady, G. T.</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Cumming, R. W.</td>
<td>Chemistry</td>
</tr>
<tr>
<td>Cummings, L. A.</td>
<td>English</td>
</tr>
<tr>
<td>Dagg, I. R.</td>
<td>Physics</td>
</tr>
<tr>
<td>Davies, D. A.</td>
<td>History</td>
</tr>
<tr>
<td>Davies, M. A. (Mrs.)</td>
<td>German and Russian</td>
</tr>
<tr>
<td>Davis, H. F.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Davison, C. (Mrs.)</td>
<td>English</td>
</tr>
<tr>
<td>Davison, S. G.</td>
<td>Physics</td>
</tr>
<tr>
<td>Davison, T. M. K.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Delahey, W. A.</td>
<td>Physical Education</td>
</tr>
<tr>
<td>Dembski, P. E.</td>
<td>History</td>
</tr>
<tr>
<td>DeRoo, C. H.</td>
<td>English</td>
</tr>
<tr>
<td>de Vos, A.</td>
<td>Geography</td>
</tr>
<tr>
<td>Diem, A.</td>
<td>Geography</td>
</tr>
<tr>
<td>Dodd, J. W.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Drynan, W. R.</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>Dubinski, R. R.</td>
<td>English</td>
</tr>
<tr>
<td>Dufault, G. J.</td>
<td>Electrical Engineering</td>
</tr>
<tr>
<td>Dumbroff, E. B.</td>
<td>Biology</td>
</tr>
<tr>
<td>Dust, A. I.</td>
<td>English</td>
</tr>
<tr>
<td>Duthie, H. C.</td>
<td>Biology</td>
</tr>
<tr>
<td>Dyck, J. W.</td>
<td>German and Russian</td>
</tr>
<tr>
<td>Eastman, P. C.</td>
<td>Physics</td>
</tr>
<tr>
<td>Edmonds, J.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Edmondson, L. G. E.</td>
<td>Political Science</td>
</tr>
<tr>
<td>Ellenton, H. K.</td>
<td>Physics</td>
</tr>
<tr>
<td>Ellis, J. B.</td>
<td>Electrical Engineering</td>
</tr>
<tr>
<td>Elsdon, W. L.</td>
<td>Chemistry</td>
</tr>
<tr>
<td>Enns, K.</td>
<td>Chemical Engineering</td>
</tr>
</tbody>
</table>
Erb, D. K. - - - - Geography
Evans, H. L. - - - - Mechanical Engineering
Eydt, H. R. N. - - - - Biology
Fahidy, T. Z. - - - - Chemical Engineering
Fallding, H. J. - - - - Sociology and Anthropology
Fenz, W. D. - - - - Psychology
Fernandez, C. M. - - - - Spanish and Italian
Fernando, C. H. - - - - Biology
Field, J. A. - - - - Electrical Engineering
Finn, J. R., C.R. - - - - French
Firth, J. - - - - English
Fisher, C. P. - - - - Civil Engineering
Fleming, G. K. - - - - Mechanical Engineering
Fletcher, I. P. - - - - Economics
Forbes, W. F. - - - - Chemistry
Ford, J. D. - - - - Chemical Engineering
Forster, J. C. - - - - Spanish and Italian
Fox, R. M. - - - - Philosophy
Fretz, J. W. - - - - Sociology and Anthropology
Friesen, R. J. - - - - Chemistry
Fryer, K. D. - - - - Mathematics
Gall, C. E. - - - - Chemical Engineering
Gaudet, P. - - - - French
Gauthier, D. H. - - - - French
George, R. A. - - - - Philosophy
Gilmore, J. B. - - - - Psychology
Goddard, G. V. - - - - Psychology
Gough, T. E. - - - - Chemistry
Graf, B. J., C.R. - - - - Classics
Graham, J. W. - - - - Mathematics
Green, H. J. - - - - Physical Education
Green, R. - - - - Civil Engineering
Greenhow, C. H. - - - - English
Grey, E. - - - - Spanish and Italian
Grindlay, J. - - - - Physics
Guest, R. M. - - - - Chemistry
Haag, S. (Mrs.) - - - - Classics
