University of Waterloo

Calendar 1968-69
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</table>
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 Architecture, Arts, Engineering, Environmental Studies, Mathematics, Optometry, Physical and Health Education, 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 two Engineering buildings and an Engineering lecture hall, the Physics building, the Mathematics and Computer Science building, the Chemistry-Biology buildings, two Arts buildings, an Arts lecture hall and the Theatre of the Arts. A Physical and Health Education building is scheduled for completion in the spring of 1968.

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

The general administrative offices are temporarily located in the Dana Porter Arts Library. The University Cafeteria is located in the new Food Services building. The Federation of Students and offices of the various student organizations are located in the new Campus Centre building.
The University Health Service Building to be completed during the summer of 1968 will house the Health Service staff which serves the university community. A fully qualified medical staff including a medical doctor and registered nurses is available for regular service from Monday to Friday from 8 a.m. to 8 p.m. Emergency Service is available at all times on a 24 hour basis.

Short term in-patient care is provided by the infirmary which is supervised by the medical staff. Further information on the Health Service may be obtained at the building which is located in the heart of the south campus between St. Jerome's College and the Campus Centre.

Residence accommodation for both men and women is provided on campus by the four Church Colleges and the non-denominational 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.

The Calendar
This calendar is intended to portray the historical and philosophical tenets of the University of Waterloo and to serve as an explanatory guide to the programmes and courses offered at the University. Candidates for admission to the University as well as students currently enrolled are urged to study carefully the policies outlined in the calendar in order to ensure a successful and orderly approach to their University education. If there is any doubt as to the interpretation of the contents of the calendar, enquiries can be made to the Registrar or to the person directly concerned with the area in question.

The calendar is arranged in chapters which fall into three general divisions. The first division (Chapters II to VII) explains the policies and programmes of each indi-
vidual faculty or school. The second division (Chapter VIII) lists alphabetically by department all courses which have been approved by the University. Since all the courses listed may not be offered in the current sessions, students are advised to consult the University timetable prior to arranging their programmes. The third division (Chapters IX to XVI) contains information concerning fees, facilities, and the general administrative structure of the University. A more detailed table of contents is to be found at the beginning of this chapter.

The information in the calendar applies to the 1968-69 academic session which commences in September, 1968. The Senate and the Board of Governors of the University of Waterloo reserve the right to make changes in the calendar without prior notice.
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 programmes:

Pass Programme (3 years)
The General Programme in Arts

Honours Programmes (4 years)
Economics
Economics and Mathematics
Economics and Political Science
English
English and French
English and German
English and History
English and Latin
English and Philosophy
English and Russian
English and Spanish
French
French and German
French and Latin
French and Political Science
French and Russian
French and Spanish
Honours Programmes (4 years) Con't.
Geography
Geography and Geology
German (with appropriate minor)
German and Russian
History
History and Philosophy
History and Political Science
Latin
Philosophy
Philosophy and Literature
Philosophy and Mathematics
Philosophy and Political Science
Philosophy and Psychology
Political Science
Psychology
Psychology and Sociology
Psychology and Statistics
Russian (with appropriate minor)
Sociology
Spanish
Urban and Regional Planning

Graduation from any of the following programmes 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 Economics and Political Science
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 History and Political Science

Admission And Registration

General
Application for admission to the Faculty of Arts should be made as early in the year as possible. Students currently enrolled full time in Ontario Grade 13 must apply on the "General application for Admission to University" form which can be obtained
from the Secondary School. All other applicants may obtain application forms directly from the Office of the Registrar. Academic certificates (not diplomas) and other supporting documents should be forwarded as soon as they become available.

Applicants should note that both Renison and St. Jerome's Colleges offer programmes leading toward the BA degree in conjunction with the University and that applicants may register for their programmes through either Renison or St. Jerome's Colleges.

Admission cannot be granted until all the requirements have been met and all documents have been submitted. Applicants currently enrolled in Ontario Grade 13 and who wish to be considered for Early Final Admission must apply before March 15, 1968. All other applicants must apply and have submitted all the necessary documents by August 1, 1968. Persons applying after this date cannot be guaranteed consideration of their application.

Admission to Year I

In order to qualify for admission to the first year of the Arts programme, the applicant should have completed Ontario Grade 13 or its equivalent, showing a minimum overall average of 60% in the seven required credits. For applicants who have taken more than one year to complete the work of Grade 13, a somewhat higher average may be required.

Standing is required in seven Grade 13 credits as follows:
- A minimum of four credits chosen from:
  - English
  - one language other than English
  - Mathematics
- three additional credits chosen wherever possible in accordance with the student's proposed major field of study.

Additional credits can be selected from any of the optional subjects offered at the Grade 13 level with the qualification that no more than one of the following may be counted as an "additional" credit: Accountancy Practice, Art, Home Economics, Mathematics of Investment, Music, or Secretarial Practice. The marks received in one of these subjects 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 credit" on the same terms as these subjects except the marks received will not be computed in the average.

Note 1 Ontario Tests for Admission to College and University (OACU)
All Grade 13 applicants will be required to submit the results of the Ontario Scholastic Aptitude Test and of such Ontario Achievement Tests as are offered in Grade 13 credits presented for admission.

Note 2 If English is not chosen as a Grade 13 subject offered for admission, applicants must have standing in English at the Grade 12 level.

Note 3 The University will use the following definition of credits for admission purposes:
- 3 credits - Mathematics A and Mathematics B combined
- 2 credits - All language subjects, Mathematics A
- 1 credit - All other subjects.
Admission

Early Final Admission
Students enrolled full time in Ontario Grade 13 will be considered for Early Final Admission. To be eligible for consideration, applicants must arrange to have the “General Application for Admission to University” form submitted by March 15, 1968. Consideration of candidates for Early Final Admission will be based on the Secondary School record, the Principal’s Recommendation, and the results of the Ontario Scholastic Aptitude Test and specified Achievement Tests. Successful applicants may expect to be notified after May 15, 1968, of their acceptance and will be asked to indicate their decision by June 15, 1968. Those applicants who are not offered Early Final Admission will be considered on the basis of the Grade 13 final results and will be notified as soon as possible after the release of the Grade 13 results.

Note All applicants will be required to complete Grade 13 to the satisfaction of the Secondary School principal.

The following certificates, recognized as being equivalent to the Ontario Grade 13 certificate, may be accepted insofar as they meet the admission requirements of the University of Waterloo in subjects and percentages:

- Alberta: Senior Matriculation (Grade 12)
- British Columbia: Senior Matriculation (Grade 13)
- Manitoba: Senior Matriculation (Grade 12)
- New Brunswick: Senior Matriculation (Grade 13)
- Newfoundland: Year 1 Memorial University
- Nova Scotia: Senior Matriculation (Grade 12)
- 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 12)
- 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 Certificate of Education
- United States of America: High School Graduation plus an additional year of formal study in subjects comparable to Ontario Grade 13.

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 may apply to enter as an adult student. It is recommended that applicants attempt to obtain standing in at least one Ontario Grade 13 level subject or its equivalent. This subject should relate to the programme to which applicants wish to study at University. 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
September 11, 12 and 13, Faculty of Arts

Fees
Refer to Section X page 380

Examinations and Standings
The following regulations govern the practice of the Faculty of Arts in regard to final examinations, standing and make-up examinations. These regulations also apply to part-time students and special programmes.

Students should note that the Faculty of Arts now operates under a “course system” in which student progress is measured in terms of courses successfully completed rather than in years. A student who has passed fewer than five courses will be considered a Year I student; those who have passed at least five courses but fewer than ten will be considered Year II students; those with at least ten but fewer than sixteen, Year III; and those with sixteen or more, Year IV.

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 Standings 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 all courses 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 make-up 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 Year I 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 courses:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
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<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)</td>
</tr>
<tr>
<td>DNW</td>
<td>Did Not Write</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) Over-all standing is determined by the cumulative average of marks assigned for all courses taken at the University (at any time, whether passed or failed) and is indicated by the following terms:

<table>
<thead>
<tr>
<th>Cumulative Average</th>
<th>Honours Programme</th>
<th>General Programme</th>
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<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>55-59</td>
<td></td>
<td>D</td>
</tr>
<tr>
<td>50-54</td>
<td></td>
<td>D (Conditional)</td>
</tr>
<tr>
<td>49 or less</td>
<td></td>
<td>F (Failure; may be required to withdraw)</td>
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</tbody>
</table>

Note: In cases where a failed course is repeated, both marks will be used in calculating the student's cumulative over-all average or standing.

(c) A regular (full-time) student in the General Arts programme must in each academic year enrol in at least five courses, but in not more than six. A regular student in the Honours Arts programme must each year enrol in at least six courses (unless otherwise specified in a departmental Honours programme), but in not more than seven.
(d) To be considered in good standing in the General Arts programme, a student must maintain a cumulative over-all average of at least 55% and an average of at least 60% in his field of specialization. If at any time a student's over-all average falls between 50% and 54% or his average in his field of specialization below 60%, he will be granted conditional status for one year, during which period he must make reasonable progress toward obtaining good standing or he will be asked to withdraw. A student whose cumulative over-all average falls below 50% may continue only with the permission of the Examinations and Standings Committee.

(e) To be considered in good standing in the Honours Arts programme, a student must maintain a cumulative over-all average of at least 60% and an average of at least 66% in his field of specialization (unless otherwise specified in a departmental Honours programme). If an Honours degree candidate's average falls below the prescribed minimum, he will be considered a candidate for the General degree and the regulations in (d) above will apply. If, subsequently, he raises his average to the required level, he may through his Department Chairman petition the Examinations and Standings Committee to review his case.

(f) Even while otherwise in good standing, a student who fails more than two full courses at the annual examinations may be required to withdraw if the Faculty Council considers that he will not profit by further study.

(g) A student who has been required to withdraw for academic reasons may be eligible to apply for re-admission after one year's absence.

4. Make-up Examinations
A student will be eligible for make-up examinations only when failure to pass is attributable to extraordinary circumstances. In addition, he
(a) 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;
(b) must have secured the permission of the professor concerned and of the Examinations and Standings Committee.
(c) make-up examinations are held in late July or early August. Application for these examinations must be filed by the end of June 1968, 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 make-up examinations must accompany the application and, if the student subsequently decides not to write the examination, this fee is not refunded. Make-up examinations must be written at the next regular make-up period.
(d) Failure to write an examination is considered a failure to pass. A student who fails to write a make-up 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 some of the other Faculties. 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 normally chooses 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.

This Calendar describes recommended Year I programmes for the various Honours Programmes, beginning on page 19. 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.

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 Programmes and General Programmes) Normally the student selects 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.

(ii) In Year 1 a student must normally complete the introductory course in the department in which he will major in his later years.

(iii) 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.

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

4. 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 date will be in cases where a student wishes to reduce his programme from the maximum to the minimum allowable or to reduce it from honours to general.

On registration day a professor from each department is available to the student for consultation and assistance in selecting the Year 1 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.
Academic Programmes

The General Programme

Year I *(For Year I programme refer to pages 17 to 18)*
At the end of Year I, each student in the General Programme must choose one of the following subjects as his major field of study.

<table>
<thead>
<tr>
<th>Subject</th>
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<tbody>
<tr>
<td>Anthropology</td>
<td>Greek</td>
<td>Psychology</td>
</tr>
<tr>
<td>Economics</td>
<td>History</td>
<td>Religious Studies</td>
</tr>
<tr>
<td>English</td>
<td>Latin</td>
<td>Russian</td>
</tr>
<tr>
<td>French</td>
<td>Mathematics</td>
<td>Sociology</td>
</tr>
<tr>
<td>Geography</td>
<td>Philosophy</td>
<td>Spanish</td>
</tr>
<tr>
<td>German</td>
<td>Political Science</td>
<td></td>
</tr>
</tbody>
</table>

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.

Before graduation each student must have completed a minimum of sixteen courses with a passing mark in each. Of these, a minimum of four, not all in one subject, must be chosen from Group A; of these four courses a student must take:
   —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
   —a minimum of two courses from Group B.

3. When a language course numbered below 100 is included in a student's programme it must be followed by either a course in that language at the 100 level or by a foreign culture civilization course to satisfy the language requirement, i.e. one course from Group A(ii). Under no circumstances may more than one language course numbered below 100 be used as credit towards a degree.

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.

Honours Programmes

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 have completed a minimum of twenty-four courses (unless otherwise specified in a departmental Honours programme) with a passing mark in each. Of these, a minimum of four, not all in one subject, must be chosen from Group A; of these four courses a student must take:
— 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.
— a minimum of two courses from Group B.
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.

Honours Economics

Prerequisite: It is desirable, but not mandatory, that students planning to enter Honour Economics should offer three Ontario Grade 13 credits in Mathematics or their equivalent.

Year I
Recommended Programme:

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economics 101*/102*</td>
<td>3</td>
</tr>
<tr>
<td>Political Science 110, or 112, or 114</td>
<td>3</td>
</tr>
<tr>
<td>English 101</td>
<td>3</td>
</tr>
<tr>
<td>History 100, or Philosophy 101 or equivalent</td>
<td>3</td>
</tr>
<tr>
<td>A language other than English</td>
<td>3</td>
</tr>
<tr>
<td>One Elective†</td>
<td>3</td>
</tr>
</tbody>
</table>

Year II

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economics 201*/202*‡‡</td>
<td>3</td>
</tr>
<tr>
<td>Economics 230††</td>
<td>3</td>
</tr>
<tr>
<td>Economics 256*/257*</td>
<td>3</td>
</tr>
<tr>
<td>One of Economics 240, 261*/262*, and 320</td>
<td>3</td>
</tr>
<tr>
<td>Two electives of which one must satisfy the Group A requirement.†††</td>
<td>3</td>
</tr>
</tbody>
</table>

Year III

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economics 300</td>
<td>3</td>
</tr>
<tr>
<td>Economics 330 and 370</td>
<td>6</td>
</tr>
<tr>
<td>Two Electives</td>
<td>6</td>
</tr>
</tbody>
</table>

Year IV

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economics 400</td>
<td>3</td>
</tr>
<tr>
<td>Economics 340 and 380</td>
<td>6</td>
</tr>
<tr>
<td>Two other approved courses</td>
<td></td>
</tr>
</tbody>
</table>

† It is strongly recommended that students elect Mathematics 130 (Calculus)
‡‡ Appropriate substitutions for these courses are possible with the approval of the department.
††† 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 Economics and Political Science

**Year I**

*Recommended Programme:*

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economics 101*/102*</td>
<td>3</td>
</tr>
<tr>
<td>One of Political Science 110 or 112 or 114</td>
<td>3</td>
</tr>
<tr>
<td>History 100</td>
<td>3</td>
</tr>
<tr>
<td>Philosophy 125*/140*</td>
<td>3</td>
</tr>
<tr>
<td>Two electives, one of which should satisfy the foreign language requirement</td>
<td>6</td>
</tr>
</tbody>
</table>

**Year II**

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economics 201*/202*</td>
<td>3</td>
</tr>
<tr>
<td>Economics 230</td>
<td>3</td>
</tr>
<tr>
<td>Economics 240</td>
<td>3</td>
</tr>
<tr>
<td>Political Science 280</td>
<td>3</td>
</tr>
<tr>
<td>The equivalent of one other full course in Political Science selected in consultation with the Department.</td>
<td>3</td>
</tr>
<tr>
<td>One elective</td>
<td>3</td>
</tr>
</tbody>
</table>

**Year III**

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economics 300</td>
<td>3</td>
</tr>
<tr>
<td>One of Economics 320, 330, 340, 380</td>
<td>3</td>
</tr>
<tr>
<td>Political Science 250</td>
<td>3</td>
</tr>
<tr>
<td>Political Science 370</td>
<td>3</td>
</tr>
<tr>
<td>The equivalent of one other full course in Political Science selected in consultation with the Department.</td>
<td>3</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>At least one further course in Economics selected in consultation with the Department.</td>
<td>3</td>
</tr>
<tr>
<td>The equivalent of at least one further full course in Political Science (at the 400 or 500 level) selected in consultation with the Department.</td>
<td>3</td>
</tr>
<tr>
<td>3 other courses selected in consultation with the Departments</td>
<td>9</td>
</tr>
</tbody>
</table>

Honours Economics and Mathematics†

**Year I**

*Recommended Programme:*

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economics 101*/102*</td>
<td>3</td>
</tr>
<tr>
<td>English 101</td>
<td>3</td>
</tr>
<tr>
<td>One foreign language or culture civilization course</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics 130, 131 and 132</td>
<td>9</td>
</tr>
</tbody>
</table>

21
Year II
Economics 201*/202* or 203*/204*
3
Economics 230 or 205*/206*
3
Mathematics 230, 233 and 237
9
Two electives
6

Year III
Economics 330 and 340
6
One other course in Economics
3
selected in consultation with
the Department
Mathematics 238 and 352
6
Two electives
6

Year IV
Economics 400 and 460
6
One other course in Economics
3
selected in consultation
with the Department
Mathematics 338 and 452
6
Two electives
6

†See Mathematics Faculty page

Honours English

Year I
Recommended Programme
Hours
English 101
3
One of French 100, German 101*-102*, Latin 100
3
Philosophy 100 or equivalent
3
History 100 or 110
3
Two courses from Group B or one course
6
from Group B and a course in Religious
Knowledge

Year II
English 251, 261, 360
9
Three other courses (See Note 1)
9

Year III
English 270, 370
6
Two other approved English courses
6
Two other courses
6

Year IV
English 350, 380
6
Two other approved English courses (See Note 2)
6
Two other courses
6

Comprehensive Examination

Note 1
Classical Civilization 260 may be chosen as one of the supporting courses.

Note 2
Senior Honours Essay may be chosen as one of these courses.

22
## Honours English and French

### Year I

**Recommended Programme**

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>English 101</td>
<td>3</td>
</tr>
<tr>
<td>French 100</td>
<td>3</td>
</tr>
<tr>
<td>History 100 (or History 110), or Philosophy 100 or equivalent</td>
<td>3</td>
</tr>
<tr>
<td><em>One of</em> History 100, Philosophy 100 or equivalent, a course in German, Latin, or Spanish</td>
<td></td>
</tr>
<tr>
<td>Two courses from Group B or one course from Group B and a course in Religious Knowledge</td>
<td></td>
</tr>
</tbody>
</table>

### Year II

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>English 251, 360</td>
<td>6</td>
</tr>
<tr>
<td>French—Two full courses or equivalent (See Note 2)</td>
<td>6</td>
</tr>
<tr>
<td>Two other courses</td>
<td>6</td>
</tr>
</tbody>
</table>

### Year III

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>One of</em> English 270 or 370</td>
<td>3</td>
</tr>
<tr>
<td>One other approved English course</td>
<td>3</td>
</tr>
<tr>
<td>French—Two (or three) full courses or equivalent (See Note 2)</td>
<td>6-9</td>
</tr>
<tr>
<td>One or two other courses (See Note 3)</td>
<td>3-6</td>
</tr>
</tbody>
</table>

### Year IV

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>One of</em> English 350 or 380</td>
<td>3</td>
</tr>
<tr>
<td>English 261 or another approved English course</td>
<td>3</td>
</tr>
<tr>
<td>One other approved English course (Note 1)</td>
<td>3</td>
</tr>
<tr>
<td>French—Two (or three) full courses or equivalent (See Note 2 and Note 3)</td>
<td>6-9</td>
</tr>
<tr>
<td>One other course (if appropriate)</td>
<td>3</td>
</tr>
</tbody>
</table>

### Note 1

Senior Honours Essay may be chosen as this course.

### Note 2

Students planning to enter the teaching profession must comply with requirements as set down by the individual Colleges of Education in Ontario. In French they should complete a minimum of eight full courses or equivalent, including 250, 350, 455*-456*.

### Note 3

A student in each of his third and fourth years must take a minimum of six full courses.
### Honours English and German

**Year I**  
*Recommended Programme*  
English 101  
German—one full course or equivalent  
History 100, or Philosophy 100 or equivalent  
Three additional courses taken in accordance with general Arts Faculty regulations  

<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>9</td>
</tr>
</tbody>
</table>

**Year II**  
English 251, 360  
German—minimum of two full courses or equivalent  
Two other courses  

<table>
<thead>
<tr>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
</tr>
<tr>
<td>6</td>
</tr>
</tbody>
</table>

**Year III**  
*One of* English 270 or 370  
One other approved English course  
German—minimum of two full courses or equivalent  
Two other courses  

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

**Year IV**  
*One of* English 350 or 380  
English 261 or another approved English course  
One other approved English course (See Note 3) or one other German course  
German—minimum of two full courses or equivalent  
One other course  

<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>6</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

---

**Note 1**  
Before graduation, students must complete a minimum of seven full German courses.

**Note 2**  
Before graduation, students must complete the requirements for Honours courses as described on page 19 of the Calendar.