Hahn, C. K. G. - - - - Design
Hale, A. M. - - - - Mechanical Engineering
Handa, V. K. - - - - Civil Engineering and Design
Hanson, J. - - - - Electrical Engineering
Haworth, L. L. - - - - Philosophy
Haworth, H. E. (Mrs.) - - - - English
Hayes, D. - - - - Physical Education
Heasell, F. L. - - - - Electrical Engineering
<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heatly, A. H.</td>
<td>Chemical Engineering</td>
</tr>
<tr>
<td>Heier, F.</td>
<td>German and Russian</td>
</tr>
<tr>
<td>Hemming, D.</td>
<td>Physics</td>
</tr>
<tr>
<td>Henderson, D. J.</td>
<td>Physics</td>
</tr>
<tr>
<td>Hennecke, H.</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Hermance, C. E.</td>
<td>Sociology and Anthropology</td>
</tr>
<tr>
<td>High, N. H.</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>Hill, H. M.</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Hillier, M. J.</td>
<td>Electrical Engineering</td>
</tr>
<tr>
<td>Hinchley, E. M.</td>
<td>German and Russian</td>
</tr>
<tr>
<td>Hodginson, R. (Miss)</td>
<td>Physical Education</td>
</tr>
<tr>
<td>Hoefert, S. P.</td>
<td>German and Russian</td>
</tr>
<tr>
<td>Holubec, I.</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>Honsberger, R. A.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Horne, J. R.</td>
<td>Philosophy</td>
</tr>
<tr>
<td>Horne, W. C.</td>
<td>Psychology</td>
</tr>
<tr>
<td>Horton, J. T.</td>
<td>Geography</td>
</tr>
<tr>
<td>Howard, J. H. G.</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Huang, R. Y-M.</td>
<td>Chemical Engineering</td>
</tr>
<tr>
<td>Hodgins, R.</td>
<td>Chemical Engineering</td>
</tr>
<tr>
<td>Hutchinson, B. G.</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>Hynes, H. B. N.</td>
<td>Biology</td>
</tr>
<tr>
<td>Inniss, W. E.</td>
<td>Biology</td>
</tr>
<tr>
<td>Irish, D. E.</td>
<td>Chemistry</td>
</tr>
<tr>
<td>Irving, R. M.</td>
<td>Geography</td>
</tr>
<tr>
<td>Isenor, N. R.</td>
<td>Physics</td>
</tr>
<tr>
<td>Jennings, P. C.</td>
<td>Psychology</td>
</tr>
<tr>
<td>Jose, C. E.</td>
<td>French</td>
</tr>
<tr>
<td>Kalbfleisch, J. G.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Karrow, P. F.</td>
<td>Earth Sciences</td>
</tr>
<tr>
<td>Keeler, J. S.</td>
<td>Electrical Engineering</td>
</tr>
<tr>
<td>Keleher, P. G., C.R.</td>
<td>Classics</td>
</tr>
<tr>
<td>Kendrick, W. B.</td>
<td>Biology</td>
</tr>
<tr>
<td>Keresztes, P.</td>
<td>Classics</td>
</tr>
<tr>
<td>Kerr-Lawson, A.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Kernaghan, W. D. K.</td>
<td>Political Science</td>
</tr>
<tr>
<td>Kieffer, M. I., C.R.</td>
<td>Spanish and Italian</td>
</tr>
<tr>
<td>Kirk, H. D.</td>
<td>Sociology and Anthropology</td>
</tr>
<tr>
<td>Kirwan, D. A.</td>
<td>Religious Knowledge</td>
</tr>
<tr>
<td>Klaassen, W.</td>
<td>Religious Knowledge</td>
</tr>
<tr>
<td>Klinghoffer, A. J.</td>
<td>Political Science</td>
</tr>
<tr>
<td>Koch, F.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Kotorynski, W. P.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Kramen, M.</td>
<td>Design and Psychology</td>
</tr>
<tr>