**Note 3**  
Senior Honours Essay may be chosen as the English course.

### Honours English and History

**Year I**  
*Recommended Programme*  
English 101  
History 100 or 110  
*One of* French 100, German 101*-102*, Latin 100  
Three additional courses taken in accordance with general Arts Faculty regulations  

<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</td>
</tr>
</tbody>
</table>
### Year II

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>English 251, 360</td>
<td>6</td>
</tr>
<tr>
<td>Two History courses (See Note 1)</td>
<td></td>
</tr>
<tr>
<td><em>One of Philosophy 100 or equivalent,</em> Psychology 110, an advanced literature course</td>
<td>6</td>
</tr>
<tr>
<td>One other course</td>
<td>3</td>
</tr>
</tbody>
</table>

### Year III

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>One of English 270 or 370</em></td>
<td>3</td>
</tr>
<tr>
<td>One approved English course</td>
<td>3</td>
</tr>
<tr>
<td>Two History courses (See Note 1)</td>
<td>6</td>
</tr>
<tr>
<td>One other course</td>
<td>3</td>
</tr>
</tbody>
</table>

### Year IV

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>One of English 350 or 380</em></td>
<td>3</td>
</tr>
<tr>
<td>English 261 or another approved English course</td>
<td>3</td>
</tr>
<tr>
<td>One other English course (See Note 2)</td>
<td>3</td>
</tr>
<tr>
<td>Two of History 450-479</td>
<td>4</td>
</tr>
<tr>
<td>One other History course (See Note 1)</td>
<td>2-3</td>
</tr>
</tbody>
</table>

**Note 1**
The five undesignated courses in History beyond the first year will normally be selected from History 250, 255, 260, 265*-266*, 295*-296*, 350, 361, 362, 363, 370.

**Note 2**
Senior Honours Essay may be chosen as this course.

---

### Honours English and Latin

#### Year I

**Recommended Programme**

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>English 101</td>
<td>3</td>
</tr>
<tr>
<td>Latin 100</td>
<td>3</td>
</tr>
<tr>
<td>History 100, or Philosophy 100 or equivalent</td>
<td>3</td>
</tr>
<tr>
<td>Two courses in social sciences</td>
<td>6</td>
</tr>
<tr>
<td>One other course</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Year II

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>English 251, 360</td>
<td>6</td>
</tr>
<tr>
<td>Latin—minimum of two full courses or equivalent</td>
<td>6</td>
</tr>
<tr>
<td>Classical Civilization 251*/252*</td>
<td>3</td>
</tr>
<tr>
<td>One other course</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Year III

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>One of English 270 or 370</em></td>
<td>3</td>
</tr>
<tr>
<td>One approved English course</td>
<td>3</td>
</tr>
<tr>
<td>Latin—minimum of two full courses or equivalent</td>
<td>6</td>
</tr>
<tr>
<td>Classical Civilization 260</td>
<td>3</td>
</tr>
<tr>
<td>One other course</td>
<td>3</td>
</tr>
</tbody>
</table>

25
Year IV  
*One of English 350 or 380  
3
English 261 or another approved English course  
3
One other approved English course (See Note 1)  
3
Latin—minimum of two full courses or equivalent (See Note 2)  
6-9
One other course (if appropriate)  
3

Note 1  
Senior Honours Essay may be chosen as this course.

Note 2  
Before graduation a student must complete a minimum of eight full courses in Latin.

Honours English and Philosophy

Year I  
*Recommended Programme*  
Hours
English 101  
3
*One of French 100, German 101*-102*,  
Latin 100, Greek 100  
3
*One of Philosophy 221*/222* or 280*/281*  
Psychology 110 or one of Political Science 112 or 114  
3
*One of History 100 (or History 110), or a foreign language course  
One other course  
3
3

Year II  
English 251, 360  
6
*One of Philosophy 221*/222* or 280*/281*  
Philosophy 282*/283* and one other  
Philosophy course  
6
One other course  
3

Year III  
*One of English 270 or 370  
One other approved English course  
3
Philosophy 299, 331, and one other  
Philosophy course  
7
One other course  
3

Year IV  
*One of English 350 or 380  
3
English 261 or another approved English course  
3
One other approved English course (See Note 2) or Philosophy 499  
3
Two Philosophy courses  
6
One other course  
3
Honours English and Russian

Note 1
Students who decide on their Honours programme on entry into Year II should take both Philosophy 221*/222* and 280*/281* during that year, and should consult the Department concerning rearrangement of their courses.

Note 2
Senior Honours Essay may be chosen as the English course.

<table>
<thead>
<tr>
<th>Year</th>
<th>Recommended Programme</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year I</td>
<td>Recommended Programme</td>
<td>Hours</td>
</tr>
<tr>
<td></td>
<td>English 101</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Russian—-one full course or equivalent</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>History 100 (or History 110), or Philosophy 100 or equivalent</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Three other courses taken in accordance with general Arts Faculty regulation</td>
<td>9</td>
</tr>
<tr>
<td>Year II</td>
<td>English 251, 360</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Russian—minimum of two full courses or equivalent</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Two other courses</td>
<td>6</td>
</tr>
<tr>
<td>Year III</td>
<td>One of English 270 or 370</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>One other approved English course</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Russian—minimum of two full courses or equivalent</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Two other courses</td>
<td>6</td>
</tr>
<tr>
<td>Year IV</td>
<td>One of English 350 or 380</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>English 261 or another approved English course</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>One other approved English course (See Note 3) or one other Russian course</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Russian—minimum of two full courses or equivalent</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>One other course</td>
<td>3</td>
</tr>
</tbody>
</table>

Note 1
Before graduation, students must complete a minimum of seven full Russian courses.

Note 2
Before graduation, students must complete the requirements for Honours courses as described on page 19 of the Calendar.

Note 3
Senior Honours Essay may be chosen as the English course.
## Honours English and Spanish

### Year I

**Recommended Programme**

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>English 101</td>
<td>3</td>
</tr>
<tr>
<td>French 100</td>
<td>3</td>
</tr>
<tr>
<td>Spanish 100</td>
<td>4</td>
</tr>
<tr>
<td>History 100 (or History 110), or Philosophy 100 or equivalent</td>
<td>3</td>
</tr>
<tr>
<td>Psychology 110 or one of Political Science 112 or 114</td>
<td>3</td>
</tr>
<tr>
<td>A course in Religious Knowledge or a second social science</td>
<td>3</td>
</tr>
</tbody>
</table>

### Year II

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>English 251, 360</td>
<td>6</td>
</tr>
<tr>
<td>Spanish—Two full courses or equivalent</td>
<td>6</td>
</tr>
<tr>
<td>Two other courses</td>
<td>6</td>
</tr>
</tbody>
</table>

### Year III

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>One of English 270 or 370</td>
<td>3</td>
</tr>
<tr>
<td>One other approved English course</td>
<td>3</td>
</tr>
<tr>
<td>Spanish—Minimum of two full courses or equivalent (See Note 2)</td>
<td>6-9</td>
</tr>
<tr>
<td>One or two other courses</td>
<td>3-6</td>
</tr>
</tbody>
</table>

### Year IV

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>One of English 350 or 380</td>
<td>3</td>
</tr>
<tr>
<td>English 261 or another approved English course</td>
<td>3</td>
</tr>
<tr>
<td>One other approved English course (See Note 1)</td>
<td>3</td>
</tr>
<tr>
<td>Spanish—Minimum of two full courses or equivalent (See Note 2)</td>
<td>6-9</td>
</tr>
<tr>
<td>One other course (if appropriate)</td>
<td>3</td>
</tr>
</tbody>
</table>

**Note 1**

Senior Honours Essay may be chosen as this course.

**Note 2**

Students planning to enter the teaching profession must comply with requirements as set down by the individual Colleges of Education in Ontario. In Spanish they should complete a minimum of eight full courses or equivalent, including Spanish 250, 350, 450.

## Honours French

### Year I

**Recommended Programme**

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>French 100</td>
<td>3</td>
</tr>
<tr>
<td>One of English, Philosophy, History, or another language</td>
<td>3</td>
</tr>
<tr>
<td>Four more courses</td>
<td>4</td>
</tr>
</tbody>
</table>
Honours French and German

Year II  
French minimum of three full courses or equivalent  
One of English, Philosophy, History, or another language  
Two more courses

Year III  
French minimum of three full courses or equivalent  
One of English, Philosophy, History, or another language  
Two more courses

Year IV  
French minimum of three full courses or equivalent  
One of English, Philosophy, History, or another language  
Two more courses

Note 1  
Before graduation, the student must complete a minimum of ten full courses (or equivalent) in French. If he intends to enter the teaching profession, he must complete French 250, 350, and 455*-456*.

Note 2  
To establish a Minor in a sister discipline, the student must complete five courses (fifteen hours) in that discipline.

Note 3  
With the permission of the department, the student may spend his third year enrolled in an acceptable university in France or in the Province of Quebec.

Honours French and German

Year I  
Recommended Programme  
French 100  
German one full course or equivalent  
Four more courses

Year II  
French minimum of two full courses or equivalent  
German minimum of two full courses or equivalent  
Two more courses

Year III  
French minimum of two full courses or equivalent  
German minimum of two full courses or equivalent  
Two more courses

Year IV  
French minimum of two full courses or equivalent  
German minimum of two full courses or equivalent  
Two more courses

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

Note 2  
Before graduation, students must complete a minimum of eight full courses (or equivalent) in French and in German.
Note 3
Students planning on entering the teaching profession should complete French 250, 350, and 455*-456*.

Note 4
Before graduation, students must complete the requirements for Honours Courses as described on page 19 of the Calendar.

Honours French and Latin

<table>
<thead>
<tr>
<th>Year</th>
<th>Recommended programme</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year I</td>
<td>French 100, Latin 100, Four more courses</td>
<td></td>
</tr>
<tr>
<td>Year II</td>
<td>French minimum of two full courses or equivalent, Latin minimum of two full courses or equivalent, Two more courses</td>
<td></td>
</tr>
<tr>
<td>Year III</td>
<td>French minimum of two full courses or equivalent, Latin minimum of two full courses or equivalent, Two more courses</td>
<td></td>
</tr>
<tr>
<td>Year IV</td>
<td>French minimum of two full courses or equivalent, Latin minimum of two full courses or equivalent, Two more courses</td>
<td></td>
</tr>
</tbody>
</table>

Note 1
Before graduation, students must complete the requirements for Honours Courses as described on page 19 of the Calendar.

Note 2
Before graduation, the student must complete a minimum of eight full courses (or equivalent) in French and in Latin.

Note 3
Students planning to enter the teaching profession should complete French 250, 350, 455*-456*.

Honours French and Political Science

<table>
<thead>
<tr>
<th>Year I</th>
<th>Recommended Programme</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>One of Political Science 110, 112 or 114</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>French 100</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>History 100</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Economics 101*/102*</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>English 101 or Philosophy 100 or equivalent</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Elective</td>
<td>3</td>
</tr>
</tbody>
</table>
Year II
Political Science 250  3
Political Science 280  3
French 250  3
The equivalent of one other full course  in French  3
History 265  3
†Elective  3

Year III
Political Science 370  3
The equivalent of one other full course  in Political Science selected in consultation with the Department  3
French 350  3
The equivalent of one other full course  in French  3
†Two Electives  6

Year IV
The equivalent of two full courses in Political Science (at least one of which must be at the 400 or 500 level) selected in consultation with the Department  6
French 455*-456*  3
The equivalent of one other full course  in French  3
†Elective  3

† 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

Year I  Recommended Programme
French 100
Russian  one full course or equivalent
Four more courses

Year II  French  minimum of two full courses or equivalent
Russian  minimum of two full courses or equivalent
Two more courses

Year III  French  minimum of two full courses or equivalent
Russian  minimum of two full courses or equivalent
Two more courses

Year IV  French  minimum of two full courses or equivalent
Russian  minimum of two full courses or equivalent
Two more courses
Note 1
The student may take the two required Social Sciences in the first year.

Note 2
Before graduation, students must complete a minimum of eight full courses (or equivalent) in French and in Russian. Those planning to enter the teaching profession must complete French 250, 350, 455*–456*.

Note 3
Before graduation, students must complete the requirements for Honours Courses as described on page 19 of the Calendar.

Honours French and Spanish

<table>
<thead>
<tr>
<th>Year</th>
<th>Recommended Programme:</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>French 100</td>
</tr>
<tr>
<td></td>
<td>Spanish 100</td>
</tr>
<tr>
<td></td>
<td>Four more courses.</td>
</tr>
<tr>
<td>II</td>
<td>French</td>
</tr>
<tr>
<td></td>
<td>minimum of two full courses or equivalent</td>
</tr>
<tr>
<td></td>
<td>Spanish</td>
</tr>
<tr>
<td></td>
<td>minimum of two full courses or equivalent</td>
</tr>
<tr>
<td></td>
<td>Two more courses</td>
</tr>
<tr>
<td>III</td>
<td>French</td>
</tr>
<tr>
<td></td>
<td>minimum of two full courses or equivalent</td>
</tr>
<tr>
<td></td>
<td>Spanish</td>
</tr>
<tr>
<td></td>
<td>minimum of two full courses or equivalent</td>
</tr>
<tr>
<td></td>
<td>Two more courses</td>
</tr>
<tr>
<td>IV</td>
<td>French</td>
</tr>
<tr>
<td></td>
<td>minimum of two full courses or equivalent</td>
</tr>
<tr>
<td></td>
<td>Spanish</td>
</tr>
<tr>
<td></td>
<td>minimum of two full courses or equivalent</td>
</tr>
<tr>
<td></td>
<td>Two more courses</td>
</tr>
</tbody>
</table>

(see Note 1.)

Note 1
Latin 100 may be taken or another romance language begun. The required two courses in the Social Sciences may be taken during the first year.

32
Honours Geography

Note 2
Before graduation, students must complete a minimum of eight full courses (or equivalent) in French and in Spanish.
Students planning to enter the teaching profession must complete French 250, 350, 455*-456*, and Spanish 250, 350, 450.

Honours Geography

<table>
<thead>
<tr>
<th>Year</th>
<th>Courses</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year I</td>
<td>Geography 101*/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>Economics 101*/102*</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A language other than English</td>
<td>3-4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Two courses chosen after consultation with the Department</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Year II</td>
<td>Geography 211*, 210*, 220, 260*, 275*</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Three courses chosen after consultation with the Department</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Year III</td>
<td>Geography 300*, 301*, 375, 381*, 451*</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Three courses chosen after consultation with the Department</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Year IV</td>
<td>Geography one of 420-432, 480</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>490, 491*</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>One course chosen after consultation with the Department</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Notes
1. This programme is designed to permit students to continue to graduate work in Geography or to enter Secondary School Teaching.
2. In order to enter Year II of the Honours Geography Programme, a student must obtain a minimum over-all average of 60% in his Year I studies, and a minimum of 66% in Geography 101* and 100*. To obtain standing in subsequent years a student must obtain an over-all average of at least 66% and a minimum of 66% in all Geography courses.
3. Geography 101*, 100*, 211*, 210*, 260*, 275*, 300* and 301* are half year courses. Where two half courses occur in sequence in the programme (e.g. 101*, 100*) they are given the same timetable slot.
4. Students preparing for teaching at the High School level should elect at least two regional courses from the 420-432 group.
5. In some Geography courses after Year I, selected reading assignments will be given in the student's second language.
6. All Honours Geography students are encouraged to obtain summer employment which will provide experience useful to a geographer. Where possible the Department will furnish information and assistance in securing a position.
Honours Urban and Regional Planning

Recommended Programme:

<table>
<thead>
<tr>
<th>Year</th>
<th>Courses</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Planning 156*</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Geography 101*</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Economics 101*/102*</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Philosophy 125*</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Anthropology 101* or 102*</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A language course other than English</td>
<td>3-4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Two courses chosen after consultation with</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>the Department (preferably Political</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Science and Sociology)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Planning 255*, 256*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Geography 100*, 211*, 220, 250</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>260*, 275*</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>One course from the Humanities chosen</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>after consultation with the Department</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Summer employment related to Planning)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Planning 357*, 358*, 332*, 333*</td>
<td>5-6</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Geography 355*, 375</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Philosophy 425*</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>One of: Political Science 270, 280, 371</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Two courses chosen after consultation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>with the Department</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Summer employment related to Planning)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Planning 456, 480, 490, 491*</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Economics 450</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Civil Engineering 61*</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>One course chosen after consultation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>with the Department</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Notes

1. This programme is accredited by the Town Planning Institute of Canada and will permit graduating students to obtain employment with a planning agency, to secure other work in the planning field or to continue to graduate work in Planning.
2. In order to enter Year II of the Honours Urban and Regional Planning programme, a student must obtain a minimum over-all average of 60% in his Year I studies, and a minimum of 66% in Planning 156* and Geography 101*. To obtain standing in subsequent years a student must obtain an over-all average of at least 66% and a minimum of 66% in all Planning and Geography courses.
3. Courses marked with an asterisk, e.g. 156*, are half year courses.
4. In addition to the four courses specifically required in Year I of this programme two courses from the Social Sciences (Group B), are recommended for students in Planning (Political Science 110, or 112, and Sociology 100). Alternatives may be selected in consultation with the Department.
Honours Geography and Geology

5. All Honours Planning Students are expected to spend two summers working with an agency involved in planning research or other work related to planning. The Department will furnish assistance in securing a position.
6. Students should take advantage of course electives in Years II, III, and IV to meet the graduation requirement of four courses from the Humanities.

Honours Geography and Geology

Core courses in Physical Geography:
100* Intro. to Physical Geography
300* Geomorphology
400* Advanced Geomorphology

Course electives in Earth Science:
130 Introductory Geology
231* Mineralogy
232* Petrography
238* Historical Geology
334 Paleontology
335 Stratigraphy and Sedimentation
340 Structural Geology
437 Crustal Evolution

1.—Students selecting this program must obtain the approval of the department and arrange their courses in consultation with the departmental advisor for this programme.
2.—Those interested in Secondary School teaching of Geography and/or Geology should elect Earth Science 130, 231*, 232*, 238*, one of: 334, 335 and 340, and 437.
3.—Those interested in broadening their background in Physical Geography in preparation for graduate study in Geography should elect Earth Science 130, 232*, 238*, 335 and 340.
4.—In each case the core courses in Physical Geography and the electives in Earth Science will form part of an overall programme which closely resembles the regular programme in Honours Geography (p. 33).

Honours German and Russian

<table>
<thead>
<tr>
<th>Year</th>
<th>German</th>
<th>Russian</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>one full course</td>
<td>one full course</td>
</tr>
<tr>
<td></td>
<td>or equivalent</td>
<td>or equivalent</td>
</tr>
<tr>
<td></td>
<td>Four more courses</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year II</th>
<th>German</th>
<th>Russian</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>minimum of two full courses or equivalent</td>
<td>minimum of two full courses or equivalent</td>
</tr>
<tr>
<td>Two more courses</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Year III
German  minimum of two full courses
or equivalent
Russian  minimum of two full courses
or equivalent
Two more courses

Year IV
German  minimum of two full courses
or equivalent
Russian  minimum of two full courses
or equivalent
Two more courses

Note 1
Each student will normally complete a minimum of at least one course from each of English, History and Philosophy.

Note 2
Before graduation students must complete a minimum of seven full German courses and eight full Russian courses.

Note 3
Before graduation students must complete the requirements for Honours Courses as described on page 19 of the Calendar.

Honours German

with minor in English or any other discipline
Year I  One full German course or equivalent
One full English course or equivalent
Four more courses

Year II  Minimum of two full German courses or equivalent
Minimum of two full English courses or equivalent
Two more courses

Year III  Minimum of three full German courses or equivalent
Minimum of one full English course or equivalent
Two more courses

Year IV  Minimum of three full German courses or equivalent
Minimum of one full English course or equivalent

Note
Before graduation students must complete the requirements for Honours Courses as described on page 19 of the Calendar.
### Honours History

#### Year I
Any first-year programme that fulfills the general requirements (see page P. 19 is acceptable. History 110 is especially recommended for those students intending to select Honours History.