<td>Krueger, R. R.</td>
<td>Geography</td>
</tr>
<tr>
<td>Name</td>
<td>Department</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Kurokawa, M. (Miss)</td>
<td></td>
</tr>
<tr>
<td>Lavigne, N. E., C.R.</td>
<td></td>
</tr>
<tr>
<td>Lawson, J. D.</td>
<td></td>
</tr>
<tr>
<td>Lefcourt, H. M.</td>
<td></td>
</tr>
<tr>
<td>LeLievre, B.</td>
<td></td>
</tr>
<tr>
<td>Lennox, W.</td>
<td></td>
</tr>
<tr>
<td>Leslie, J. D.</td>
<td></td>
</tr>
<tr>
<td>Levitsky, I.</td>
<td></td>
</tr>
<tr>
<td>Levitsky, R. (Mrs.)</td>
<td></td>
</tr>
<tr>
<td>Lim, C. C.</td>
<td></td>
</tr>
<tr>
<td>Lind, N. C.</td>
<td></td>
</tr>
<tr>
<td>Mackay, D.</td>
<td></td>
</tr>
<tr>
<td>MacGillivray, R. C.</td>
<td></td>
</tr>
<tr>
<td>MacKinnon, G. E.</td>
<td></td>
</tr>
<tr>
<td>MacKinnon, H. (Rev.)</td>
<td></td>
</tr>
<tr>
<td>MacKirdy, K. A.</td>
<td></td>
</tr>
<tr>
<td>MacPhie, R. H.</td>
<td></td>
</tr>
<tr>
<td>MacRae, C. F.</td>
<td></td>
</tr>
<tr>
<td>Madgett, A. C.</td>
<td></td>
</tr>
<tr>
<td>Marsden, H. (Mrs.)</td>
<td></td>
</tr>
<tr>
<td>Marsh, C.</td>
<td></td>
</tr>
<tr>
<td>Martens, H. (Miss)</td>
<td></td>
</tr>
<tr>
<td>Martin, W. R.</td>
<td></td>
</tr>
<tr>
<td>Maynes, A. D.</td>
<td></td>
</tr>
<tr>
<td>Matyas, E.</td>
<td></td>
</tr>
<tr>
<td>McBryde, W. A. E.</td>
<td></td>
</tr>
<tr>
<td>McClure, J. P.</td>
<td></td>
</tr>
<tr>
<td>McGee, W. F.</td>
<td></td>
</tr>
<tr>
<td>McIntosh, I. H.</td>
<td></td>
</tr>
<tr>
<td>McKegney, J. C.</td>
<td></td>
</tr>
<tr>
<td>McKiernan, M. A.</td>
<td></td>
</tr>
<tr>
<td>McLachlin, A. M.</td>
<td></td>
</tr>
<tr>
<td>McLaughlin, W. A.</td>
<td></td>
</tr>
<tr>
<td>McLeod, H. G.</td>
<td></td>
</tr>
<tr>
<td>Meikle, W. N.</td>
<td></td>
</tr>
<tr>
<td>Meincke, P. H.</td>
<td></td>
</tr>
<tr>
<td>Michael, M. C. (Miss)</td>
<td></td>
</tr>
<tr>
<td>Miller, D. J.</td>
<td></td>
</tr>
<tr>
<td>Miller, W. C.</td>
<td></td>
</tr>
<tr>
<td>Mills, J. R.</td>
<td></td>
</tr>
<tr>
<td>Minas, J. S.</td>
<td></td>
</tr>
<tr>
<td>Moffat, J. B.</td>
<td></td>
</tr>
<tr>
<td>Moirenc, S. (Miss)</td>
<td></td>
</tr>
<tr>
<td>Montgomery, F. K. (Miss)</td>
<td></td>
</tr>
<tr>
<td>Morrison, H. M.</td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Faculty</td>
</tr>
<tr>
<td>-------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Morrison, P. E.</td>
<td>Biology</td>
</tr>
<tr>
<td>Mullin, R. C.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Munk, J. J.</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>Muntean, A. J.</td>
<td>Sociology and Anthropology</td>
</tr>
<tr>
<td>Murdie, R. A.</td>
<td>Geography</td>
</tr>
<tr>
<td>Myers, R. L.</td>
<td>French</td>
</tr>
<tr>
<td>Naidoo, J. C.</td>
<td>Psychology</td>
</tr>
<tr>
<td>Narveson, J. F.</td>
<td>Philosophy</td>
</tr>
<tr>
<td>Needham, W. R.</td>
<td>Economics</td>
</tr>
<tr>
<td>Nelson, A. D.</td>
<td>Political Science</td>
</tr>
<tr>
<td>Nicoll, W. B.</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Noton, A. R. M.</td>
<td>Electrical Engineering</td>
</tr>
<tr>
<td>Ober, W. U.</td>
<td>English</td>
</tr>
<tr>
<td>Officer, E. R.</td>
<td>Geography</td>
</tr>
<tr>
<td>Ord, J. L.</td>
<td>Physics</td>
</tr>
<tr>
<td>Parkinson, D.</td>
<td>Biology</td>
</tr>
<tr>
<td>Pasternak, J. J.</td>
<td>Biology</td>
</tr>
<tr>
<td>Patterson, E. P.</td>
<td>History</td>
</tr>
<tr>
<td>Pearce, G. F.</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Pearson, N.</td>
<td>Geography</td>
</tr>
<tr>
<td>Pei, D. C. T.</td>
<td>Chemical Engineering</td>
</tr>
<tr>
<td>Penney, R. K.</td>
<td>Psychology</td>
</tr>
<tr>
<td>Piekarski, K. R.</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Pindera, J. T.</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>Plumtree, A.</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Ponzo, P. J.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Poorooshasb, H. R.</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>Porter, R. L.</td>
<td>Classics</td>
</tr>
<tr>
<td>Power, G.</td>
<td>Biology</td>
</tr>
<tr>
<td>Preston, C. F.</td>
<td>Psychology</td>
</tr>
<tr>
<td>Puglics, D. J.</td>
<td>Physical Education</td>
</tr>
<tr>
<td>Qualter, T. H.</td>
<td>Political Science</td>
</tr>
<tr>
<td>Ralston, Z. T., C.R.</td>
<td>French</td>
</tr>
<tr>
<td>Rao, V. K.</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Ratz, H. C.</td>
<td>Electrical Engineering</td>
</tr>
<tr>
<td>Rees, A. W.</td>
<td>History</td>
</tr>
<tr>
<td>Reesor, G. E.</td>
<td>Physics</td>
</tr>
<tr>
<td>Reilly, P. M.</td>
<td>Chemical Engineering</td>
</tr>
<tr>
<td>Rhodes, E.</td>
<td>Chemical Engineering</td>
</tr>
<tr>
<td>Rich, G., C.R.</td>
<td>Classics</td>
</tr>
<tr>
<td>Richter, M.</td>
<td>German and Russian</td>
</tr>
<tr>
<td>Roberts, D. D.</td>
<td>Philosophy</td>
</tr>
<tr>
<td>Robertson, G. N.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Name</td>
<td>Department</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Rochester, M. G.</td>
<td>Physics</td>
</tr>
<tr>
<td>Roe, P. H.</td>
<td>Electrical Engineering and Design</td>
</tr>
<tr>
<td>Roosa, W. B.</td>
<td>Sociology and Anthropology</td>
</tr>
<tr>
<td>Ross, R. R.</td>
<td>Psychology</td>
</tr>
<tr>
<td>Rowe, K. A.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Rowe, P. M.</td>
<td>Psychology</td>
</tr>
<tr>
<td>Ryall, P. L. J.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Salkauskas, K.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Salzen, E. A.</td>
<td>Psychology</td>
</tr>
<tr>
<td>Sandler, S. L.</td>
<td>History</td>
</tr>
<tr>
<td>Sardinha, C. D.</td>
<td>Spanish and Italian</td>
</tr>
<tr>
<td>Sauer, W. L.</td>
<td>Sociology and Anthropology</td>
</tr>
<tr>
<td>Schlossberg, H.</td>
<td>History</td>
</tr>
<tr>
<td>Schmidt, C.</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>Schnarr, W. H., C.R.</td>
<td>Classics</td>
</tr>
<tr>
<td>Scott, D. S.</td>
<td>Chemical Engineering</td>
</tr>
<tr>
<td>Scott, J. D.</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>Scott, W. G.</td>
<td>Sociology and Anthropology</td>
</tr>
<tr>
<td>Seligman, P.</td>
<td>Philosophy</td>
</tr>
<tr>
<td>Seward, A. W. R.</td>
<td>English</td>
</tr>
<tr>