#### Year II
Three Honours History courses including at least one of History 250, 255, 260 (see note 1).
Three other courses (see note 2).

#### Year III
Three Honours History courses (see note 1).
Two other courses (see note 2).

#### Year IV
Two of History 450-79
History 499
Three History or approved alternative senior courses

### Notes
1. Before graduation an Honours History student must have completed at least nine Honours History courses, four of which should come from the following core group: History 250, 255, 260, 350, (361, 362, 363) 370. Honours History courses are numbered 250-99, 350-99, 450-99.
2. These courses will be selected in consultation with a departmental advisor and tailored to the individual academic development of each student. By the end of Year III a sequence of at least two full courses should be completed both in the humanities and in the social sciences in addition to History.
3. Graduation in this course with at least Second Class standing qualifies a student for admission to the Type A course in History at a College of Education in Ontario.
Honours History and Philosophy

Year I

Recommended Programme:

One of Philosophy 221*/222* or 280*/281*
History 100 or 110

Four other courses to fulfill the general requirements (see page 20)

Hours

3
3

Year II

One of Philosophy 221*/222* or 280*/281*
Philosophy 282*/283* and one other Philosophy course
Three Honours History courses (see note 2).

9

Year III

Philosophy 299, 325/326
Philosophy 346
Two Honours History courses (see note 2).

6

Year IV

Three Philosophy courses
Two of History 450 to 479
History 499

9

Notes

1.—Students who decide on their Honours programme on entry into Year II should take both Philosophy 221*/222* and 280*/281* during that year, and should consult the Department concerning rearrangement of their courses.

2.—The five undesignated courses in History in the Second and Third Years must be selected from History 250-99, 350-99 in consultation with a departmental advisor so as to be tailored to the student's individual academic development.

Honours History and Political Science

Year I

Recommended Programme:

History 100 or 110
One of Political Science 110, 112 or 114
One of Sociology 100 or Economics 101*/102*
Three electives, one of which must satisfy the foreign language requirement.

9

Year II

Two Honours History courses (see note 1).
Political Science 280 and the equivalent of Two other full Political Science courses selected in consultation with the Department. One elective.

6

9

3
Honours Latin

Year III
Two Honours History courses (see note 1).
Political Science 250 and the equivalent of
One other full course in Political Science
selected in consultation with the Department.
One elective.

Year IV
Two of History 450-79.
History 499
The equivalent of two full courses in Political
Science (at least one of which must be at the
400 or 500 level) selected in consultation
with the Department
One elective.

Notes
1.—The four undesignated courses in History in the Second and Third years must be
selected from History 250-99, 350-99 in consultation with a departmental advisor so
as to be tailored to the student's individual academic development.
2.—Those wishing to qualify for admission to the Type A course at a College of Edu-
cation in Ontario should use one of the electives for an additional course in Honours
History.

Honours Latin

Year I
Latin 100
Classical Civilization 251*-252*.
Four more courses (see Note 1.)

Year II
Latin
Classical Civilization
Two more courses
minimum of three full courses or
equivalent
265*-266*

Year III
Latin
Classical Civilization
Two more courses
minimum of three full courses or
equivalent
350

Year IV
Latin
Three more courses
minimum of three full courses or
equivalent

Note 1
Students 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 mi-
nor subject, three courses (nine hours) are required, in French, English, or Italian, five
courses (fifteen hours) are required. The Electives each year provide room for these
requirements.
Note 2
Before graduation, students must complete a minimum of ten courses in Latin.

Honours Philosophy

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

<table>
<thead>
<tr>
<th>Year I</th>
<th>Recommended Programme:</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Philosophy 221*/222* and 280*/281*</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>English or History</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><em>One of French, German, Latin or Greek</em></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Two electives</td>
<td>6</td>
</tr>
</tbody>
</table>

| Year II         | Philosophy 240 or 340, 282*/283*, and 299 or one other Philosophy course | 7-9   |
|                 | Three electives                                            | 6-9   |

| Year III        | Four Philosophy courses (including 299 if not taken in Year II) | 10-12 |
|                 | Two electives                                              | 4-6   |

| Year IV         | Five Philosophy courses including Philosophy 499            | 13    |
|                 | 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*/222*, 280*/281* and one other Philosophy course | 9     |
|                 | *One of Philosophy 240 or 282*/283*                         | 3     |
|                 | Two electives                                              | 4-6   |

| Year III        | *One of Philosophy 240 or 282*/283*                         | 3     |
|                 | Three other Philosophy courses (including 299)              | 7     |
|                 | Two electives                                              | 4-6   |

| Year IV         | Five Philosophy courses (including 499)                    | 13    |
|                 | One elective                                               | 2-3   |
Honours Philosophy and Literature

Year I

Recommended Programme:

One of Philosophy 221*/222* or 280*/281*
French 100 (or German 101*-102*)
English 101†
A Social Science
Two of A Natural Science
Mathematics
History
Another language††
Another Social Science

Hours
3
3
3
3
6

Year II

One of Philosophy 221*/222* or 280*/281*
Philosophy 282*/283* and one other Philosophy course
French: minimum of two full courses
or equivalent (see note 1)
(or German 261*-262* and one of
German 251*-252*; 271*-272*)
One elective (Social Science, if requirement not met in first year)

Hours
3
6
6-9
3

Year III

Philosophy 299, 331 and one other Philosophy course
French: minimum of two full courses
or equivalent (see note 1)
(or German 351*-352*; 361*-362*; 381*-382*)
One elective

Hours
7
9
3

Year IV

Three Philosophy courses
French: minimum of two full courses
or equivalent (see note 1)
(or German 451*-452*; 461*-462*; 471*-472*)
Senior Essay

Hours
9
6-9

†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 1
Before graduation students must complete a minimum of eight courses (or equivalent) in French. Students intending to teach French should complete French 250, 350, 453*-456*.

Note 2
Students who decide on their Honours programme on entry into Year II should take both Philosophy 221*/222* or 280*/281* during that year, and should consult the Department concerning rearrangement of their courses.
### Honours Philosophy and Mathematics

#### Year I

**Recommended Programme:**

- English 101  
- *One of* Philosophy 221*/222* or 280*/281*  
- A foreign language  
- One course in the social sciences  
- Mathematics 130, 131

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>English 101</td>
<td>3</td>
</tr>
<tr>
<td><em>One of</em> Philosophy 221*/222* or 280*/281*</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>

#### Year II

- Mathematics 230, and (a) 231, 232 or (b) 237  
  and either 236 or 238.  
- *One of* Philosophy 221*/222* or 280*/281*  
- *One of* Philosophy 240 or 340 or 282*/283*  
- Elective

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 230, and (a) 231, 232 or (b) 237</td>
<td>8</td>
</tr>
<tr>
<td>and either 236 or 238.</td>
<td></td>
</tr>
<tr>
<td><em>One of</em> Philosophy 221*/222* or 280*/281*</td>
<td>3</td>
</tr>
<tr>
<td><em>One of</em> Philosophy 240 or 340 or 282*/283*</td>
<td>3</td>
</tr>
<tr>
<td>Elective</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Year III

- Mathematics 330, 332, 233, 234  
- *One of* Philosophy 240 or 340 or 282*/283*  
- Philosophy 299 and one other Philosophy course

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 330, 332, 233, 234</td>
<td>10</td>
</tr>
<tr>
<td><em>One of</em> Philosophy 240 or 340 or 282*/283*</td>
<td>3</td>
</tr>
<tr>
<td>Philosophy 299 and one other Philosophy course</td>
<td>4</td>
</tr>
</tbody>
</table>

#### Year IV

- Mathematics 331, 337, 433, 446  
- Three Philosophy courses  
- Elective (may be another Math.)

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 331, 337, 433, 446</td>
<td>7</td>
</tr>
<tr>
<td>Three Philosophy courses</td>
<td>9</td>
</tr>
<tr>
<td>Elective (may be another Math.)</td>
<td>2-3</td>
</tr>
</tbody>
</table>

**Note 1**

Students who decide on their Honours programme on entry into Year II should take both Philosophy 221*/222* and 280*/281* 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*/222* or 280*/281*  
- One of Political Science 110, 112 or 114  
- History 100  
- A Social Science other than Political Science  
- Two electives, one of which should satisfy the foreign language requirement

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>One of Philosophy 221*/222* or 280*/281*</td>
<td>3</td>
</tr>
<tr>
<td>One of Political Science 110, 112 or 114</td>
<td>3</td>
</tr>
<tr>
<td>History 100</td>
<td>3</td>
</tr>
<tr>
<td>A Social Science other than Political Science</td>
<td>3</td>
</tr>
<tr>
<td>Two electives, one of which should satisfy the foreign language requirement</td>
<td>6</td>
</tr>
</tbody>
</table>

#### Year II

- One of Philosophy 221*/222* or 280*/281*  
- Philosophy 282*/283*  
- Philosophy 240 or alternatively 140 and another half course in Philosophy  
- Political Science 280  
- The equivalent of one full course selected from Political Science 284*, 286*, 287* 288* or 289*  
- One elective

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>One of Philosophy 221*/222* or 280*/281*</td>
<td>3</td>
</tr>
<tr>
<td>Philosophy 282*/283*</td>
<td>3</td>
</tr>
<tr>
<td>Philosophy 240 or alternatively 140 and another half course in Philosophy</td>
<td>3</td>
</tr>
<tr>
<td>Political Science 280</td>
<td>280</td>
</tr>
<tr>
<td>The equivalent of one full course selected from Political Science 284*, 286*, 287* 288* or 289*</td>
<td>3</td>
</tr>
<tr>
<td>One elective</td>
<td>3</td>
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</table>
### Honours Philosophy and Psychology

**Year III**

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Philosophy 299</td>
<td>1</td>
</tr>
<tr>
<td>Philosophy 327* and another half course in Philosophy</td>
<td>3</td>
</tr>
<tr>
<td>The equivalent of three full courses in Political Science selected in consultation</td>
<td>9</td>
</tr>
<tr>
<td>with the Department</td>
<td></td>
</tr>
<tr>
<td>One elective</td>
<td>3</td>
</tr>
</tbody>
</table>

**Year IV**

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Philosophy 325*/326* or one other full course or equivalent</td>
<td>3</td>
</tr>
<tr>
<td>Philosophy 499</td>
<td>1</td>
</tr>
<tr>
<td>The equivalent of two full courses in Political Science (at least one of which</td>
<td>6</td>
</tr>
<tr>
<td>must be at the 400 or 500 level) selected in consultation</td>
<td></td>
</tr>
<tr>
<td>with the Department</td>
<td></td>
</tr>
<tr>
<td>Two electives</td>
<td>6</td>
</tr>
</tbody>
</table>

**Note**

Students who decide on their Honours programmes on entry into Year II should take both Philosophy 221*/222* and 280*/281* during that year, and should consult the Department concerning rearrangement of their courses.

---

**Honours Philosophy and Psychology**

<table>
<thead>
<tr>
<th>Year</th>
<th>Recommended Programme:</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Lectures</td>
</tr>
<tr>
<td>Year I</td>
<td>One of Philosophy 221*/222* or 280*/281*</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Psychology 150</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>A language other than English</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>English 101</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>A Social Science other than Psychology</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Mathematics or a Natural Science</td>
<td>2-3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0-2</td>
</tr>
<tr>
<td>Year II</td>
<td>One of Philosophy 221*/222* or 280*/281*</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>One of Philosophy 240 or 340 or 282*/283*</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>One other Philosophy Course</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Psychology 280</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Psychology 290</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>One other Psychology Course</td>
<td>3</td>
</tr>
<tr>
<td>Year III</td>
<td>One of Philosophy 240 or 340 or 282*/283*</td>
<td>3</td>
</tr>
</tbody>
</table>
Philosophy 299 3
Two other Philosophy Courses 6
Psychology 360 2
One other Psychology Course 3
An elective 3

Year IV
Two Philosophy Courses 6
Psychology 410 3
Psychology 430 2
Senior Honours Essay
(Philosophy-Psychology 499)
An Elective 3

Note 1
Biology 101 or 131 is recommended for students who lack Ontario Grade 13 Biology, Mathematics 85 for students who lack Ontario Grade 13 Mathematics. Students may benefit from including Mathematics 130, 243, or 449 and Biology 231 within their programmes.

Note 2
Students who decide on the Honours Programme on entry into Year II should take both Philosophy 221*/222* and 280*/281* during their second year and should consult the Department concerning rearrangement of their courses.

**Honours Political Science**

**Year I**

*Recommended Programme:*

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Political Science 110</td>
<td>3</td>
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<tr>
<td>Two of Economics 101*/102*, Psychology 110,</td>
<td>6</td>
</tr>
<tr>
<td>Sociology 100, Geography 101*/100*</td>
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<tr>
<td>One of History 100, Philosophy 100 or</td>
<td></td>
</tr>
<tr>
<td>equivalent</td>
<td></td>
</tr>
<tr>
<td>Two electives, one of which should satisfy</td>
<td></td>
</tr>
<tr>
<td>the foreign language requirement</td>
<td>6</td>
</tr>
</tbody>
</table>

**Year II**

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Political Science 280</td>
<td>3</td>
</tr>
<tr>
<td>The equivalent of two other full courses</td>
<td></td>
</tr>
<tr>
<td>in Political Science at the 200 level</td>
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</tr>
<tr>
<td>selected in consultation with the</td>
<td></td>
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<tr>
<td>Department</td>
<td>6</td>
</tr>
<tr>
<td>An approved course in History, Philosophy</td>
<td></td>
</tr>
<tr>
<td>or Economics</td>
<td>3</td>
</tr>
<tr>
<td>Two other courses, at least one of which</td>
<td></td>
</tr>
<tr>
<td>must be in a subject taken in Year I</td>
<td>6</td>
</tr>
</tbody>
</table>

**Year III**

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>The equivalent of three full courses in</td>
<td></td>
</tr>
<tr>
<td>Political Science (which must include</td>
<td></td>
</tr>
<tr>
<td>250 and 365*) selected in consultation</td>
<td>9</td>
</tr>
<tr>
<td>with the Department</td>
<td></td>
</tr>
<tr>
<td>Two other approved courses</td>
<td>6</td>
</tr>
</tbody>
</table>
### Honours Psychology

**Year IV**
The equivalent of three full courses in Political Science (at least two of which must be at 400 or 500 level) selected in consultation with the Department.

Two other approved courses

9

6

### Honours Psychology

<table>
<thead>
<tr>
<th>Year</th>
<th>Recommended Programme</th>
<th>Hours</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year I</strong></td>
<td>Psychology 150</td>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>One of Philosophy, History or English</td>
<td></td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>A language other than English</td>
<td></td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>A Social Science other than Psychology</td>
<td></td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Two other full year courses (or equivalent half courses)</td>
<td></td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td><strong>Year II</strong></td>
<td>Psychology 280, 290</td>
<td></td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>One other full-year course (or equivalent half courses) in Psychology</td>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Three other full-year courses (one from group A) or the equivalent in half-courses</td>
<td></td>
<td>2-3</td>
<td>0-2</td>
</tr>
<tr>
<td><strong>Year III</strong></td>
<td>Psychology 360, 2 other full-year courses (or equivalent half courses) in Psychology</td>
<td></td>
<td>2</td>
<td>3</td>
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<tr>
<td></td>
<td>Three other full-year courses (one from group A) or the equivalent in half-courses</td>
<td></td>
<td>4-6</td>
<td>0-4</td>
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<tr>
<td><strong>Year IV</strong></td>
<td>Psychology 430, One more full-year course (or equivalent half-courses) in Psychology</td>
<td></td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Two other full-year courses or the equivalent in half-year courses</td>
<td></td>
<td>2-3</td>
<td>0-2</td>
</tr>
</tbody>
</table>

**Notes**

1. Psychology 280, 290, 360, 430 and 499 are required of all students in Honours Psychology.

2. It is strongly recommended that students intending to enter the honours programme in psychology offer three credits in Ontario Grade 13 Mathematics. Students who do not offer these papers should consult the department for advice on their programme.

3. Students are permitted to enter 2nd year honours psychology from the first year of the general course.
4. See also: Honours Biology and Psychology (Faculty of Science), Philosophy and Psychology, Psychology and Statistics, Psychology and Sociology, Statistics and Psychology (Faculty of Mathematics).

**Honours Psychology and Sociology**

<table>
<thead>
<tr>
<th>Year</th>
<th>Recommended Programme</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Psychology 150</td>
<td>2</td>
<td>2</td>
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<tr>
<td></td>
<td>Sociology 100</td>
<td>3</td>
<td>-</td>
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<td></td>
<td>A Language other than English</td>
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<td>-</td>
</tr>
<tr>
<td></td>
<td>One of Philosophy, English or History</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Two other full year courses (or equivalent half courses)</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td>II</td>
<td>Psychology 280</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Psychology 290</td>
<td>2</td>
<td>2</td>
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<tr>
<td></td>
<td>Psychology 253* or Sociology 210* and one half course in Social Psychology (Psychology 254* or 256*)</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>One other full-year course (or equivalent half courses) in Sociology</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Two other full year courses (or equivalent half courses)</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td>III</td>
<td>Psychology 360</td>
<td>2</td>
<td>3</td>
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<td>One other full year (or equivalent half courses) in Psychology</td>
<td>2-3</td>
<td>0-2</td>
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<td></td>
<td>Sociology 320</td>
<td>3</td>
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<tr>
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<td>Sociology 325</td>
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<td>-</td>
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<td>One other full year (or equivalent half courses) in Sociology</td>
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<td>-</td>
</tr>
<tr>
<td></td>
<td>One other full year course (or equivalent half courses)</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>IV</td>
<td>Psychology 430</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Sociology 450</td>
<td>3</td>
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<td>Psychology 499 or Sociology 499</td>
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<td>5</td>
</tr>
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<td></td>
<td>Two other full year courses (or equivalent half courses)</td>
<td>6</td>
<td>-</td>
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</tbody>
</table>

**Honours Psychology and Statistics**

<table>
<thead>
<tr>
<th>Year</th>
<th>Recommended Programme</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Psychology 150</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Mathematics 130, 131, 132</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Year</td>
<td>Courses</td>
<td>Credits</td>
<td></td>
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<tr>
<td>------</td>
<td>-------------------------------------------------------------------------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Philosophy 100 or two of Philosophy 125, 135, 140, 150</td>
<td>3 -</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A language other than English</td>
<td>3 -</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Psychology 290</td>
<td>2 2</td>
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<tr>
<td></td>
<td>One other full year course in Psychology or the equivalent in half-year courses</td>
<td>2-3 0-2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mathematics 230, 233, 237</td>
<td>6 -</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A course in English, History, Philosophy, or a language other than English</td>
<td>3 -</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Psychology 360</td>
<td>2 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>One other full year course in Psychology or the equivalent in half-year courses</td>
<td>2-3 0-2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mathematics 332, 338</td>
<td>4 -</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A course in English, History, Philosophy, or a language other than English</td>
<td>3 -</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elective</td>
<td>2 -</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Psychology 430, 499</td>
<td>3 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>One other full year course in Psychology or the equivalent in half-year courses</td>
<td>2-3 0-2</td>
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<tr>
<td></td>
<td>Mathematics 438 or 440</td>
<td>2 -</td>
<td></td>
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<tr>
<td></td>
<td>Mathematics 439</td>
<td>2 -</td>
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</tr>
<tr>
<td></td>
<td>Elective</td>
<td>2 -</td>
<td></td>
</tr>
</tbody>
</table>

**Note 1**
This is a recommended programme. Substitutions are permitted in courses other than Psychology and Mathematics with the consent of the departments. This programme leads to a B.A. degree; the same programme may be taken in the Faculty of Mathematics leading to a B. Math. degree (see Honours Statistics and Psychology).

**Note 2**
Students lacking Ontario Grade 13 Mathematics should elect Mathematics 85. Other Electives recommended include Mathematics 130 and 499 and Biology 231.

**Note 3**
Honours Students are required to have Mathematics 253 or if their preparation permits, Mathematics 140 and Mathematics 243.

**Honours Russian**

with minor in English or any other discipline

**Year I**

*Recommended Programme:*
One full Russian course or equivalent
One full English course or equivalent
Four more courses
<table>
<thead>
<tr>
<th>Year</th>
<th>Minimum of two full Russian courses or equivalent</th>
<th>Minimum of two full English courses or equivalent</th>
<th>Two more courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year II</td>
<td>Minimum of three full Russian courses or equivalent</td>
<td>Minimum of one full English course or equivalent</td>
<td>Two more courses</td>
</tr>
<tr>
<td>Year III</td>
<td>Minimum of three full Russian courses or equivalent</td>
<td>Minimum of one full English course or equivalent</td>
<td>Two more courses</td>
</tr>
<tr>
<td>Note</td>
<td>Before graduation students must complete the requirements for Honours Courses as described on page 19 of the Calendar.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Honours Sociology**

**Recommended Programme:**

<table>
<thead>
<tr>
<th>Year</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year I</td>
<td>Sociology 100 3</td>
</tr>
<tr>
<td></td>
<td>History 100 3</td>
</tr>
<tr>
<td></td>
<td>Philosophy 100 or equivalent 3</td>
</tr>
<tr>
<td></td>
<td>English 101 3</td>
</tr>
<tr>
<td></td>
<td>Psychology 110 3</td>
</tr>
<tr>
<td></td>
<td>A language other than English 3</td>
</tr>
<tr>
<td>Year II</td>
<td>Anthropology 102 and Sociology 212</td>
</tr>
<tr>
<td></td>
<td>and two other full courses in Sociology</td>
</tr>
<tr>
<td></td>
<td>Three electives</td>
</tr>
<tr>
<td>Year III</td>
<td>Sociology 320, 325 and two other courses</td>
</tr>
<tr>
<td></td>
<td>in Sociology 12</td>
</tr>
<tr>
<td></td>
<td>Two electives 6</td>
</tr>
<tr>
<td>Year IV</td>
<td>Sociology 450, 465, 470 and 499 12</td>
</tr>
<tr>
<td></td>
<td>One elective 3</td>
</tr>
</tbody>
</table>

**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.

**Honours Spanish**

**Recommended Programme**

<table>
<thead>
<tr>
<th>Year</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year I</td>
<td>Spanish 100</td>
</tr>
<tr>
<td></td>
<td>One of English, Philosophy, History, or another language</td>
</tr>
<tr>
<td></td>
<td>Four more courses</td>
</tr>
</tbody>
</table>

48
Honours Spanish

Year II
Spanish minimum of three full courses or equivalent
One of English, Philosophy, History, or another language
Two more courses

Year III
Spanish minimum of three full courses or equivalent
One of English, Philosophy, History, or another language
Two more courses

Year IV
Spanish minimum of three full courses or equivalent
One of English, Philosophy, History, or another language
Two more courses.

Note 1
Before graduation, the student must complete a minimum of ten full courses (or equivalent) in Spanish. If he intends to enter the teaching profession, he must complete Spanish 250, 350, and 450.

Note 2
To establish a Minor in a sister discipline, he must complete five courses (fifteen hours) in that discipline.

Note 3
With permission of the department, the student may spend his third year enrolled in an acceptable university in Spain or Mexico.

Note 4
Students registering in Honours Spanish are strongly advised to minor in French.

Area Study Programmes
In certain Honours Courses, students may choose to place greater emphasis on one part of the world than on others. Students who are taking Honours Courses in History, Political Science, Economics or Geography, for example, may wish to concentrate on the application of these subjects to Latin America, Africa or the Soviet Union. In these cases students may, with the permission of the Department Chairman concerned, arrange to take courses related to the area in which they are particularly interested.
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 Ontario and was until recently, 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 except Chemical Engineering. A substantial part of the work of the first and second years is common to all programmes. Starting with the second year (first year for Chemical Engineering) 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 employ-
ment 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 for the Master's degree at the University of Waterloo require 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.

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 Graduate Studies, and special remarks on the graduate co-operative programme on page 52, and as well the particular courses in graduate work in the various departments as listed in Chapter VIII.

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>1968</th>
<th>1969</th>
<th>1970</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Winter</td>
<td>Spring</td>
</tr>
<tr>
<td>Stream “A” Term</td>
<td>First Term</td>
<td>Second Term</td>
</tr>
<tr>
<td>Stream “B” Term</td>
<td>First Term</td>
<td>Work Period</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1971</th>
<th>1972</th>
<th>1973</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td>Spring</td>
<td>Fall</td>
</tr>
<tr>
<td>Stream “A” Term</td>
<td>Fifth Term</td>
<td>Work Period</td>
</tr>
<tr>
<td>Stream “B” Term</td>
<td>Work Period</td>
<td>Fifth 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 oppor-
Admission and Registration

General
Application for admission to the Faculty of Engineering should be made as early in the year as possible. Students currently enrolled full time in Ontario Grade 13 must apply on the "General Application for Admission to University" form which can be obtained from the Secondary School. All other applicants may obtain application forms directly from 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 have been submitted.

Applicants currently enrolled in Ontario Grade 13 and who wish to be considered for Early Final Admission must apply before March 15, 1968. All other applicants must apply and have submitted all the necessary documents by August 1, 1968. Persons applying after this date cannot be guaranteed consideration of their application.

Admission to Year I
In order to qualify for admission to the first year of the Engineering programme, the applicant should have completed Ontario Grade 13 or its equivalent, showing a minimum overall average of 60% in the seven required credits and with a minimum overall average of 60% in the five credits in Mathematics and Science. For applicants who have taken more than one year to complete the work of Grade 13, a somewhat higher average may be required.

Standing is required in seven Grade 13 credits as follows:
  Five credits from Chemistry,
  Physics,
  Mathematics A,
  Mathematics B
  two additional credits.

Additional credits can be selected from any of the optional subjects offered at the Grade 13 level with the qualification that no more than one of the following may be counted as an "additional" credit: Accountancy Practice, Art, Home Economics, Mathematics of Investment, Music, or Secretarial Practice. The marks received in one of these subjects 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 credit" on the same terms as these subjects except the marks received will not be computed in the average.

Note 1
Ontario Tests for Admission to College and University (OACU)
All Grade 13 applicants will be required to submit the results of the Ontario Scholas-
tic Aptitude Test and of such Ontario Achievement Tests as are offered in Grade 13 credits presented for admission.

Note 2
If English is not chosen as a Grade 13 subject offered for admission, applicants must have standing in English at the Grade 12 level.

Note 3
The University will use the following definition of credits for admission purposes:
3 credits—Mathematics A and Mathematics B combined
2 credits—All language subjects, Mathematics A
1 credit—All other subjects.

Early Final Admission
Students enrolled full time in Ontario Grade 13 will be considered for Early Final Admission. To be eligible for consideration, applicants must arrange to have the "General Application for Admission to University" form submitted by March 15, 1968. Consideration of candidates for Early Final Admission will be based on the Secondary School record, the Principal’s Recommendation, and the results of the Ontario Scholastic Aptitude Test and specified Achievement Tests. Successful applicants may expect to be notified after May 15, 1968, of their acceptance and will be asked to indicate their decision by June 15, 1968. Those applicants who are not offered Early Final Admission will be considered on the basis of the Grade 13 final results and will be notified as soon as possible after the release of the Grade 13 results.

Note
All applicants will be required to complete Grade 13 to the satisfaction of the Secondary School principal.

The following certificates, recognized as being equivalent to the Ontario Grade 13 certificate, may be accepted insofar as they meet the admission requirements of the University of Waterloo in subjects and percentages:

<table>
<thead>
<tr>
<th>Province/Region</th>
<th>Equivalent Certificate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alberta</td>
<td>Senior Matriculation (Grade 12)</td>
</tr>
<tr>
<td>British Columbia</td>
<td>Senior Matriculation (Grade 13)</td>
</tr>
<tr>
<td>Manitoba</td>
<td>Senior Matriculation (Grade 12)</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>Senior Matriculation (Grade 13)</td>
</tr>
<tr>
<td>Newfoundland</td>
<td>Year I Memorial University</td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>Senior Matriculation (Grade 12)</td>
</tr>
<tr>
<td>Prince Edward Island</td>
<td>Third Year Certificate from Prince of Wales College</td>
</tr>
<tr>
<td>Quebec</td>
<td>McGill Senior Matriculation or Quebec Senior High School Leaving Certificate</td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>Senior Matriculation (Grade 12)</td>
</tr>
<tr>
<td>England and Wales, West</td>
<td>The General Certificate of Education with passes in at least five subjects, two of which must be at Advanced Level.</td>
</tr>
<tr>
<td>Indies, East and West Africa</td>
<td>The Scottish Certificate of Education</td>
</tr>
<tr>
<td>Scotland</td>
<td>High School Graduation plus an additional year of formal study in subjects comparable to Ontario Grade 13.</td>
</tr>
<tr>
<td>United States of America</td>
<td></td>
</tr>
</tbody>
</table>
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. It is recommended that applicants attempt to obtain standing in Ontario Grade 13 level Mathematics and Science subjects or their equivalent. 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 11, 12 and 13, Faculty of Engineering

Fees

Refer to Section X page 380

Examinations and Promotions

The Faculty constitutes the examining body for all University examinations. The arrangement of the undergraduate engineering programme is shown on page 54. The first two terms or semesters comprise the "First Year" and some 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 generally 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 Executive Committee of 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 second term 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.

   Note The progress of students' will be reviewed by the examinations and promotions committee at the end of the first term in Year 1. At that time a student may be required to withdraw from the programme should his progress be considered unsatisfactory.

4. For promotion in the third and subsequent terms an overall average of 60% is required in the work of the term.

5. A student allowed to repeat a term will be required to repeat all or part of the work of the term. Where timetables permit, repeating students may be excused from repeating individual courses in which good grades have been obtained, and permitted to register in other appropriate courses.

6. Overall average of grades or standings may be interpreted according to the following:
   75.0-100 First Class Honours
   66.0-74.9 Second Class Honours
   60.0-65.9 Third Class Honours
   Conditional—(Supplemental Examination Required)

7. 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.
Academic Programmes

8. 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.

9. 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.

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 privilege. Doctors' certificates, or other documents indicating reasons for absence from examinations must be filed in the Office of the Registrar by one week after the last day of examinations.

11. 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.

12. A student may not repeat a given term more than once. Degree requirements must be fulfilled in not more than 10 terms of resident study.

13. Faculty Council may recommend or require a student to withdraw at any time if, in the opinion of the Council, the student is unlikely to profit from further study.

14. A student may take a fourth-year elective as an extra elective in third year. This elective shall not be used in computing the overall average in the term in which it is taken but the grade in it may be transferred, at the discretion of the Department, to the term in which it would normally be taken and used in computing the overall average for that term. For such an elective to be recognized as an extra, it must be so indicated and approved by the student's Department Head at registration or before the end of the normal "Change Period", which is a period of two weeks at the beginning of each term.

15. A student who withdraws from the programme shall be considered to have failed that specific year or term, if such withdrawal takes place after the date four weeks prior to the commencement of final examinations in that year or term.

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 products, 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-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—Engineering students

(For Admission Requirements see page 55)

All students enrolling in Year I are required to register for the following courses:

Mathematics 12
Mathematics 21
Physics 11
Chemistry 11
An introductory course in social sciences and humanities.

Students who are intending to pursue a course of study in the Department of Chemical Engineering should register for:

Chemical Engineering 10

All other students are required to register for

Engineering I
Course Arrangement

<table>
<thead>
<tr>
<th>Course</th>
<th>First Term</th>
<th>Second Term</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lect. lab./prob.</td>
<td>tut</td>
</tr>
<tr>
<td>Math 12 Calculus I</td>
<td>2 3*</td>
<td>2 3*</td>
</tr>
<tr>
<td>Math 21 Algebra and Solid Geometry</td>
<td>2 3*</td>
<td>3*</td>
</tr>
<tr>
<td>Physics I Physics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chem. II General Chemistry</td>
<td>2 3*</td>
<td>3 3* 2*</td>
</tr>
<tr>
<td>Eng. I GE21 Graphics I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>GE22 Graphics II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GE23 Measurement</td>
<td>3*</td>
<td></td>
</tr>
<tr>
<td>GE11 Synthesis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ch.E. 10</td>
<td>2 3</td>
<td>2 3</td>
</tr>
<tr>
<td>GE 24 Tutorial</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Introduction to Social Sciences and Humanities</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Note
signifies a course given on alternate weeks. Detailed course descriptions commence on page 145.

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

It should be noted that students who wish to transfer into the Department of Chemical Engineering at the end of Year I from the general Engineering Year I are free to do so. Similarly, students who have selected the Chemical Engineering option in Year I are free to transfer into the programmes of the Departments of Civil, Electrical, and Mechanical Engineering in Year II.

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 transformations 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, enable 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 the biochemical, extractive metallurgical or polymer industries, or towards more intensive studies in control and optimization theory, or the theory of transport phenomena. 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>Proh.</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>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>Proh.</th>
</tr>
</thead>
<tbody>
<tr>
<td>G.E. 32 Fluid Mechanics (Transport Processes I)&amp; 3</td>
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<td>G.E. 61 Philosophy of Science</td>
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<tr>
<td>E.E. 12 Electricity and Magnetism I</td>
<td>2</td>
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<tr>
<td>E.E. 13 Electricity and Magnetism II</td>
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<td></td>
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<tr>
<td>Ch.E. 10 Chem. Process Principles I</td>
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<tr>
<td>Ch.E. 12 Chem. Process Principles II</td>
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<td>Ch.E. 16 Inorganic Chemistry</td>
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<tr>
<td>Ch.E. 17 Applied Mathematics I</td>
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<tr>
<td>Ch.E. 18 Engineering Statistics</td>
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<td>3</td>
</tr>
<tr>
<td>Ch.E. 22 Transport Processes II</td>
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<tr>
<td>Ch.E. 23 Transport Processes III</td>
<td>3</td>
<td></td>
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<tr>
<td>Ch.E. 31 Physical-Chemical Principles I</td>
<td>3</td>
<td></td>
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<tr>
<td>Ch.E. 32 Thermodynamics I</td>
<td>3</td>
<td>2*</td>
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<tr>
<td>Ch.E. 33 Thermodynamics II</td>
<td>3</td>
<td></td>
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<tr>
<td>Ch.E. 36 Physical-Chemical Laboratory</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Ch.E. 41 Reaction Kinetics I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Ch.E. 42 Reaction Kinetics II</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Ch.E. 51 Process Dynamics and Control I</td>
<td>3</td>
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<td>Ch.E. 61 Engineering Economics</td>
<td>3</td>
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<tr>
<td>Ch.E. 62 Process System Design</td>
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<td>3</td>
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<tr>
<td>Ch.E. 71 Chemical Engineering Lab. I</td>
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<tr>
<td>Ch.E. 72 Chemical Engineering Lab. II</td>
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<tr>
<td>Ch.E. 91 Seminar</td>
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</tr>
</tbody>
</table>
B. Elective Courses

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. One course (three hours) should be chosen from non-technical electives in the humanities or social sciences. The equivalent of five courses are to be technical electives, and three of these are to be selected from any one of the optional groups listed below. The other electives 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. 535 Estimation of Physical Properties of Gas and Liquids
Ch.E. 543 Reactor Design and Catalysis
Ch.E. 554 Chem. Eng. Analysis

(II) Polymer Science
Ch.E. 80 Polymer Chemistry
Ch.E. 81 Physical Chemistry of Polymers
Ch.E. 82 Polymer Processing

(III) Extractive and Process Metallurgy
Ch. E. 85 Chemical Metallurgy
Ch. E. 587 Metallurgy of Iron and Steel
An additional approved course

(IV) Systems Option
Ch.E. 554 Chem. Eng. Analysis
Ch.E. 552 Process Dynamics and Control II
Ch.E. 650 or on approved course from management Science or Mathematics

(V) Biochemical Engineering
Ch.E. 590 Biochemical Engineering Processes
Ch.E. 591 Industrial Microbiology
One additional elective selected in consultation with Department

(VI) 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 (1968/69)

Chemical Engineering

Year IIA. Fall 1968-Winter 1969
Math. 22
Math. 23
E.E. 12
Chem. 22
Chem. 26
Ch.E. 11
Ch.E. 31
Ch.E. 36
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 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 sanitisation and design of municipal facilities.

(c) **Transportation Engineering**—is intended for the student interested in the planning, design, construction and operation of streets and highways and other modes of transportation.

(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 a 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.

(g) **Experimental Mechanics**—for students with an interest in the rheology of materials used in experimental mechanics.

(h) **Materials**—is intended to provide the student interested in structural engineering, mechanics or properties of materials with a background in materials science.

**A. Core Programme**

**a. Engineering Courses**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.E. 10</td>
<td>Electricity and Magnetism</td>
</tr>
<tr>
<td>G.E. 31</td>
<td>Thermodynamics</td>
</tr>
<tr>
<td>G.E. 32</td>
<td>Fluid Mechanics</td>
</tr>
<tr>
<td>G.E. 41</td>
<td>Mechanics of Deformable Solids I</td>
</tr>
<tr>
<td>G.E. 42</td>
<td>Kinematics and Dynamics</td>
</tr>
<tr>
<td>G.E. 53</td>
<td>Structure and Properties of Materials I</td>
</tr>
<tr>
<td>G.E. 54</td>
<td>Structure and Properties of Materials II</td>
</tr>
<tr>
<td>G.E. 61</td>
<td>History and Philosophy of Science</td>
</tr>
</tbody>
</table>

**b. Civil Engineering Core Courses**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.E. 221</td>
<td>Calculus II</td>
</tr>
<tr>
<td>C.E. 222</td>
<td>Differential Equations</td>
</tr>
<tr>
<td>C.E. 223</td>
<td>Computer Programming</td>
</tr>
<tr>
<td>C.E. 232</td>
<td>Economics and Social Sciences</td>
</tr>
<tr>
<td>C.E. 241</td>
<td>Survey Camp</td>
</tr>
<tr>
<td>C.E. 301</td>
<td>Mechanics of Deformable Solids II</td>
</tr>
<tr>
<td>C.E. 303</td>
<td>Structural Analysis I</td>
</tr>
</tbody>
</table>
Elective Courses

The technical electives, two in number, may be selected from the list below in consultation with a Civil Engineering Faculty advisor.

C.E. 304 Structural Analysis II
C.E. 320 Statistics
C.E. 322 Engineering Analysis
C.E. 351 Hydraulics
C.E. 361 Urban Planning
C.E. 371 Geology for Engineers
C.E. 372 Soil Mechanics
C.E. 400 Project
C.E. 452 Water Resources Engineering
C.E. 461 Transportation Engineering
C.E. 481 Engineering Law
C.E. 500 Project

B. Elective Courses

The technical electives, two in number, may be selected from the list below in consultation with a Civil Engineering Faculty advisor.

C.E. 34 Reinforced Concrete II
C.E. 35 Design of Steel Structures
C.E. 62 Highway Engineering
C.E. 63 Pavement Materials
C.E. 64 Pavement Structural Design
C.E. 78 Hydraulic Structures
C.E. 321 Applied Mathematics
C.E. 401 Structural Steel
C.E. 402 Reinforced Concrete I
C.E. 471 Soil Engineering
C.E. 605 Mechanical Behaviour of Materials
C.E. 606 Fatigue Behaviour of Metals
C.E. 607 Advanced Mechanics of Materials
C.E. 608 Advanced Analysis of Structures
C.E. 609 Stability and Dynamics of Structures
C.E. 610 Inelastic Behaviour of Ductile Members and Structures
C.E. 611 Elementary Mechanics of Continua
C.E. 612 Experimental Mechanics
C.E. 613 Mathematical Methods in Applied Mechanics
C.E. 625 Failure in Metal Assemblies
C.E. 631 Introduction to Experimental Strength Analysis
C.E. 632 Physical Basis of Mechanical Model Studies
C.E. 640 Highway Engineering (Planning and Design)
C.E. 645 Highway Planning
C.E. 647 Geometric Design
C.E. 658 Soil Engineering
C.E. 664 Engineering Aspects of Surficial Soils
C.E. 686 Engineering Hydrology
C.E. 689 Open Channel Hydraulics
Civil Engineering

Academic Programmes for Each Term (1968-69) Civil Engineering

Year IIA. Fall 1968
C.E. 241
C.E. 232
G.E. 41
C.E. 221
E.E. 10
Problems

Year IIA. Winter 1969
C.E. 232
G.E. 41
C.E. 221
E.E. 10
Problems

Year IIB. Fall 1968
G.E. 31
G.E. 42
C.E. 222
C.E. 223
C.E. 241
C.E. 301
Problems

Year IIB. Summer 1969
C.E. 222
G.E. 31
G.E. 42
C.E. 223
C.E. 301

Year IIIA. Summer 1969
G.E. 32
G.E. 53
C.E. 303
C.E. 320
C.E. 371
C.E. 361

Year IIIA. Winter 1969
G.E. 53
G.E. 32
C.E. 320
C.E. 303
C.E. 371
C.E. 361
Year IIIB. Fall 1968
G.E. 54
C.E. 322
C.E. 351
C.E. 372
C.E. 304

Year IIIB. Winter 1969
C.E. 322
C.E. 351
C.E. 304
C.E. 372
G.E. 54

Year IVA. Fall 1968
C.E. 400
C.E. 361
C.E. 461
G.E. 61
Either
C.E. 401
C.E. 402
C.E. 471
or
C.E. 607
C.E. 608
C.E. 609

Year IVA. Summer 1969
C.E. 400
C.E. 452
C.E. 461
G.E. 61
Either
C.E. 401
C.E. 402
C.E. 471
or
C.E. 607
C.E. 608
C.E. 609

Year IVB. Winter 1969
C.E. 500
C.E. 481
C.E. 452
3 Technical Electives
Department of Design

The Department of Design offers post graduate programmes in Environmental Design leading to the degrees of Master of Applied Science and Doctor of Philosophy. The department is unique in that it brings together various academic disciplines to achieve an educational balance between, on the one hand, research and the development of the theory and methodology of design, and on the other the application of the design process to the ever-increasing complexity of the human physical environment.