<td>Shantz, P. W.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Sharma, H. D.</td>
<td>Chemistry</td>
</tr>
<tr>
<td>Shelest, W.</td>
<td>German and Russian</td>
</tr>
<tr>
<td>Sherbourne, A. N.</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>Shortreed, J.</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>Siess, L. J.</td>
<td>Religious Knowledge</td>
</tr>
<tr>
<td>Silverman, I. W.</td>
<td>Psychology</td>
</tr>
<tr>
<td>Silveston, P. L.</td>
<td>Chemical Engineering</td>
</tr>
<tr>
<td>Sister M. Leon</td>
<td>English</td>
</tr>
<tr>
<td>Sister M. Stella</td>
<td>Classics</td>
</tr>
<tr>
<td>Smith, H. J. T.</td>
<td>Physics</td>
</tr>
<tr>
<td>Soulis, G. N.</td>
<td>Design</td>
</tr>
<tr>
<td>Springer, C.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Sprott, D. A.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Staal, R. A.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Stanton, R. G.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Steffy, R. A.</td>
<td>Psychology</td>
</tr>
<tr>
<td>Stolle, H. J.</td>
<td>Geography</td>
</tr>
<tr>
<td>Stone, J. S.</td>
<td>English</td>
</tr>
<tr>
<td>Streeter, J.</td>
<td>English</td>
</tr>
<tr>
<td>Strong, A. B.</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Suits, B. H.</td>
<td>Philosophy</td>
</tr>
<tr>
<td>Sumner, D. B.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Sydor, L. P.</td>
<td>Economics</td>
</tr>
<tr>
<td>Tang, F. C. Y.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Thomas, W. K.</td>
<td>English</td>
</tr>
</tbody>
</table>
Faculty

Thomas, R. S. D. - - - Mathematics
Thomson, B. S. - - - Mathematics
Thysell, Mary (Mrs.) - - - English
Thysell, R. V. - - - Psychology
Toogood, G. E. - - - Chemistry
Topper, T. H. - - - Civil Engineering
Torrie, R. H. - - - Physics
Totzke, C. A. W. - - - Physical Education
Turner, G. A. - - - Chemical Engineering
Tutte, W. T. - - - Mathematics

Unny, T. E. - - - Civil Engineering
Uram, E. M. - - - English

Van Evra, J. W. - - - Philosophy
Van Heeswijk, R. G. - - - Electrical Engineering
Vaz, E. W. - - - Sociology and Anthropology
Vetter, W. J. - - - Electrical Engineering
Viswanatha, T. - - - Chemistry
Vogel-Sprott, M. D. - - - Psychology
Vuorinen, P. A. - - - Electrical Engineering

Walter, D. (Mrs.) - - - French
Walters, R. H. - - - Psychology
Wang, S. F. - - - Physics
Warrior, V. M. (Miss) - - - Classics
Wei, L. Y. - - - Electrical Engineering
Wentzell, R. A. - - - Mathematics
Wertheim, D. G. - - - Mathematics
White, O. L. - - - Civil Engineering
Widmeyer, W. N. - - - Physical Education
Wilkinson, J. - - - Mathematics
Wilson, J. C. - - - Mathematics
Wilson, J. M. - - - Political Science
Winkelman, J. - - - German and Russian
Woolford, R. G. - - - Chemistry
Woolner, K. A. - - - Physics
Wright, D. T. - - - Civil Engineering
Wubnig, J. (Miss) - - - Philosophy
Wynne, R. E. - - - History

Zafiriu, L. - - - Electrical Engineering
Zoltvany, Y. F. - - - History
XIII

Academic Calendar
# Academic Calendar

The University of Waterloo reserves the right to change its academic calendar at any time.