The programmes consist of Department of Design course work, electives from 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.

In general the department recognizes three general divisions of the human environment, namely:

the visual and communication environment,
the industrial products environment,
the structural spatial environment.

Research is being carried forward in these areas, with particular projects presently encompassing the following, among other topics:

Computer Graphics
Educational Films and Teaching Aids
Computer Generated Animated Film
Exhibition Design
Specifications for mass residence accommodation
Resource allocation for under-developed regions
High Speed Photographic Techniques, etc.

The Master of Applied Science Programme

The Master's programme is open to candidates who can satisfy the general requirements for admission to graduate studies and the requirements of the Admissions 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:

   Architecture          Engineering          Graphics
   Communication         Economics          Sociology
   Geography             Psychology
   Commerce              Industrial Design

2. Evidence of the candidate's interest and/or experience in Environmental Design through previous course work or as practical experience.
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 including Design 604, Design Morphology and Organization. (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 the 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 Doctor of Philosophy Programme

(a) Admission requirements—In addition to the general admission requirements for graduate studies at the University of Waterloo an applicant for this programme must submit evidence that he has successfully completed a Master's degree in one of the following or related general areas:

(a) Architecture  (f) Geography
(b) Commerce      (g) Graphics
(c) Communication (h) Industrial Design
(d) Economics     (i) Psychology
(e) Engineering   (j) Sociology

Additionally, certain minimum standards must be attained in subjects related to the sciences and engineering, and "make-up" work is frequently required by new graduate students entering the Ph.D. programme from outside the Department of Design.

(b) Graduate Course requirements—In order to obtain the Ph.D. degree in Environmental Design, and in addition to the doctoral thesis and other requirements, the candidate must show evidence of successful completion of the following courses or their equivalent (some of the courses may have been completed in fulfillment of the requirements for a master's degree):

(a) Design 604 Design Morphology and Organization.
(b) At least two other courses from Group A (see courses offered).
(c) At least one course from Group B (see courses offered).
(d) Other courses numbered 601 or above as specified by the candidate's supervising committee.

(c) Dissertation—The candidate's dissertation shall:

(a) embody the results of independent original research work done by the candidate,
(b) contribute substantially to the general fields of design methodology or design theory or both,
(c) contain normally an original design.

(d) Further requirements—In addition to the graduate course requirements and the dissertation, a candidate for the Ph.D. in environmental design shall satisfy the foreign language requirements of the University of Waterloo, and must successfully pass
an oral comprehensive examination conducted by the Department of Design after completion of the graduate course requirements.

The Diploma Programme
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 successfully meet the course requirements.
2. Evidence from prior education or experience that the student has an interest and has exhibited some skill in one of the areas shown under Admission Requirements.

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

By his ingenuity and inventiveness, the engineer utilizes the resources and forces of nature, to provide goods and services for mankind. Some of the areas in which he works are research, development, design, production, sales, service, management, etc. The specialities in electrical engineering are very numerous. Some of these are Electronics, Electro-mechanical Energy Conversion, Radio Communications, Sound and Audio, Computers, Antennas and Microwaves, Circuit Theory, Instrumentation, Control Systems, Bio-Medical Engineering, Ultrasonics, etc.

Because the scope of electrical engineering is so broad, it is not feasible to specialize to any appreciable degree in the undergraduate programme. Consequently emphasis is placed on fundamentals, especially mathematics and physics. Some degree of specialization is provided in the latter half of the fourth year by a choice of options.
### A. Core Programme

#### a. Mathematics and Science Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Math. 22</td>
<td>Calculus II</td>
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</tr>
<tr>
<td>Math. 23</td>
<td>Numerical Methods</td>
<td>1 2</td>
</tr>
<tr>
<td>Math. 31</td>
<td>Differential Equations</td>
<td>3</td>
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<td>Math. 32</td>
<td>Numerical Analysis</td>
<td>2 2</td>
</tr>
<tr>
<td>Math. 33</td>
<td>Differential Calculus</td>
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</tr>
<tr>
<td>Math. 34</td>
<td>Integral Calculus</td>
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</tr>
<tr>
<td>Math. 44</td>
<td>Complex Variables</td>
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<tr>
<td>Phys. 15</td>
<td>Modern Physics</td>
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</table>

#### b. Engineering Courses

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<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
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<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 2</td>
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<tr>
<td>G.E. 41</td>
<td>Mechanics of Deformable Solids I</td>
<td>2 2</td>
</tr>
<tr>
<td>G.E. 42</td>
<td>Dynamics</td>
<td>2 1</td>
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<tr>
<td>E.E. 12</td>
<td>Electrical Circuits</td>
<td>3 3 2</td>
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<td>E.E. 13</td>
<td>Electricity and Magnetism</td>
<td>3 3** 1</td>
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<tr>
<td>E.E. 21</td>
<td>Probability and Reliability Theory</td>
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<tr>
<td>E.E. 25</td>
<td>Application of Electronic Computers</td>
<td>3 3*</td>
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<tr>
<td>E.E. 26</td>
<td>Design of Computing Machines</td>
<td>3 3**</td>
</tr>
<tr>
<td>E.E. 33</td>
<td>Physical Electronics</td>
<td>3 2</td>
</tr>
<tr>
<td>F.F. 34</td>
<td>Physical Properties of Materials</td>
<td>3</td>
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<tr>
<td>E.E. 42</td>
<td>Network Theory I</td>
<td>2 3*</td>
</tr>
<tr>
<td>E.E. 543</td>
<td>Network Theory II</td>
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</tr>
<tr>
<td>E.E. 51</td>
<td>Electronics I</td>
<td>2 3*</td>
</tr>
<tr>
<td>E.E. 52</td>
<td>Electronics II</td>
<td>2 3*</td>
</tr>
<tr>
<td>E.E. 61</td>
<td>Electrodynmamic Energy Conversion</td>
<td>2 3* 1</td>
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<td>E.E. 62</td>
<td>Electromechanics</td>
<td>2 3*</td>
</tr>
<tr>
<td>E.E. 76</td>
<td>Electromagnetic Fields</td>
<td>3 3*</td>
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<tr>
<td>E.E. 77</td>
<td>Transmission Lines and Waveguides</td>
<td>3 3**</td>
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<tr>
<td>E.E. 81</td>
<td>Control Systems I</td>
<td>3 3**</td>
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<tr>
<td>E.E. 99</td>
<td>Project</td>
<td>- 8</td>
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</table>

#### c. Non-Technical Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tr>
<td></td>
<td>Arts elective</td>
<td>3</td>
</tr>
</tbody>
</table>

### B. Option areas (one to be chosen)

1. **E.E.** 28 Communication Theory 3 -
   - E.E. 35 Solid State Electronics 3 -
   - E.E. 44 Pulse and Switching Circuits 3 3**
   - E.E. 578 Microwave Engineering 3 -

2. **E.E.** 28 Communication Theory 3 -
   - E.E. 529 Communication of Information 3 -
   - E.E. 44 Pulse and Switching Circuits 3 3**
   - E.E. 582 Control Systems II 3 -
### Academic Programmes for Each Term (1968/69) Electrical Engineering

#### Year IIA. Fall 1968-Winter 1969
- Math. 22
- Math. 23
- G.E. 41
- G.E. 42
- E.E. 12
- arts elective

#### Year IIB. Fall 1968-Summer 1969
- Math. 31
- Math. 32
- Phys. 15
- G.E. 12
- G.E. 31
- E.E. 13

#### Year IIIA. Winter 1969-Summer 1970
- Math. 33
- Math. 34
- E.E. 33
- E.E. 42
- E.E. 51
- E.E. 61

#### Year IIIB. Fall 1968-Winter 1969
- Math. 44
- E.E. 25
- E.E. 34
- E.E. 52
- E.E. 62
- E.E. 76

#### Year IVA. Fall 1968-Summer 1969
- E.E. 21
- G.E. 61
- E.E. 26
- E.E. 77
- E.E. 81
- E.E. 99

#### Year IV IB. Winter 1969
- E.E. 543
- E.E. 99
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 fundamental 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 inter-related 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) **Solid Body Mechanics and Mechanical Design Option** The courses offered in this option range from those which provide the mathematical and physical basis of the subject matter through to those which are largely applied. Subjects treated are: mechanics (including vibrations); theories of elasticity, plasticity and fracture; choice of working stress, mechanical design and design optimization. Students taking this option will be prepared for careers in design and development, or graduate study.
(c) **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.

(d) **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.

(e) **General Mechanical Engineering Option** The General Mechanical Engineering Option is designed to give the student a general background rather than specialize in any particular option. The course material has been carefully chosen to equip the student for a broad range of Mechanical Engineering practice including research.

### A. Core Programme

<table>
<thead>
<tr>
<th>Course</th>
<th>Lab. or Lect.</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>a. Mathematics and Science Courses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math. 22 Calculus II</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Math. 23 Numerical Methods</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Math. 31 Differential Equations</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Math. 32 Numerical Analysis</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Math. 41 Applied Analysis</td>
<td>3</td>
<td>-</td>
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<table>
<thead>
<tr>
<th>Course</th>
<th>Lab. or Lect.</th>
<th>Prob.</th>
</tr>
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<tbody>
<tr>
<td><strong>b. Engineering Courses</strong></td>
<td></td>
<td></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>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. 60 Control Systems</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>M.E. 62 Fluid Mechanics II</td>
<td>3</td>
<td>-</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. 301 Mechanics of Deformable Solids II</td>
<td>2</td>
<td>-</td>
</tr>
</tbody>
</table>

75
c. Non-Technical Courses
M.E. 61 History and Philosophy of Science 3 -
Two Arts Electives 6 -

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. Choices of electives generally should be restricted to those offered in a single option, however, other electives may be chosen, if good reasons exist. All choices of electives must be approved by a designated faculty member.

a. Thermodynamics—Fluid Mechanics Option
ME 54 Thermodynamics II
ME 55 Thermodynamics III
ME 56 Heat Transfer II
ME 57 Combustion I
ME 58 Internal Combustion Engines
ME 59 Energy Conversion
ME 63 Turbomachines
ME 64 Industrial Aerodynamics
ME 65 Gas Dynamics I
ME 66 Turbulent Flow I
ME 67 Aerodynamics of Flight
ME 68 Acoustics

b. Solid Body Mechanics and Mechanical Design Option
ME 22 Mechanical Design I
ME 23 Mechanical Design II
ME 24 Advanced Dynamics
ME 25 Mechanical Vibrations
ME 26 Mechanical Design III-Human Factors
ME 27 Mechanics of Deformable Solids III
ME 49 Metrology
ME 625 Experimental Mechanics
GE 13 Management Science I
GE 14 Statistics in Engineering & Management
Math 55 Digital Computer Programming

c. Manufacturing Sciences Option
1 Metals
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. 49 Metrology
M.E. 31 Physical Metallurgy I
M.E. 22 Mechanical Design I

76
ii Plastics
Chem. 55 Polymer Chemistry
Ch.E. 81 Physical Chemistry of Polymers
Ch. E. 607 Non-Newtonian Flow
M.E. 647 Manufacturing Science VII

iii Industrial Engineering
G.E. 13 Management Science I
G.E. 14 Statistics in Engineering and Management
M.E. 26 Mechanical Design III (Human Factors)
M.S. 618 People, Machines and Organisations
M.S. 630 Introduction to Production
Math. 55 Digital Computer Programming

d. Engineering Materials Option
Mechanical Engineering Electives:
ME 31 Physical Metallurgy I
ME 32 Physical Metallurgy II
ME 33 Materials Science Laboratories
ME 37 Ceramics
ME 641 Mechanical Metallurgy

Suggested electives from other options and departments
ME 22 Mechanical Design I
ME 26 Human Factors Engineering
ME 27 Mechanics of Deformable Solids III
ME 41 Manufacturing Science I (Plasticity)
ME 44 Manufacturing Science V (Welding)
ME 56 Heat Transfer II
Chem 25 Polymer Chemistry and Physics
CE 611 Elementary Mechanics of Continua
Ch.E. 683 Mechanical Properties of Polymers

e. General Mechanical Engineering Option
ME 32 Physical Metallurgy II
ME 41 Manufacturing Science I
ME 56 Heat Transfer II
ME 63 Turbo Machines
ME 22 Mechanical Design I
ME 625 Experimental Mechanics

1 Technical Electives.

Mechanical Engineering
Year IIA. Fall 1968 and Winter 1969
Math. 22
Math. 23
E.E. 12
G.E. 41
M.E. 13
G.E. 42

77
Year IIB. Summer 1968 and Fall 1968
Math. 32
Math. 31
E.E. 13
G.E. 31
G.E. 53
E.E. 32

Year IIIA. Winter 1969 and Summer 1969
G.E. 54
G.E. 32
M.E. 21
C.E. 301
Math 41

Year IIIB. Fall 1968 and Winter 1969
M.E. 53
M.E. 60
Math 41
2 Technical electives
Arts elective

Year IVA. Fall 1968 and Summer 1968
G.E. 61 or M.E. 60
M.E. 82
2 Technical electives
Math. 32
M.E.

Year IVB. Winter 1969
M.E. 81
M.E. 82
3 Technical electives
Arts elective

Programme in Environmental Studies and Architecture

In the fall term of 1967 the university initiated a programme in Environmental Studies and Architecture. Currently this programme is being administered by the Faculty of Engineering through the Department of Design. As it develops it will become a separate organizational identity in the university. This is a programme which is intended to prepare students for entry into the profession of Architecture while at the same time giving a broad pre-professional base in academic studies with an orientation toward problems of environmental design. The opportunity is offered for students not wishing to continue to the professional degree in Architecture to branch into advanced studies related to other area of environmental design.
Environmental Studies and Architecture

Degrees
Environmental Studies consist of six terms of pre-professional studies leading to the Degree of Bachelor of Environmental Studies (B.E.S.). This degree is considered as appropriate preparation for five subsequent terms of study leading to the professional degree of Bachelor of Architecture (B.Arch.) or for entry to the two year Master of Applied Science (M.A.Sc.) programme in the Department of Design.

Cooperative Programme
The programme provides six terms of study and five terms of employment during the Bachelor of Environmental Studies programme and five terms of study and five terms of employment during the subsequent Bachelor of Architecture programme. These are arranged as shown in the diagram below.

Bachelor Environmental Studies

<table>
<thead>
<tr>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Winter</td>
<td>Spring</td>
<td>Fall</td>
<td>Winter</td>
</tr>
<tr>
<td>1st Term</td>
<td>Work Period</td>
<td>2nd Term</td>
<td>Work Period</td>
<td>3rd Term</td>
</tr>
</tbody>
</table>

Bachelor of Architecture

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring</td>
<td>Fall</td>
<td>Winter</td>
<td>Spring</td>
</tr>
<tr>
<td>From B.E.S.</td>
<td>Work Period</td>
<td>1st Term</td>
<td>Work Double Period</td>
</tr>
</tbody>
</table>

For students who may choose a two year M.A.Sc. programme in the Department of Design following the B.E.S. the arrangement of terms is as in regular or cooperative studies in Engineering.

Terms available in 1968-1969
In 1968-69 the first, second and third terms in the B.E.S. programme will be available as well as M.A.Sc. graduate work in the Department of Design. In subsequent years further terms will be added. Admission on the basis of advanced standing is available only to those terms being offered in 1968-69.

Admission and Registration

General
Application for admission to the Programme of Environmental Studies should be made as early in the year as possible. Students currently enrolled full time in Ontario Grade 13 must apply on the "General Application for Admission to University" form which can be obtained from the Secondary School. All other applicants may obtain application forms directly from 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 have been submitted. Applicants currently enrolled in Ontario Grade 13 and who wish to be considered for Early Final Admission must apply before March 15, 1968. All other applicants must apply and have submitted all the necessary documents by August 1, 1968. Persons applying after this date cannot be guaranteed consideration of their application.

Admission to Year I
In order to qualify for admission to the first year of the Environmental Studies programme, the applicant should have completed Ontario Grade 13 or its equivalent, showing a minimum overall average of 60% in the seven required credits and with a minimum overall average of 60% in Mathematics A and Physics. For applicants who have taken more than one year to complete the work of Grade 13, a somewhat higher average may be required.

Standing is required in seven Grade 13 credits as follows:

- Three credits from: Mathematics A
  - Physics

- Two credits from: Biology
  - Chemistry
  - Geography
  - History
  - Mathematics B

- Two additional credits.

Additional credits can be selected from any of the optional subjects offered at the Grade 13 level with the qualification that no more than one of the following may be counted as an "additional" credit: Accountancy Practice, Art, Home Economics, Mathematics of Investment, Music, or Secretarial Practice. The marks received in one of these subjects 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 credit" on the same terms as these subjects except the marks received will not be computed in the average.

Note 1
Ontario Tests for Admission to College and University (OACU)
All Grade 13 applicants will be required to submit the results of the Ontario Scholastic Aptitude Test and of such Ontario Achievement Tests as are offered in Grade 13 credits presented for admission.

Note 2
If English is not chosen as a Grade 13 subject offered for admission, applicants must have standing in English at the Grade 12 level.

Note 3
The University will use the following definition of credits for admission purposes:
- 3 credits—Mathematics A and Mathematics B combined
- 2 credits—All language subjects, Mathematics A
- 1 credit—All other subjects.
Early Final Admission

Students enrolled full time in Ontario Grade 13 will be considered for Early Final Admission. To be eligible for consideration, applicants must arrange to have the “General Application for Admission to University” form submitted by March 15, 1968. Consideration of candidates for Early Final Admission will be based on the Secondary School record, the Principal’s Recommendation, and the results of the Ontario Scholastic Aptitude Test and specified Achievement Tests. Successful applicants may expect to be notified after May 15, 1968, of their acceptance and will be asked to indicate their decision by June 15, 1968. Those applicants who are not offered Early Final Admission will be considered on the basis of the Grade 13 final results and will be notified as soon as possible after the release of the Grade 13 results.

Note

All applicants will be required to complete Grade 13 to the satisfaction of the Secondary School principal. The following certificates, recognized as being equivalent to the Ontario Grade 13 certificate, may be accepted insofar as they meet the admission requirements of the University of Waterloo in subjects and percentages:

- Alberta
- British Columbia
- Manitoba
- New Brunswick
- Newfoundland
- Nova Scotia
- Prince Edward Island
- Quebec
- Saskatchewan
- England and Wales, West Indies, East and West Africa
- Scotland
- United States of America

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. It is recommended that applicants attempt to obtain standing in Ontario Grade 13 level Mathematics and Physics subjects or their equivalent. 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 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 11, 12 and 13, Environmental Studies Programme

Fees
Refer to Section X page 380

Examinations and Promotions
The regulations of the Faculty of Engineering governing examinations and promotions apply to students registered in the Environmental Studies programme with the following exceptions: page 58

Regulation 12 is changed to require a student in the B.E.S. programme to fulfill the requirements for the degree to be completed in no more than 8 terms of resident study.
Regulation 14 page 59 is deleted.

Academic Programme
In the context of the present complex technological, social and aesthetic environment, the architect and designer are called upon to exhibit not only a sensitive and highly developed aesthetic capability but also a competent understanding of technological and social phenomena. He must be capable of creative and original work which contains those elements of insight which will ensure that his creations fit into the environment and are neither physical, economic nor social failures.

The programme being offered attempts to expose the student not only to the traditional approaches to design but also to the rigor of modern analytic and quantitative methods. In entering the course the student should be prepared to develop a basic understanding of five subject areas.
1. The physical sciences (ES100, ES200, ES300)
2. Analytic and quantitative methods (ES110, ES210, ES310)
3. Physiological and psychological characteristics of human behavior (ES120, ES220, ES320)
4. Historical and cultural characteristics of the human environment (ES130, ES230, ES330)
5. Design theories and methods (ES140, ES240, ES340)

In the programme these five subject areas are developed and amplified by studies of the techniques (ES150, ES250, ES350) associated with each area and by studio problem solving (ES10, ES20, ES30) which requires the utilization of insight gained in the subject areas. Each of the subject areas along with techniques and studio work are studied each year. Various topics considered appropriate to the subject areas are dealt with in each year. In the last year of the B.E.S. programme the student may also choose optional topics for study in an area of special interest to him. In the five terms of the B.Arch programme the subject areas 1 and 2 are combined under the heading “Studies of the Physical Systems”, (Arch I) subject areas 3 and 4 are combined under the heading “Studies of the Human Social Systems”, (Arch II) and subject area 4 is combined with the techniques course under the heading “Architectural Practice”, (Arch III). At all levels the studio work is present (Arch Problems Level 1, 2 & 3 and thesis) and in the B.Arch. programme the optional portion is expanded and given more emphasis. The particular topics considered in each subject area in the first year of the B.E.S. programme are listed in the Course Descriptions of the Department of Design (Page 196).
| Term | 0  | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | 11  | 12  | 13  | 14  | 15  | 16  | 17  | 18  | 19  | 20  | 21  | 22  | 23  | 24  | 25  | 26  | 27  | 28  |
|------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1    | ES 100 | ES 110 | ES 120 | ES 130 | ES 140 | ES 150 | ES 10 |
| 2    | ES 100 | ES 110 | ES 120 | ES 130 | ES 140 | ES 150 | ES 10 |
| 3    | ES 200 | ES 210 | ES 220 | ES 230 | ES 240 | ES 250 | ES 20 |
| 4    | ES 200 | ES 210 | ES 220 | ES 230 | ES 240 | ES 250 | ES 20 |
| 5    | ES 300 | ES 310 | ES 320 | ES 330 | ES 340 | ES 350 | Option | ES 30 |
| 6    | ES 300 | ES 310 | ES 320 | ES 330 | ES 340 | ES 350 | Option | ES 30 |
| 7    | Arch I | Arch II | Arch III | Option | Arch Problems Level 1 |
| 8    | Arch I | Arch II | Arch III | Option | Level 2 |
| 9    | Arch I | Arch II | Arch III | Option | Level 3 |
| 10   | Arch I | Arch II | Arch III | Option | Thesis |
| 11   | Arch I | Arch II | Arch III | Option | Thesis |

B.E.S.

- Physical Systems
- Social Systems
- Professional Studies
- Optional Courses
- Studio and Problems

For course descriptions in Environment Studies, year 1, see the Department of Design.

The following chart illustrates the approximate time devoted to each topic area in each of the terms.
The Faculty of Mathematics
The Faculty of Mathematics

The Faculty of Mathematics of the University of Waterloo has only been inaugurated as a separate faculty since 1966. However, general and honours programmes in Mathematics have been offered through the Faculties of Arts and Science for a number of years. The continued growth and development of these programmes has made it natural to unite them under one faculty. At the same time, this unification has led to greater flexibility in choice of electives.

Previously, entering students selected a General or Honours Mathematics programme with Arts electives, or a General or Honours Mathematics programme with Science electives (most frequently Physics electives), or the Co-operative Honours Mathematics programme for those with an interest in Actuarial Mathematics or Computer Science. Now, in the Faculty of Mathematics, all these possibilities, together with numerous others, are still open to mathematics students.

Professor Richard Courant, one of the most distinguished of living mathematicians, recently gave an evaluation of the role of mathematics in the modern world as follows.

"The expanding role of mathematics in the modern world is vividly reflected in the proliferation of mathematicians. Since 1900 memberships in the several professional mathematical organizations in the U.S. have multiplied by an estimated 30 times. Today the number qualified by the doctorate stands at 4,800. During the past 25 years the number of mathematicians at work outside the Universities in industry and Government has increased twelve-fold. Activities of a more or less mathematical character now employ tens of thousands of workers at all levels of competence. In
The Faculty of Mathematics

colleges three times as many undergraduates were majoring in mathematics in 1962 as in 1956. Mathematics is no longer the pre-occupation of an academic elite; it is a broad profession attracting talented men and women in increasing numbers. The scope of mathematical research and teaching has been greatly extended in the present period and mathematical techniques have penetrated deep into fields outside the mathematical sciences such as Physics, into new realms of technology, into the biological sciences and even into economics and the other social sciences. Computing machines and computing techniques have stimulated areas of research with obviously enormous and as yet only partly understood importance for mathematics itself and for all sciences with inherent mathematical elements."

Certainly Professor Courant's remarks are borne out by mathematical developments at the University of Waterloo. Each year entering students come in with additional secondary school background, and the enrollments in classical areas of pure and applied mathematics are rapidly increasing at almost the same rate as enrollments in the newer technological areas of statistics and computer science.

The University of Waterloo has pioneered in making courses in Computer Science readily available, from the very first year, to Mathematics students. On the other hand, even students specializing in this area are required to obtain a wide knowledge of other mathematical background.

Graduate work in the Faculty of Mathematics is very active. A large number of graduate degrees have been conferred, and active research is carried on in many areas. Further information is given later in the Calendar in the sections devoted to undergraduates and graduate course descriptions.

Faculty of Mathematics Brochure

Students requiring further information should contact the Dean of the Faculty of Mathematics. The Faculty also publishes a brochure largely devoted to a discussion of mathematical careers, and detailed information concerning the Co-operative Mathematics programme and other programmes in the Faculty of Mathematics.

Degrees

Students in the Faculty of Mathematics may take a three-year programme (the General Course) or a four-year programme (the Honours Course). The Co-operative Mathematics course is merely a rearrangement in the scheduling of academic terms so as to permit considerable practical experience.

Students who successfully complete programmes in the Faculty of Mathematics will be awarded the degree of Bachelor of Mathematics (B.Math.), Master of Mathematics (M.Math.), Master of Philosophy (M.Phil.) and Doctor of Philosophy (Ph.D.) by the University. A student may, as the programme descriptions on pages show, specialize in Applied Analysis and Computer Science, Applied Mathematics, Combinatorics and Optimization, Pure Mathematics, or Statistics.
Admission and Registration

General
Application for admission to the Faculty of Mathematics should be made as early in the year as possible. Students currently enrolled full time in Ontario Grade 13 must apply on the “General Application for Admission to University” form which can be obtained from the Secondary School. All other applicants may obtain application forms directly from the Office of the Registrar. Academic certificates (not diplomas) and other supporting documents should be forwarded as soon as they become available.

Applicants should note that both Renison and St. Jerome's Colleges offer programs leading toward the B.Math. degree and that applicants may register for their programs through either Renison or St. Jerome's Colleges.

Admission cannot be granted until all the requirements have been met and all documents have been submitted. Applicants currently enrolled in Ontario Grade 13 and who wish to be considered for Early Final Admission must apply before March 15, 1968. All other applicants must apply and have submitted all the necessary documents by August 1, 1968. Persons applying after this date cannot be guaranteed consideration of their application.

Admission to Year I
In order to qualify for admission to the first year of the Mathematics programme, the applicant should have completed Ontario Grade 13 or its equivalent, showing a minimum overall average of 60% in the seven required credits and with a minimum overall average of 68% in the three credits in Mathematics. For applicants who have taken more than one year to complete the work of Grade 13, a somewhat higher average may be required.

Standing is required in seven Grade 13 credits as follows:
Three credits from Mathematics A
Mathematics B
Four additional credits chosen wherever possible in accordance with the student's proposed major field of study.
Students wishing to take Science electives must present Chemistry and/or Physics among their additional credits.
Students entering the Co-operative programme must have a minimum of 66% in three credits from Mathematics.

Additional credits can be selected from any of the optional subjects offered at the Grade 13 level with the qualification that no more than one of the following may be counted as an "additional" credit: Accountancy Practice, Art, Home Economics, Mathematics of Investment, Music, or Secretarial Practice. The marks received in one of these subjects 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 credit" on the same terms as these subjects except the marks received will not be computed in the average.

Note 1
Ontario Tests for Admission to College and University (OACU)
All Grade 13 applicants will be required to submit the results of the Ontario Scholas-
Admission and Registration

tic Aptitude Test and the Ontario Achievement Test in Mathematics and any other subjects as are available in Grade 13 credits presented for admission.

Note 2
If English is not chosen as a Grade 13 subject offered for admission, applicants must have standing in English at the Grade 12 level.

Note 3
The University will use the following definition of credits for admission purposes.
3 credits—Mathematics A and Mathematics B combined
2 credits—all language subjects, Mathematics A
1 credit—all other subjects

Early Final Admission
Students enrolled full time in Ontario Grade 13 will be considered for Early Final Admission. To be eligible for consideration, applicants must arrange to have the "General Application for Admission to University" form submitted by March 15, 1968. Consideration of candidates for Early Final Admission will be based on the Secondary School record, the Principal's Recommendation, and the results of the Ontario Scholastic Aptitude Test and specified Achievement Tests. Successful applicants may expect to be notified after May 15, 1968, of their acceptance and will be asked to indicate their decision by June 15, 1968. Those applicants who are not offered Early Final Admission will be considered on the basis of the Grade 13 final results and will be notified as soon as possible after the release of the Grade 13 results.

Note
All applicants will be required to complete Grade 13 to the satisfaction of the Secondary School principal.

The following certificates, recognized as being equivalent to the Ontario Grade 13 certificate, may be accepted insofar as they meet the admission requirements of the University of Waterloo in subjects and percentages:

Alberta
British Columbia
Manitoba
New Brunswick
Newfoundland
Nova Scotia
Prince Edward Island
Quebec
Saskatchewan
England Wales, West Indies
East and West Africa
Scotland
United States of America

Senior Matriculation (Grade 12)
Senior Matriculation (Grade 13)
Senior Matriculation (Grade 12)
Senior Matriculation (Grade 13)
Year I Memorial University
Senior Matriculation (Grade 12)
Third Year Certificate from Prince of Wales College
McGill Senior Matriculation or Quebec Senior High School Leaving Certificate
Senior Matriculation (Grade 12)
The General Certificate of Education with passes in at least five subjects, two of which must be at Advanced Level.
The Scottish Certificate of Education
High School Graduation plus an additional year of formal study in subjects comparable to Ontario Grade 13.
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 may apply to enter as an adult student. It is recommended that applicants attempt to obtain standing in Ontario Grade 13 level Mathematics or their equivalent. 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 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.

Transfer Privileges
The first year Mathematics programme is set up so that students who select Physics and Chemistry as elective courses may, on successful completion of Year I, apply for transfer to the second year of the Faculty of Science or the Faculty of Engineering. Similarly, students who complete successfully Year I Science or Year I Engineering may apply for transfer to Year II in the Faculty of Mathematics.

Students who successfully complete Year I Arts and who have taken Mathematics may transfer to Year II of the Faculty of Mathematics. Similarly, students who successfully complete Year I Mathematics may transfer to Year II of the Faculty of Arts.

Registration
September 11, 12 and 13, Faculty of Mathematics

Fees
Refer to Section X page 380
Examinations and Promotions

The Faculty constitutes the examining body for all examinations. The time normally allowed for each examination is three hours.

The following regulations govern the practice of the Faculty of Mathematics 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 are 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>

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

4. To pass his year clear in the General course, a student must pass in all subjects and have 60% average in Mathematics.

5. An over-all standing in each year will be assigned based on the average of the results of the final examinations in the course. It will not be altered by marks obtained in supplemental examinations.

<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>66-74.9</td>
<td>Second Class Honours</td>
<td>B</td>
</tr>
<tr>
<td>60-65.9</td>
<td>Third Class Honours</td>
<td>C</td>
</tr>
<tr>
<td>50-59.9</td>
<td></td>
<td>D</td>
</tr>
</tbody>
</table>

6. In cases where a student has obtained 60% in an Honours course or 50% in a General course, but has failed certain examinations, he may be granted supplemental privileges.

7. Supplemental examinations will be held in July for students in the regular programme. Applications for supplemental examinations must be filed by June 26, 1968, 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.

8. 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. He may be permitted to proceed to the next year, conditioned in one subject, if it is not a prerequisite. If two subjects are failed, the student fails his year.

9. A student who has been promoted with a condition in a subject from a previous year must clear that condition before being promoted further. If the subject is not compulsory, the student may, with permission of the Dean, substitute another subject for one in which he is conditioned.

10. The Committee on Standings and Promotions may require a student in the Gen-
eral course to write a Special Examination in one mathematics paper to improve his average in mathematics.

11. 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 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.

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

13. In cases where a student fails his year, he is normally permitted to repeat. However, if Faculty Council considers that a student will not profit by further study, he is required to withdraw from the Faculty of Mathematics.

14. A student may normally spend only four academic years to complete a three-year programme or five academic years to complete a four-year programme.

15. Continuation in the co-operative programme is contingent upon acceptable performance on the job.

**Academic Programmes, Regular And Co-operative**

**Regular Programmes**

**First Year**
The first year programme is common to all General or Honours courses in Mathematics.

Students will take Mathematics 130, Mathematics 131, Mathematics 132 and three other courses.

According to their fields of interest, students will enter Group A, Group B or Group C.

*Group A*—Students interested in Science electives normally choose Physics 131, Chemistry 131, English 101.

*Group B*—Students interested in Arts electives normally choose English 101, Philosophy 100, Psychology 110.

*Group C*—Students interested in a variety of fields should discuss their elective courses with a Faculty advisor. For example, Physics 131, Philosophy 100, English 101, or a language course, would be a quite permissible selection. Another sample selection would be: Biology 131, History 100, Psychology 110.

The above choices are suggested, but are not compulsory.

**The General Course in Mathematics**

**First Year** Common to General and Honours programmes.

**Second Year** Mathematics 229, 237 and one other mathematics course.

Two electives other than mathematics.

**Third Year** Three mathematics courses and two electives:

The following specialized third year programmes are to be noted:
Academic Programmes

Applied Analysis and Computer Science Programme

Three mathematics courses including
Mathematics 238 if not taken in second year
One or two of Mathematics 334, 340.
Two electives from outside mathematics.

Combinatorics and Optimization Programme

Three mathematics courses including
Mathematics 243
One or two of Mathematics 351 or 352.
Two electives from outside Mathematics.

Teaching Programme

Mathematics 446
Two of Mathematics 236, 238, 243, 329, 330,
334, 340, 352.
Two electives from outside Mathematics.

Honours Courses in Mathematics

Recommended programmes are shown but students should consult the general notes following these programmes.

First Year Common to General and Honours Programme.
Students in Year I of the Faculty of Mathematics not receiving an average of at least 70% in the three mathematics courses should consider proceeding in the General Mathematics programme rather than in the Honours Mathematics programme.

Second Year Mathematics 229, 233
Mathematics 231, 232; or Mathematics 237 and one of Mathematics 234, 238.
Three elective courses, one of which may be another Mathematics course.
At the completion of the second year, students are required to select a programme within which they will continue their studies.

Notes
(1) Students proceeding to Pure Mathematics will normally take Mathematics 231, 232.

(2) Students proceeding to Applied Mathematics will normally take Mathematics 234, 237.

(3) Students proceeding to Computer Science will normally take Mathematics 238.

(4) Students taking Actuarial Science will normally take Mathematics 235.
(5) Students desiring minor fields of specialization should normally include the following choices among their electives:

Physics Minor: Physics 232, 234/6
Biology Minor: Biology 131, 231, 235
Chemistry Minor: Chemistry 231, 235
Philosophy Minor: Philosophy 221/2 or 280/1
Philosophy Minor: Philosophy 240 or 282/3
Other Minors: Consult the Dean of the Faculty and the Chairman of the Department concerned.

The following are recommended programmes for students entering Year III:

**Actuarial Science Programme**

**Third Year**
- Five mathematics courses
  - Mathematics 329, 332, 334, 336
  - One of Mathematics 333, 335, 338, 351, 352
  - Two electives from outside Mathematics.

**Fourth Year**
- Five mathematics courses
  - Mathematics 435, 437, 461
  - Two of Mathematics 427, 438, 439, 440, 446, 452, 454, 457.
  - Two electives from outside Mathematics.

**Applied Mathematics Programme**

**Third Year**
- Mathematics 329, 332, 363
- One of Mathematics 360, 361
- One other mathematics course
- Two electives from outside Mathematics.

**Note**
Students who have not taken Mathematics 234 in Second Year must take this course in Third Year in place of 363.

**Fourth Year**
- Five mathematics courses including Mathematics 462, 470
- Two electives from outside Mathematics.

**Applied Analysis and Computer Science Programme**

**Third Year**
- Five mathematics courses including
  - Mathematics 329, 332 and at least
  - One of Mathematics 334, 340, 363.
  - Two electives from outside Mathematics.
Academic Programmes

Fourth Year
Five mathematics courses to be chosen in consultation with the Department Chairman.
Two electives from outside Mathematics.

Combinatorics and Optimization Programme

Third Year
Five mathematics courses including
Mathematics 329 or 341
One of 332, 342, 343
Mathematics 351
One or both of 345, 352.
Two electives from outside Mathematics.

Fourth Year
Five mathematics courses including
Three or more of Mathematics 451, 452, 453, 454, 455, 457, 458, 459, 460.
Two elective from outside Mathematics.

Pure Mathematics Programme

Third Year
Mathematics 333, 341, 342, 343, 344 and one of 330 (a), 330 (b), 360 (a), 360 (b), 361 (a).
Two electives from outside Mathematics.

Fourth Year
Five mathematics courses including
One of Mathematics 432, 433
One of Mathematics 410, 411, 412.
Two electives from outside Mathematics.

Statistics Programme

Third Year
Mathematics 329, 332, 338
Two additional mathematics courses.
Two electives from outside Mathematics.

Fourth Year
Mathematics 438, 439, 440
Two additional mathematics courses.
Two electives from outside Mathematics.

Teaching Programme

Third Year
Five mathematics courses including
Mathematics 329, 330, 332
Two of Mathematics 334, 351, 352, 340, 234, 235, 238.
Two electives from outside Mathematics.
Fourth Year  Five mathematics courses including
Mathematics 446
One of Mathematics 425, 344, 436
One of Mathematics 427, 451, 452, 453, 454, 455, 457.
Two electives from outside Mathematics.

Honours Mathematics and Economics

Year I  Economics 101/102 or 103/104.
Mathematics 130, 131, 132.
Two electives. (†)
(†) Students registered in the
Faculty of Arts should choose
English 101 and one language or
culture civilization course.

Year II  Economics 201/202 or 203/204.
Economics 230 or 205/206.
Mathematics 229, 233, 237.
Two electives.

Year III  Economics 330 and 340.
One other course in Economics
(except Economics 300).
Mathematics 238, 352.
One other mathematics course to
be chosen in consultation with
Department Chairman.
One other elective.

Year IV  Economics 400 and 460.
One other Economics course chosen
with the consent of the Department.
Mathematics 338, 452.
One other mathematics course chosen
with the consent of the Department.
One elective.

†See also Honours Economics and Mathematics Faculty of Arts.

Honours Mathematics and Philosophy

Year I  Recommended Programme:  Hours
English 101  3
One of Philosophy 221/222 or 280/281  3
A foreign language  3
One course in the social sciences  3
Mathematics 130, 131  6
### Honours Statistics and Psychology

**Year II**
- Mathematics 229, 231, 232: 8
- *One of* Philosophy 221/222 or 280/281: 3
- *One of* Philosophy 240 or 340 or 282/283: 3
- Elective: 3

**Year III**
- Mathematics 330, 332, 233, 234: 10
- *One of* Philosophy 240 or 340 or 282/283: 3
- Philosophy 299 and one other Philosophy course: 4

**Year IV**
- Mathematics 329, 337, 433, 446: 7
- Three Philosophy courses: 9
- 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 221/222 or 281/281 during that year, and should consult the Department concerning rearrangement of their courses.