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 4, 1966</td>
<td>Monday</td>
<td>Lectures Begin—Post Degree Programme</td>
</tr>
<tr>
<td>July 18</td>
<td>Monday</td>
<td>Supplemental Examinations Begin—Arts, Engineering and Science</td>
</tr>
<tr>
<td>August 11</td>
<td>Thursday</td>
<td>Examinations—Post Degree Programme</td>
</tr>
<tr>
<td>August 12</td>
<td>Friday</td>
<td>Examinations End—Co-operative Programmes</td>
</tr>
<tr>
<td>August 26</td>
<td>Friday</td>
<td>Spring Work Term Ends—Co-operative Programmes</td>
</tr>
<tr>
<td>August 29</td>
<td>Monday</td>
<td>Fall Work Term Begins Co-operative Programmes</td>
</tr>
<tr>
<td>September 5</td>
<td>Monday</td>
<td>Labour Day—University Buildings Closed</td>
</tr>
<tr>
<td>September 14</td>
<td>Wednesday</td>
<td>Registration—Co-operative Programmes - Year I</td>
</tr>
<tr>
<td>September 14</td>
<td>Wednesday</td>
<td>Registration—Science - All Years</td>
</tr>
<tr>
<td>September 15</td>
<td>Thursday</td>
<td>Registration—Arts - Years I and II</td>
</tr>
<tr>
<td>September 16</td>
<td>Friday</td>
<td>Registration—Co-operative Programmes - Advanced Years</td>
</tr>
<tr>
<td>September 16</td>
<td>Friday</td>
<td>Registration—Arts - Years III and IV</td>
</tr>
<tr>
<td>September 17</td>
<td>Saturday</td>
<td>Registration (Morning Only)—Part-Time Undergraduates</td>
</tr>
<tr>
<td>September 19</td>
<td>Monday</td>
<td>Lectures Begin</td>
</tr>
<tr>
<td>September 26</td>
<td>Monday</td>
<td>Registration—Graduate Studies</td>
</tr>
<tr>
<td>October 10</td>
<td>Monday</td>
<td>Thanksgiving Day—University Buildings Closed</td>
</tr>
<tr>
<td>October 13</td>
<td>Thursday</td>
<td>Meeting—Senate Executive Committee</td>
</tr>
<tr>
<td>October 20</td>
<td>Thursday</td>
<td>Meeting—Board of Governors</td>
</tr>
<tr>
<td>October 27</td>
<td>Thursday</td>
<td>Meeting—University Senate</td>
</tr>
<tr>
<td>October 28</td>
<td>Friday</td>
<td>Fall Convocation</td>
</tr>
<tr>
<td>November 7</td>
<td>Monday</td>
<td>Supplemental Examinations Begin—Co-operative Programmes</td>
</tr>
<tr>
<td>November 10</td>
<td>Thursday</td>
<td>Meeting—Board of Governors</td>
</tr>
<tr>
<td>December 1</td>
<td>Thursday</td>
<td>Meeting—Senate Executive Committee</td>
</tr>
<tr>
<td>December 15</td>
<td>Thursday</td>
<td>Meeting—University Senate</td>
</tr>
<tr>
<td>December 16</td>
<td>Friday</td>
<td>Lectures End</td>
</tr>
<tr>
<td>December 17</td>
<td>Saturday</td>
<td>Examinations Begin—Co-operative Programmes</td>
</tr>
<tr>
<td>December 23</td>
<td>Friday</td>
<td>Examinations End—Co-operative Programmes</td>
</tr>
<tr>
<td>December 23</td>
<td>Friday</td>
<td>Fall Work Term Ends—Co-operative Programmes</td>
</tr>
<tr>
<td>Date</td>
<td>Day</td>
<td>Event</td>
</tr>
<tr>
<td>--------------------</td>
<td>--------------</td>
<td>------------------------------------------------------------</td>
</tr>
<tr>
<td>December 25</td>
<td>Sunday</td>
<td>Christmas Day—University Buildings Closed</td>
</tr>
<tr>
<td>December 27</td>
<td>Tuesday</td>
<td>Winter Work Term Begins—Co-operative Programmes</td>
</tr>
<tr>
<td>December 28</td>
<td>Wednesday</td>
<td>Supplemental Examinations—Post Degree Programme</td>
</tr>
<tr>
<td>January 1, 1967</td>
<td>Sunday</td>
<td>New Year's Day—University Buildings Closed</td>
</tr>
<tr>
<td>January 3</td>
<td>Tuesday</td>
<td>Registration—Undergraduate Co-operative Programmes</td>
</tr>
<tr>
<td>January 4</td>
<td>Wednesday</td>
<td>Lectures Begin</td>
</tr>
<tr>
<td>January 6</td>
<td>Friday</td>
<td>Registration—Winter Term—Graduate Students in Engineering</td>
</tr>
<tr>
<td>January 19</td>
<td>Thursday</td>
<td>Meeting—Board of Governors</td>
</tr>
<tr>
<td>February 9</td>
<td>Thursday</td>
<td>Meeting—Senate Executive Committee</td>
</tr>
<tr>
<td>February 23</td>
<td>Thursday</td>
<td>Meeting—University Senate</td>
</tr>
<tr>
<td>March 13</td>
<td>Monday</td>
<td>Supplemental Examinations Begin—Co-operative Programmes</td>
</tr>
<tr>
<td>March 24</td>
<td>Friday</td>
<td>Good Friday—University Buildings Closed</td>
</tr>
<tr>
<td>April 7</td>
<td>Friday</td>
<td>Lectures End</td>
</tr>
<tr>
<td>April 8</td>
<td>Saturday</td>
<td>Examinations Begin</td>
</tr>
<tr>
<td>April 13</td>
<td>Thursday</td>
<td>Meeting—Senate Executive Committee</td>
</tr>
<tr>
<td>April 20</td>
<td>Thursday</td>
<td>Meeting—Board of Governors</td>
</tr>
<tr>
<td>April 27</td>
<td>Thursday</td>
<td>Meeting—University Senate</td>
</tr>
<tr>
<td>April 28</td>
<td>Friday</td>
<td>Winter Work Term Ends—Co-operative Programmes</td>
</tr>
<tr>
<td>April 29</td>
<td>Saturday</td>
<td>Examinations End</td>
</tr>
<tr>
<td>May 1</td>
<td>Monday</td>
<td>Registration—Undergraduate Co-operative Programmes</td>
</tr>
<tr>
<td>May 1</td>
<td>Monday</td>
<td>Spring Work Term Begins—Co-operative Programmes</td>
</tr>
<tr>
<td>May 2</td>
<td>Tuesday</td>
<td>Lectures Begin—Co-operative Programmes</td>
</tr>
<tr>
<td>May 26</td>
<td>Friday</td>
<td>Convocation—Arts and Science</td>
</tr>
<tr>
<td>May 27</td>
<td>Saturday</td>
<td>Convocation—Engineering</td>
</tr>
<tr>
<td>June 15</td>
<td>Thursday</td>
<td>Meeting—Board of Governors</td>
</tr>
</tbody>
</table>
### CALENDAR FOR 1966

<table>
<thead>
<tr>
<th>JANUARY</th>
<th>FEBRUARY</th>
<th>MARCH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S</strong></td>
<td><strong>T</strong></td>
<td><strong>W</strong></td>
</tr>
<tr>
<td>1 2 3 4 5 6 7</td>
<td>1 2 3 4 5 6 7</td>
<td>1 2 3 4 5 6</td>
</tr>
<tr>
<td>8 9 10 11 12 13 14</td>
<td>8 9 10 11 12 13 14</td>
<td>8 9 10 11 12</td>
</tr>
<tr>
<td>15 16 17 18 19 20 21</td>
<td>15 16 17 18 19 20 21</td>
<td>15 16 17 18</td>
</tr>
<tr>
<td>22 23 24 25 26 27 28</td>
<td>22 23 24 25 26 27 28</td>
<td>22 23 24</td>
</tr>
<tr>
<td><strong>30 31</strong></td>
<td><strong>30 31</strong></td>
<td><strong>30 31</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>APRIL</th>
<th>JUNE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S</strong></td>
<td><strong>T</strong></td>
</tr>
<tr>
<td>1 2 3 4 5 6 7</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>8 9 10 11 12 13 14</td>
<td>8 9 10 11 12 13 14</td>
</tr>
<tr>
<td>15 16 17 18 19 20 21</td>
<td>15 16 17 18 19 20 21</td>
</tr>
<tr>
<td>22 23 24 25 26 27 28</td>
<td>22 23 24 25 26 27 28</td>
</tr>
<tr>
<td><strong>30 31</strong></td>
<td><strong>30 31</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>JULY</th>
<th>AUGUST</th>
<th>SEPTEMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S</strong></td>
<td><strong>T</strong></td>
<td><strong>W</strong></td>
</tr>
<tr>
<td>1 2 3 4 5 6 7</td>
<td>1 2 3 4 5 6 7</td>
<td>1 2 3 4 5 6</td>
</tr>
<tr>
<td>8 9 10 11 12 13 14</td>
<td>8 9 10 11 12 13 14</td>
<td>8 9 10</td>
</tr>
<tr>
<td>15 16 17 18 19 20 21</td>
<td>15 16 17 18 19 20 21</td>