See also Honours Philosophy and Mathematics Faculty of Arts.

### Honours Statistics and Psychology

**Year I**
- Psychology 150.
- Mathematics 130, 131, 132.
- Two electives.

**Year II**
- Psychology 290.
- Psychology elective.
- Mathematics 229, 233 (substituted for Psychology 280).
- Mathematics 237.
- One elective.

**Year III**
- Psychology 360.
- Psychology elective.
- Mathematics 332, 338.
- One Mathematics elective.
- One other elective.

**Year IV**
- Psychology 430.
- Psychology 499.
- Psychology elective.
- Mathematics 438 or 440.
- Mathematics 439.
- Mathematics elective.

See Honours Psychology and Statistics, Faculty of Arts.
The Co-operative Programme in Honours Mathematics
(Actuarial, Computer Science, Optimization, Statistics, and Teaching Options)

Year I
Students will take Mathematics 130, 131, 132, and three other courses.
According to their fields of interest, students will enter Group A, Group B, or Group C.

Group A Students interested in Science minors normally choose English 15, Chemistry 101, Physics 131.

Group B Students interested in Arts minors normally choose English 15, Philosophy 125, Psychology 111.

Group C Students who wish to take their elective courses in a variety of fields should discuss their problems with a Faculty advisor; they may wish to take some Arts and some Science electives.

Year II
Mathematics 229, 233, 235, 237, 238.
Two elective subjects.

Year III
Mathematics 329, 332, 334.
Mathematics 336 or 340.
One of Mathematics 335, 336, 338, 340 and 352, if not taken above.
Two elective subjects other than Mathematics.

Year IV
Five mathematics courses to be chosen in consultation with the Department Chairman.
Two electives in subjects other than Mathematics.

A wide choice of electives is available in the upper years. These electives are arranged on a year-to-year basis, and the choice broadens as student numbers increase. To date, electives have been available in Economics, English, History, Philosophy, Physics, Chemistry, Political Science, Psychology, Russian Culture, Sociology.

Further details concerning the organization of Co-operative Mathematics are available in the brochure described on page 87.

The Department of Combinatorics and Optimization

The following undergraduate courses are offered by the Department of Combinatorics and Optimization: 345, 351, 352, 451, 452, 453, 454, 455, 457, 458, 459, 460.

The following graduate courses are offered by the Department of Combinatorics and Optimization:

Combinatorics

Combinatorial Analysis (780)
Special Topics in Combinatorial Analysis (799).

Seminar in Combinatorial Analysis (798).

Literature and Research Studies in Combinatorial Analysis or Graph Theory (690).

Combinatorial Graph Theory (782). Selected topics in graph theory and related areas of mathematics will be studied in some depth, emphasising where possible recent developments and promising areas for future research. The topics discussed will probably vary from year to year, but may include for example: existence of Hamiltonian arcs and circuits in graphs and similar problems; determination of the thickness, genus and crossing-number of particular graphs; the dimer problem; percolation processes; well-quasi-ordering problems related to graph theory; matchings in graphs; path problems; smallest regular graphs of given degree and girth.

Matroid Theory (789). Introductory lectures concerning the standard axiomatizations and classical examples of matroids (i.e. incidence geometry, or the theory of combinatorial dependence). Outlines of current research in the combinatorial, algebraic, geometric, latticial and integer-programming schools of matroid theory will be drawn.

Extrema in Graphs (786).

Analytic Graph Theory (783).


Linear Graphs (784). Definitions and basic theorems. Planar graphs and Kuratowski’s theorem. Selected topics from advanced graph theory.

Topics in Graph Theory (797).

Seminar in Graph Theory (796).

Optimization.

Mathematical Operations Research (975). A selection of topics with emphasis on mathematical techniques having direct application to business, industrial, military and scientific problems.

Mathematical Optimization (970). A selection of theoretical mathematical techniques from classical optimization, sequential optimization or mathematical programming, Kuhn-Tucker theory.

Mathematical Programming (972). A selection of topics from non-linear programming, quadratic programming, integer linear programming, stochastic linear programming, dynamic programming and applications.
Directed Graphs and Applications (971). Directed linear graphs with application to operations research, economics, and other pertinent disciplines. Topics include: partial order, Dilworth's theorem, other minimax relationships, duality, relations between matrices and graphs, and network flows.

Network Programming (973). General study of flows and flow algorithms with applications.

Literature and Research Studies in Optimization (690).

Seminar in Mathematical Operations Research (976).

Seminar in Optimization (978).
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. Enrolments increased annually thereafter until they reached a maximum in the autumn of 1966.

With the creation of the Faculty of Mathematics in 1967, most students in the Faculty whose major field was mathematics enrolled in the new Faculty and 1967 registrations in Science appear somewhat smaller than in the preceding year in consequence.

There are five teaching departments in the Faculty of Science: Biology, Chemistry, Earth Sciences, Physics and a newly introduced School of Optometry. Extensive instruction is also given by members of the University's Faculty 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 programmes and research facilities and these are listed in Section VIII of this Calendar—Course Descriptions. General regulations governing post-graduate studies are set forth in Section VII. The majority of the graduates in Honours programmes in Science undertake some post-graduate study.

The School of Optometry in the Faculty of Science developed from the former College of Optometry in Toronto. This has been integrated into the Faculty of Science and offers a 5-year programme leading to the degree of Doctor of Optometry (O.D.), commencing in September of 1967. Further information about this programme appears on page 122.

All Science students are enrolled on a full-time basis. Each year of any programme in this Faculty except Co-operative Applied Physics and Co-operative Applied Chemistry is offered in two terms throughout a conventional academic year. The Applied Physics and Applied Chemistry programmes are given exclusively on a co-operative basis with alternating terms of academic and industrial work in the same manner as the programmes in the Faculty of Engineering (see chart on page 54).

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 Science Programme in either the three or four-year option. The honours degree, B.Sc. (Honours), will be awarded on completion of any of the honours programmes shown under Academic Programmes. The O.D. (Doctor of Optometry) degree is described above. M.Sc. and Ph.D. degrees are discussed in Section VII.
Admission and Registration

General
Application for admission to the Faculty of Science and the School of Optometry should be made as early in the year as possible. Students currently enrolled full time in Ontario Grade 13 must apply on the "General Application for Admission to University" form which can be obtained from the Secondary School. All other applicants may obtain application forms directly from 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 have been submitted. Applicants currently enrolled in Ontario Grade 13 and who wish to be considered for Early Final Admission must apply before March 15, 1968. All other applicants must apply and have submitted all the necessary documents by August 1, 1968. Persons applying after this date cannot be guaranteed consideration of their application.

Admission to Year I
In order to qualify for admission to the first year of the Science and Optometry programmes, the applicant should have completed Ontario Grade 13 or its equivalent, showing a minimum overall average of 60% in the seven required credits and with a minimum overall average of 60% in the five credits in Mathematics and Science. For applicants who have taken more than one year to complete the work of Grade 13, a somewhat higher average may be required.

Standing is required in seven Grade 13 credits as follows:
- Five credits from Chemistry
- Physics
- Mathematics A
- Mathematics B or Biology
Two additional credits should be chosen from English, a language other than English, Geography, History or, if not chosen above, Biology or Mathematics B.

The Faculty of Science does not recommend, but will accept no more than one of the following subjects as an "additional" credit: Accountancy Practice, Art, Home Economics, Mathematics of Investment, Music, or Secretarial Practice. The marks received in one of these subjects 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 credit" on the same terms as these subjects except the marks received will not be computed in the average.

Students intending to take an Honours programme in Physics, Chemistry and Physics, or Co-operative Applied Physics should have a minimum of 66% in the five credits required in Mathematics and Science.

Note 1
Ontario Tests for Admission to College and University (OACU)
All Grade 13 applicants will be required to submit the results of the Ontario Scholastic Aptitude Test and the Ontario Achievement Tests in English Composition, Mathematics and Physics.

Note 2
If English is not chosen as a Grade 13 subject offered for admission, applicants must have standing in English at the Grade 12 level.
Note 3
The University will use the following definition of credits for admission purposes.
3 credits—Mathematics A and Mathematics B combined
2 credits—all language subjects, Mathematics A
1 credit—all other subjects

Early Final Admission
Students enrolled full time in Ontario Grade 13 will be considered for Early Final Admission. To be eligible for consideration, applicants must arrange to have the “General Application for Admission to University” form submitted by March 15, 1968. Consideration of candidates for Early Final Admission will be based on the Secondary School record, the Principal’s Recommendation, and the results of the Ontario Scholastic Aptitude Test and specified Achievement Tests. Successful applicants may expect to be notified after May 15, 1968, of their acceptance and will be asked to indicate their decision by June 15, 1968. Those applicants who are not offered Early Final Admission will be considered on the basis of the Grade 13 final results and will be notified as soon as possible after the release of the Grade 13 results.

Note: All applicants will be required to complete Grade 13 to the satisfaction of the Secondary School Principal.
The following certificates, recognized as being equivalent to the Ontario Grade 13 certificate, may be accepted insofar as they meet the admission requirements of the University of Waterloo in subjects and percentages:

- Alberta
- British Columbia
- Manitoba
- New Brunswick
- Newfoundland
- Nova Scotia
- Prince Edward Island
- Quebec
- Saskatchewan
- England and Wales, West Indies
- East and West Africa
- Scotland
- United States of America

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 had 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 may apply to enter as an adult student. It is recommended that applicants attempt to obtain standing in Ontario Grade 13 level Mathematics and Science subjects or their equivalent. 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 area 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
September 11, 12, and 13, Faculty of Science.

Once the student has completed his registration, he may not change his programmes, add courses, or drop courses, without obtaining permission from the Dean, or Associate Dean, the Department Chairman of the students major field and the Instructor of the course to which he is changing. Such a change must be processed on the proper forms, through the Office of the Registrar. Changes in courses and programmes are permitted for a period of three weeks from the date of beginning of lectures. The only changes normally permitted after this period will be dropping a course designated as an extra or reducing a programme from Honours to General where applicable.

Fees

— Refer to Section X page 380
Examinations and Promotions

The Faculty constitutes the examining body for all University examinations.

Regular Programmes
Final examinations in one term course are held in December or in April-May. Final examinations for all full year courses 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.

Co-operative Programmes
In Year I, final examinations in one-term courses are held at the end of the term in which the course is taken, whereas final examinations in full-year courses are held at the end of the second term and cover the whole work of each such course. Beyond first year, final examinations are held at the end of each term. The time normally allowed for each examination is three hours.

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 courses 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>

If a supplemental examination is necessary in a course of D standing, it will be indicated in the Faculty decision.

3. Standing in an individual course 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 course, a candidate must obtain a minimum of 50% in the combined term mark and examination mark. A student whose term work is deficient in a course may, at the discretion of the department concerned and the Dean, be barred from writing the final examination in that course.

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 courses where a candidate has not passed his year.

5. To pass his year clear, a student must pass in all courses with a minimum overall average of 50% in the General Science programme and 60% in an Honours programme. In addition, a minimum average of 60% in the courses of the major field.
Examinations and Promotions

must be obtained in both the General and Honours programme. Standing and promotion in the Optometry programme is on the same basis as used in the regular Honours programmes of the Faculty.

Students in an Honours programme on a co-operative basis must obtain the 60% overall average and 60% major field average in each term beyond Year I.

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

<table>
<thead>
<tr>
<th>Range of Average Mark</th>
<th>Honours Programme</th>
<th>General Programme</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>

7. 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 or health-related 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.

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

9. In Year I, supplemental examinations will be allowed in failing courses only. In upper years, supplemental examinations may be allowed in courses where D or lower standing has been obtained.

Supplemental examinations will be allowed if all of the following conditions are met:

a) The student must have attended lecture and laboratory classes and completed all term work assignments to the satisfaction of the instructor of the course concerned.

b) The student must not have defaulted the final examination except for a properly certified reason.

c) The required overall average (described in 5) must be obtained before supplemental examinations will be allowed.

d) In any given academic year of a regular programme no more than 2 supplementals in full year courses or 3 supplementals in a combination of full year and semester (i.e. one-term) courses will be allowed. No more than 2 supplementals will be allowed in any term of a co-operative programme.

By such supplemental examinations a student may clear failing courses or achieve his major field average.

10. If more supplemental examinations than indicated in 9 (d) would be necessary for a student to pass his year clear, the student will have automatically failed the year regardless of his overall average. He will not be eligible to try 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.
11. A student repeating any year of a programme must repeat all courses in class unless exemption has been granted by the Dean and the Faculty Council.

12. Supplemental examinations will be held in July for regular programmes. Applications for these supplemental examinations must be filed by June 26, 1968 on forms provided by the Office of the Registrar. In co-operative programmes, supplemental examinations will be written in the term immediately following that in which the respective final examinations are written. Fees for supplemental examinations must accompany the application. If the student subsequently decides not to write the examination, the fee is not refunded.

13. 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 to achieve his major field average, he has failed his year. If he has failed a supplemental examination in a non-prerequisite course in other than his major field, he may be allowed a pass standing conditioned in this course; otherwise he must repeat the year. Where the conditioned course was not a mandatory part of his programme and where his major Department concurs, a student may be permitted to substitute another course for one in which he is conditioned.

14. If a student is conditioned in a course from a previous year and fails to pass it at the regular examinations, he may be allowed an additional chance at writing a supplemental if he has otherwise passed in the regular courses of his year as outlined in 9. No student may be promoted further until a condition from a previous year is cleared.

**Academic Programmes**

In descriptions of regular (i.e. non-co-operative) programmes, the symbol * after a Course number indicates a one term course; * after the number of laboratory hours indicates a laboratory taken in alternate weeks.

**First Year**

(For all students whether Honours or General except Co-operative Applied Physics (see page 109) and Co-operative Applied Chemistry (see page 109).

<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arts Elective (English 130 recommended)</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>
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</tbody>
</table>

Two of:

<table>
<thead>
<tr>
<th>Course</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>
</tbody>
</table>

108
Academic Programmes

Mathematics 132  Introduction to Computer Science  2  2
Psychology 110 or  Introductory Psychology or  3  0
150  Experimental Methods in Psychology  2  2

A total of six courses in the above listing must be selected at the time of registration. Chemistry, Physics, Calculus and an Arts elective are compulsory for all students as indicated. The choice of optional courses 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; the requirements for the Optometry programme are also shown.

<table>
<thead>
<tr>
<th>Major Field of Study</th>
<th>Options Required in First Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology</td>
<td>Biology 131 or 132.</td>
</tr>
<tr>
<td>Biology &amp; Chemistry</td>
<td>Biology 131 or 132, Mathematics 131</td>
</tr>
<tr>
<td>Biology &amp; Psychology</td>
<td>Biology 131 or 132, Psychology 150</td>
</tr>
<tr>
<td>Chemistry</td>
<td>Mathematics 131 (Mathematics 132 recommended)</td>
</tr>
<tr>
<td>Chemistry (Math Option)</td>
<td>Mathematics 131, Mathematics 132</td>
</tr>
<tr>
<td>Chemistry &amp; Physics</td>
<td>Mathematics 131 (Mathematics 132 recommended)</td>
</tr>
<tr>
<td>Earth Sciences</td>
<td>Earth Sciences 130 (Biology 131 or 132 recommended)</td>
</tr>
<tr>
<td>Optometry</td>
<td>Physics 100, Biology 131, Psychology 110</td>
</tr>
<tr>
<td>Physics</td>
<td>Mathematics 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 course for students in the third year of the General Science programme 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. All other students wishing Psychology as an option should elect Psychology 110.

Note 4
Students planning to major in Earth Sciences may select Mathematics 131 in place of Biology if they have good standing in post-1965 Grade 13 Biology or on consultation with the Department.

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. Students electing Physics 100 cannot be admitted to Year II Honours Chemistry, Honours Chemistry and Physics, or Honours Biology and Chemistry.

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

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 101</td>
<td>General Chemistry</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Physics 131</td>
<td>Mechanics, Wave Motion &amp; Heat</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics 130</td>
<td>Calculus</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 131</td>
<td>Algebra and Solid Geometry</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Mathematics 132</td>
<td>Introduction to Computer Science</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Arts Elective</td>
<td>(English 16 recommended)</td>
<td>3</td>
<td>0</td>
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</tbody>
</table>

Year IB

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 101</td>
<td>General Chemistry</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Physics 131</td>
<td>Mechanics, Wave Motion &amp; Heat</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics 130</td>
<td>Calculus</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 131</td>
<td>Algebra and Solid Geometry</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Mathematics 132</td>
<td>Introduction to Computer Science</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Arts Elective</td>
<td>(English 17 recommended)</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

Honours Programmes

The normal route to attain professional standing in science is to take an Honours Programme in the appropriate field or combination of fields. The Honours Programmes 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 post-graduate study in Canadian Universities. Graduates of certain Honours Programme 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 108)

Year II

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

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 333</td>
<td>Invertebrate Zoology</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 334</td>
<td>Taxonomy and Evolution</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 335</td>
<td>Microbiology I</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 337</td>
<td>General Physiology</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 337</td>
<td>Biochemistry I</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Elective</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

as specified
Honours Biology and Chemistry

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 108)

<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>Elementary Differential Equations</td>
<td>2</td>
</tr>
<tr>
<td>Two of:</td>
<td></td>
<td></td>
</tr>
<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>General Microbiology</td>
<td>2</td>
</tr>
</tbody>
</table>

Year III

<table>
<thead>
<tr>
<th>Year III</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 325</td>
<td>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>Two of:</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>

Year IV

<table>
<thead>
<tr>
<th>Year IV</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 341</td>
<td>Inorganic and Nuclear Chemistry</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 437</td>
<td>Biochemistry II</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 243</td>
<td>Statistics for the Sciences</td>
<td>2</td>
</tr>
<tr>
<td>Three of:</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

This programme is designed to qualify graduates for a career in behavioural research and is not recommended for any other purpose.