<td>15 16 17</td>
</tr>
<tr>
<td>22 23 24 25 26 27 28</td>
<td>22 23 24 25 26 27 28</td>
<td>22 23</td>
</tr>
<tr>
<td><strong>30 31</strong></td>
<td><strong>30 31</strong></td>
<td><strong>30 31</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OCTOBER</th>
<th>NOVEMBER</th>
<th>DECEMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S</strong></td>
<td><strong>T</strong></td>
<td><strong>W</strong></td>
</tr>
<tr>
<td>1 2 3 4 5 6 7</td>
<td>1 2 3 4 5 6 7</td>
<td>1 2 3 4 5 6</td>
</tr>
<tr>
<td>8 9 10 11 12 13 14</td>
<td>8 9 10 11 12 13 14</td>
<td>8 9 10</td>
</tr>
<tr>
<td>15 16 17 18 19 20 21</td>
<td>15 16 17 18 19 20 21</td>
<td>15 16 17</td>
</tr>
<tr>
<td>22 23 24 25 26 27 28</td>
<td>22 23 24 25 26 27 28</td>
<td>22 23</td>
</tr>
<tr>
<td><strong>30 31</strong></td>
<td><strong>30 31</strong></td>
<td><strong>30 31</strong></td>
</tr>
</tbody>
</table>

### CALENDAR FOR 1967

<table>
<thead>
<tr>
<th>JANUARY</th>
<th>FEBRUARY</th>
<th>MARCH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S</strong></td>
<td><strong>T</strong></td>
<td><strong>W</strong></td>
</tr>
<tr>
<td>1 2 3 4 5 6 7</td>
<td>1 2 3 4 5 6 7</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>8 9 10 11 12 13 14</td>
<td>8 9 10 11 12 13 14</td>
<td>8 9 10 11</td>
</tr>
<tr>
<td>15 16 17 18 19 20 21</td>
<td>15 16 17 18 19 20 21</td>
<td>15 16 17</td>
</tr>
<tr>
<td>22 23 24 25 26 27 28</td>
<td>22 23 24 25 26 27 28</td>
<td>22 23</td>
</tr>
<tr>
<td><strong>30 31</strong></td>
<td><strong>30 31</strong></td>
<td><strong>30 31</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>APRIL</th>
<th>JUNE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S</strong></td>
<td><strong>T</strong></td>
</tr>
<tr>
<td>1 2 3 4 5 6 7</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>8 9 10 11 12 13 14</td>
<td>8 9 10 11 12 13 14</td>
</tr>
<tr>
<td>15 16 17 18 19 20 21</td>
<td>15 16 17 18 19 20 21</td>
</tr>
<tr>
<td>22 23 24 25 26 27 28</td>
<td>22 23 24 25 26 27 28</td>
</tr>
<tr>
<td><strong>30 31</strong></td>
<td><strong>30 31</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>JULY</th>
<th>AUGUST</th>
<th>SEPTEMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S</strong></td>
<td><strong>T</strong></td>
<td><strong>W</strong></td>
</tr>
<tr>
<td>1 2 3 4 5 6 7</td>
<td>1 2 3 4 5 6 7</td>
<td>1 2 3 4 5 6</td>
</tr>
<tr>
<td>8 9 10 11 12 13 14</td>
<td>8 9 10 11 12 13 14</td>
<td>8 9 10</td>
</tr>
<tr>
<td>15 16 17 18 19 20 21</td>
<td>15 16 17 18 19 20 21</td>
<td>15 16 17</td>
</tr>
<tr>
<td>22 23 24 25 26 27 28</td>
<td>22 23 24 25 26 27 28</td>
<td>22 23</td>
</tr>
<tr>
<td><strong>30 31</strong></td>
<td><strong>30 31</strong></td>
<td><strong>30 31</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OCTOBER</th>
<th>NOVEMBER</th>
<th>DECEMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S</strong></td>
<td><strong>T</strong></td>
<td><strong>W</strong></td>
</tr>
<tr>
<td>1 2 3 4 5 6 7</td>
<td>1 2 3 4 5 6 7</td>
<td>1 2 3 4 5 6</td>
</tr>
<tr>
<td>8 9 10 11 12 13 14</td>
<td>8 9 10 11 12 13 14</td>
<td>8 9 10</td>
</tr>
<tr>
<td>15 16 17 18 19 20 21</td>
<td>15 16 17 18 19 20 21</td>
<td>15 16 17</td>
</tr>
<tr>
<td>22 23 24 25 26 27 28</td>
<td>22 23 24 25 26 27 28</td>
<td>22 23</td>
</tr>
<tr>
<td><strong>30 31</strong></td>
<td><strong>30 31</strong></td>
<td><strong>30 31</strong></td>
</tr>
</tbody>
</table>