(For Year I, see page 108)

<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 260</td>
<td>Physiological Psychology</td>
<td>2</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Name</td>
<td>Lectures</td>
</tr>
<tr>
<td>-------------</td>
<td>------------------------------------</td>
<td>----------</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>
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</tbody>
</table>

**Year III**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 333</td>
<td>Invertebrate Zoology</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Psychology 370</td>
<td>Animal Behaviour</td>
<td>3</td>
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</tr>
<tr>
<td>Psychology 380</td>
<td>Advanced Physiological Psychology</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 243</td>
<td>Statistics for the Sciences</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 337</td>
<td>Biochemistry I</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 301</td>
<td>Vertebrate Physiology</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 337</td>
<td>General Physiology</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

**Year IV**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 434</td>
<td>Genetics</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 436</td>
<td>Neurophysiology and Electrophysiology</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Psychology 430</td>
<td>Problems in Contemporary Psychology</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 431</td>
<td>Ecology</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Biology 442</td>
<td>Animal Physiology</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Psychology 499</td>
<td>Senior Honours Essay</td>
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<td>5</td>
</tr>
<tr>
<td>Biology 499</td>
<td>Senior Honours Project</td>
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<tr>
<td>Approved Elective</td>
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Honours Chemistry

*(For Year I, see page 108)*

**Year II**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 231</td>
<td>Chemical Bonding and Structure</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 232</td>
<td>Analytical Chemistry</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Chemistry 235</td>
<td>Physical Chemistry I</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 236</td>
<td>Organic Chemistry I</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Physics 242</td>
<td>Electricity and Magnetism</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics 236</td>
<td>Elementary Differential Equations</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

**Year III**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 331</td>
<td>Inorganic Chemistry I</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 335</td>
<td>Physical Chemistry II</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Chemistry 336</td>
<td>Organic Chemistry II</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>Physics 235</td>
<td>Optics</td>
<td>2</td>
<td>3*</td>
</tr>
<tr>
<td>Physics 332</td>
<td>Electronics</td>
<td>2</td>
<td>3*</td>
</tr>
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</table>

*One or two 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>Mathematics 229</td>
<td>Linear Algebra</td>
<td>3</td>
<td>0</td>
</tr>
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</table>

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### Honours Chemistry

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 233</td>
<td>2</td>
</tr>
<tr>
<td>or</td>
<td></td>
</tr>
<tr>
<td>Mathematics 243</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 238</td>
<td>2</td>
</tr>
<tr>
<td>Physics 332</td>
<td>2</td>
</tr>
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### Year IV

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Chemistry 431</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 435</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 436</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 439</td>
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### Two or three of:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 337</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 440</td>
<td>2</td>
</tr>
<tr>
<td>Physics 332</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 233 or 243</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 450</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 437</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 229</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics 238</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 329</td>
<td>2</td>
</tr>
<tr>
<td>Arts Elective</td>
<td>as specified</td>
</tr>
</tbody>
</table>

### Honours Chemistry (Mathematics Option)

(For Year I, see page 108)

<table>
<thead>
<tr>
<th>Year II</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 231</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 232</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Chemistry 235</td>
<td>2</td>
<td>1</td>
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<tr>
<td>Chemistry 236</td>
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<td>3</td>
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<tr>
<td>Mathematics 236</td>
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<td>0</td>
</tr>
<tr>
<td>Mathematics 238</td>
<td>2</td>
<td>1</td>
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### One of:

<table>
<thead>
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<th>Course</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>Mathematics 233</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 243</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 234</td>
<td>2</td>
</tr>
<tr>
<td>Physics 232</td>
<td>2</td>
</tr>
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</table>

### Year III

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 331</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 335</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 336</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 229</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics 237</td>
<td>3</td>
</tr>
</tbody>
</table>

113
One of:
Chemistry 337  Biochemistry I  2  0
Physics 235  Optics  2  3*
Physics 332  Electronics  2  3*
A third year Mathematics course approved by the Department of Chemistry

Year IV
Chemistry 431  Inorganic Chemistry II  2  0
Chemistry 435  Physical Chemistry III  2  1
Chemistry 436  Organic Chemistry III  2  0
Mathematics 329  Abstract Algebra  2  0
Mathematics 343  Complex Variable Theory  2  0
Mathematics 434  Differential Equations of Mathematical Physics  2  1

One of:
Chemistry 437  Biochemistry II  2  3
Chemistry 440  Polymer Chemistry  2  0
Chemistry 439  Advanced Laboratory  0  6

Honours Chemistry (Physics Option)

(For Year I, see page 108)

<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  3</td>
</tr>
<tr>
<td>Chemistry 232</td>
<td>Analytical Chemistry</td>
<td>2  6</td>
</tr>
<tr>
<td>Chemistry 235</td>
<td>Physical Chemistry I</td>
<td>2  1</td>
</tr>
<tr>
<td>Chemistry 236</td>
<td>Organic Chemistry I</td>
<td>2  3</td>
</tr>
<tr>
<td>Mathematics 236</td>
<td>Elementary Differential Equations</td>
<td>2  0</td>
</tr>
<tr>
<td>Physics 232</td>
<td>Electricity and Magnetism</td>
<td>2  3*</td>
</tr>
<tr>
<td>Physics 235</td>
<td>Optics</td>
<td>2  3*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year III</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 331</td>
<td>Inorganic Chemistry I</td>
<td>2  3</td>
</tr>
<tr>
<td>Chemistry 335</td>
<td>Physical Chemistry II</td>
<td>2  6</td>
</tr>
<tr>
<td>Chemistry 336</td>
<td>Organic Chemistry II</td>
<td>2  3</td>
</tr>
<tr>
<td>Mathematics 237</td>
<td>Differential and Integral Calculus</td>
<td>3  0</td>
</tr>
<tr>
<td>Physics 331</td>
<td>Classical Mechanics I</td>
<td>3  0</td>
</tr>
<tr>
<td>Physics 339</td>
<td>Atomic and Nuclear Physics</td>
<td>3  0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year IV</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 431</td>
<td>Inorganic Chemistry II</td>
<td>2  0</td>
</tr>
<tr>
<td>Chemistry 435</td>
<td>Physical Chemistry III</td>
<td>2  1</td>
</tr>
<tr>
<td>Chemistry 436</td>
<td>Organic Chemistry III</td>
<td>2  0</td>
</tr>
<tr>
<td>Mathematics 450</td>
<td>Applied Analysis</td>
<td>2  0</td>
</tr>
<tr>
<td>Physics 332</td>
<td>Electronics</td>
<td>2  3*</td>
</tr>
<tr>
<td>Physics 435*</td>
<td>Solid State Physics</td>
<td>3  0</td>
</tr>
</tbody>
</table>
Co-operative Applied Chemistry

One of:
Chemistry 337  Biochemistry I  2  0
Chemistry 440  Polymer Chemistry  2  0
Chemistry 439  Advanced Laboratory  0  6

Co-operative Applied Chemistry (Honours)

(For Year I, see page 108)

<table>
<thead>
<tr>
<th>Year II A</th>
<th>Courses</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>Chemistry 209</td>
<td>Technical Literature</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 31</td>
<td>Differential Equations</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Physics 236</td>
<td>Optics</td>
<td>3</td>
<td>3*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year II B</th>
<th>Courses</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>3</td>
<td>1</td>
</tr>
<tr>
<td>Physics 243</td>
<td>Electricity and Magnetism</td>
<td>3</td>
<td>3*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year III A</th>
<th>Courses</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 341</td>
<td>Electronics</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Arts Elective</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year III B</th>
<th>Courses</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>3</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year IVA</th>
<th>Courses</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>3</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

One of:
Chemistry 403  Physical Chemistry of Polymers  3  3
Chemistry 405  Surface Chemistry  3  0
Chemistry 407  Applied Biochemistry  3  3
Chemistry 408  Instrumentation I  1  3
Mech. Eng. 31  Physical Metallurgy I  2  0
Year IVB
Chemistry 412  Analysis of Materials  2  3
Chemical Eng. 61  Industrial Economics  3  0
Civil Eng. 452  Water Resources Engineering  2  3
Elective (Arts, Science or Engineering)  3  0
Chemistry 410  Applied Chemistry Seminar  0  1
One of:
Chemistry 413  Properties of Polymers  3  3
Chemistry 415  Catalysis  3  0
Chemistry 418  Instrumentation II  1  3
Mech. Eng. 37  Ceramics  3  3
Biology 235A  Microbiology  2  3

Honours Chemistry and Physics

(For Year I, see page 108)

Year II
<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 231</td>
<td>Chemical Bonding and Structure</td>
<td>2  0</td>
</tr>
<tr>
<td>Chemistry 232</td>
<td>Analytical Chemistry</td>
<td>2  6</td>
</tr>
<tr>
<td>Chemistry 235</td>
<td>Physical Chemistry I</td>
<td>2  1</td>
</tr>
<tr>
<td>Mathematics 236</td>
<td>Elementary Differential Equations</td>
<td>2  0</td>
</tr>
<tr>
<td>Mathematics 237</td>
<td>Differential and Integral Calculus</td>
<td>3  0</td>
</tr>
<tr>
<td>Physics 232</td>
<td>Electricity and Magnetism</td>
<td>2  3*</td>
</tr>
<tr>
<td>Physics 234*</td>
<td>Quantum Physics</td>
<td>3  0</td>
</tr>
<tr>
<td>Physics 236*</td>
<td>Optics</td>
<td>3  3*</td>
</tr>
</tbody>
</table>

Year III
<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 236</td>
<td>Organic Chemistry I</td>
<td>2  3</td>
</tr>
<tr>
<td>Chemistry 335</td>
<td>Physical Chemistry II</td>
<td>2  6</td>
</tr>
<tr>
<td>Mathematics 233</td>
<td>Probability and Statistics</td>
<td>2  1</td>
</tr>
<tr>
<td>or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics 243</td>
<td>Statistics for the Sciences</td>
<td>2  1</td>
</tr>
<tr>
<td>Physics 331</td>
<td>Classical Mechanics I</td>
<td>3  0</td>
</tr>
<tr>
<td>Physics 334†</td>
<td>Atomic and Nuclear Physics I</td>
<td>2  0</td>
</tr>
<tr>
<td>Physics 336</td>
<td>Physical Mathematics I</td>
<td>2  0</td>
</tr>
<tr>
<td>one Arts Elective</td>
<td></td>
<td>as specified</td>
</tr>
</tbody>
</table>
|†During the 1968-9 session, students without Physics 234 as prerequisite may take Physics 339 in place of Physics 334

Year IV
<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 341</td>
<td>Inorganic and Nuclear Chemistry</td>
<td>2  0</td>
</tr>
<tr>
<td>Chemistry 336</td>
<td>Organic Chemistry II</td>
<td>2  3</td>
</tr>
<tr>
<td>Physics 332</td>
<td>Electronics</td>
<td>2  0</td>
</tr>
<tr>
<td>Physics 333</td>
<td>Intermediate Laboratory</td>
<td>0  6</td>
</tr>
<tr>
<td>Physics 434</td>
<td>Atomic and Nuclear Physics II</td>
<td>2  0</td>
</tr>
</tbody>
</table>

Option A (Chemistry)
<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 435</td>
<td>Physical Chemistry III</td>
<td>2  1</td>
</tr>
</tbody>
</table>
One of:
Chemistry 337   Biochemistry I   2  0
Chemistry 440   Polymer Chemistry  2  0
one Arts Elective

Option B (Physics)
Physics 435*   Solid State Physics  3  0
one Arts or Science Elective

Honours Earth Sciences

(Geology Option)

(For Year I see page 108 and note 4)

<table>
<thead>
<tr>
<th>Year II</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Sciences 230   Mineralogy</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 232*   Petrography (half course)</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 237*   Field Geology (half course)</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Earth Sciences 238*   Historical Geology (half course)</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 240*   Geomorphology (half course)</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 241 Principles and Applications of Chemical Bonding</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Arts Elective. English 240 is strongly recommended. One of: Mathematics 132 Introduction to Computer Science</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 243 Statistics for the Sciences</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Year III

<table>
<thead>
<tr>
<th>Year III</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Sciences 330   Igneous and Metamorphic Petrology</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 334   Paleontology</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 335   Stratigraphy and Sedimentation</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Earth Sciences 340   Structural Geology</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Arts Elective. One of: Biology 333 Invertebrate Zoology</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Physics 200 General Physics II</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Physics 237 Astronomy I</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

Year IV (Commencing 1969)

<table>
<thead>
<tr>
<th>Year IV</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Sciences 430   Economic Geology</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 435*   Seminar</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Earth Sciences 436   Thesis</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Earth Sciences 437   Crustal Evolution</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 440*   Quaternary Geology (half course)</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Arts Elective. Two courses from: Earth Sciences 338 Geophysics</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Earth Sciences 431 Geochemistry</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>
Honours Mathematics

In 1967 the association between the Department of Mathematics and the Faculty of Science was modified by the creation of a separate Faculty of Mathematics. The B.Sc. programme in Honours Mathematics will be continued this year for the last time for those fourth-year students who began work in the Faculty of Science and elected to remain in it. Such students should have their programme of studies arranged by the Faculty of Mathematics and then approved by the Faculty of Science. Any other students desiring to major in Mathematics should enrol in the Faculty of Mathematics.

Honours Physics

(For Year I, see page 108)

Basic Programme

The basic Honours Physics programme is in the form of a core of required courses, plus three or four other courses as follows:

<table>
<thead>
<tr>
<th>Year II</th>
<th>Core:</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Physics 233</td>
<td>Laboratory</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Physics 232</td>
<td>Electricity and Magnetism</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Physics 236*</td>
<td>Optics (half course)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Physics 234*</td>
<td>Quantum Physics (half course)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Mathematics 237</td>
<td>Differential &amp; Integral Calculus</td>
<td>3</td>
</tr>
</tbody>
</table>

Electives: Three other courses.

<table>
<thead>
<tr>
<th>Year III</th>
<th>Core:</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Physics 333</td>
<td>Intermediate Laboratory</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Physics 331</td>
<td>Classical Mechanics I</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Physics 334</td>
<td>Atomic &amp; Nuclear Physics I</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Physics 335</td>
<td>Thermodynamics, Statistical Physics</td>
<td>3</td>
</tr>
</tbody>
</table>

Electives: Three other courses.

<table>
<thead>
<tr>
<th>Year IV</th>
<th>Core:</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Physics 433*</td>
<td>Advanced Laboratory (half course)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Physics 434</td>
<td>Atomic &amp; Nuclear Physics II</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Physics 435*</td>
<td>Solid State Physics (half course)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Physics 441</td>
<td>Electromagnetic Theory</td>
<td>2</td>
</tr>
</tbody>
</table>
Electives: *Four* other courses.

**Elective Programmes**

The elective courses noted in the basic programme may be chosen from a wide range of courses offered by the Physics Department and by other departments of the University. By careful selection of his electives, a student can deepen his knowledge of experimental or theoretical physics, or obtain a background in another subject (e.g., Astronomy, Geophysics, Chemistry, Mathematics, Computing). 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 flexibility of this “core plus electives” structure is demonstrated by the following examples of possible programmes, all of which are sufficient preparation for graduate work in physics, although each has a slightly different emphasis. Details of other possible programmes may be obtained from the Chairman of the Physics Department.

**Ex. 1. Honours Physics**

*Core plus:* Year II: Physics 237, 245*, Mathematics 51, 238.
Year III: Physics 332, 336, Arts Elective.
Year IV: Physics 453*, (or 437*), 431, 432* (or 443*), 436, Arts, Mathematics or Science Elective.

**Ex. 2. Honours Physics**

*Core plus:* Year II: Chemistry 231, Mathematics 229, 238.
Year III: Physics 332, 338, Chemistry 325.
Year IV: Physics 453*, 336, Science 400, Arts or Science Elective.

**Ex. 3. Honours Physics**

*Core plus:* Year II: Mathematics 32, 243, Chemistry 206*, Elective.
Year III: Physics 316*, 317*, 332, Chemistry 337

**Ex. 4. Honours Physics**

*Core plus:* Year II: Mathematics 229, 233, Elective.
Year IV: Physics 431, 436, Mathematics 422, Elective.

**Ex. 5. Honours Physics**

*Core plus:* Year II: Physics 245*, Mathematics 51, 238, Arts Elective.
Year IV: Physics 332, two Mathematics courses at the fourth year level, Arts or Science Elective.

**Ex. 6. Honours Physics**

*Core plus:* Year II: Chemistry 231, 235, Mathematics 238.
Year III: Physics 332, 336, Chemistry 236.
Year IV: Physics 432*, Chemistry 335, 341, Mathematics or Science Elective.
Co-operative Applied Physics (Honours)

Applied Physics is an honours programme and is also in the form of a core of required courses plus appropriate electives. At the post-graduate level an Applied Physicist is one who does his research in an area where the results he obtains are potentially useful in industry, even though his work is fundamental physics. The electives in the second, third and fourth years of the undergraduate programme allow students to strengthen any complementary areas of interest whether that interest involves some specific field in physics or some other subject. The work terms are normally arranged to provide complementary, practical experience in research and development laboratories, in Government and Industry. This experience gives the student a deeper insight into the meaning and methods of research, as well as incentive to develop his course work. This provides a contribution to the development of a scientist that cannot be learned in lecture courses.

A steadily increasing demand for Applied Physicists in Canada is virtually assured by the ever increasing emphasis that government and industry are placing on applied research, to go hand in hand with the development of more extensive secondary industry in Canada.

(For Year I, see page 108)

Year IIA

Core: Physics 233
Physics 232
Physics 236
Mathematics 237

Electives: three other courses.

Laboratory
Electricity & Magnetism
Optics
Differential & Integral Calculus

Lectures Labs.
0 6
2 0
3 0
3 0

Year IIB

Core: Physics 233
Physics 232
Physics 234
Mathematics 237

Electives: three other courses.

Laboratory
Electricity & Magnetism
Quantum Physics
Differential & Integral Calculus

Lectures Labs.
0 6
2 0
3 0
3 0

Year IIIA

Core: Physics 333
Physics 331
Physics 334
Physics 335

Electives: three other courses.

Intermediate Laboratory
Classical Mechanics I
Atomic & Nuclear Physics I
Thermodynamics, Statistical Physics

Lectures Labs.
0 6
3 0
2 0
3 0

Year IIIB

Core: Physics 333
Physics 331
Physics 334
Physics 335

Intermediate Lab.
Classical Mechanics I
Atomic & Nuclear Physics I
Thermodynamics, Statistical Physics

Lectures Labs.
0 6
3 0
2 0
3 0
Co-operative Applied Physics

Electives: *three* other courses.

**Year IVA**

**Core:**
- Physics 433
- Physics 434
- Physics 435
- Physics 441

Electives: *three* other courses.

**Year IVB**

**Core:**
- Physics 434
- Physics 441

Electives: *five* other courses including *two* physics courses.

**Options:**

Some suggested programmes are given below.

**Ex. 1 Co-op. Appl. Physics (Solid State)**

Core plus:

**Year IIA:** Mathematics 31, 238, 243, (or one other course).

**Year IIB:** Physics 245, Mathematics 238, 243, (or one other course).

**Year IIIA:** Physics 332, 336, E. E. 42, or Chemistry 201.

**Year IIIB:** Physics 332, 336, Chemistry 301, (or one other course).

**Year IVA:** Physics 436, Mathematics 334, E. E. 44, (or one other course).

**Year IVB:** Physics 432, 436, 453, Mathematics 334, E.E. 81, (or one other course).

**Ex. 2 Co-op. Appl. Physics (Biophysics)**

Core plus:

**Year IIA:** Mathematics 31, 243, Chemistry 206, (or one other course).

**Year IIB:** Physics 245, 316, Mathematics 243, (or one other course).

**Year IIIA:** Physics 332. Chemistry 307, (one other course).

**Year IIIB:** Physics 317, 332, (one other course).

**Year IVA:** Chemistry 407, Biology 321, (one other course).

**Year IVB:** Physics 416, 432, 453, Biology 231, (one other course).

**Ex. 3 Co-op. Appl. Physics (and Chemistry)**

Core plus:

**Year IIA:** Mathematics 31, Chemistry 206, (one other course).

**Year IIB:** Chemistry 201, Physics 245, Chemistry 205.

**Year IIIA:** Physics 332, 336, Chemistry 301.

**Year IIIB:** Chemistry 305, Physics 332, 336.

**Year IVA:** Physics 431, or 436, Chemistry 400.

**Year IVB:** Physics 431, 432, 436, 453, Chemistry 303, (one other course).
Optometry Programme

General
Within the Science Faculty, the School of Optometry offers a five year programme leading to the degree Doctor of Optometry. The first is a pre-optometrical year preparatory to the four years of the professional optometrical programme.

The immediate purpose of the programme is to qualify men and women for the practice of optometry. However, the programme is designed to provide the student with sufficient general and specialized knowledge in science so that he may follow a career in research and teaching if he so wishes. Students at the end of Year III, on petition to the Dean, may be permitted to transfer to a B. Sc. program requiring one additional year of study. The degree awarded in this case will be the 3-year General B.Sc. and will normally require a major in the Dept. of Biology.

Upon completion of their training in optometry graduates will be eligible to apply for registration as optometrists in the province of their choice† or to undertake Graduate Studies. Graduate training will lead to the degrees of Master of Science and Doctor of Philosophy. It is expected that graduate studies in the School of Optometry will be available by 1970.

Inquiries regarding admission requirements should be sent to the Registrar of the University. Specific admissions requirements and regulations for Examinations and Promotions may be found on page 106. All other inquiries relating to the course should be sent to the Secretary of the School of Optometry at the University.

†As in the case of other professions, graduates in optometry must hold the certificate of the licensing body of the Province in which they elect to engage in practice.

Academic Programme
(For Year I, see page 108. This Pre-Optometrical year is the normal Year I programme of the Faculty of Science with Physics 100, Biology 131 and Psychology 110 as options.)

<table>
<thead>
<tr>
<th>Year II</th>
<th>Lectures</th>
<th>Labs</th>
<th>Clinic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 201</td>
<td>Anatomy, Histology and Embryology</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Biology 233</td>
<td>Vertebrate Zoology</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 216*</td>
<td>Introduction to Organic and Biochemistry</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Physics 236*</td>
<td>Optics</td>
<td>3</td>
<td>3*</td>
</tr>
<tr>
<td>Psychology 201*</td>
<td>General Experimental Psychology: Learning</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Psychology 202*</td>
<td>General Experimental Psychology: Perception</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Optometry 200*</td>
<td>History and Orientation</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>
### Optometry Programme

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optometry 201*</td>
<td>Physiological Optics</td>
<td>3 2 0</td>
</tr>
<tr>
<td>Optometry 202*</td>
<td>Introduction to Clinical Optometry</td>
<td>3 3 0</td>
</tr>
<tr>
<td>Optometry 204</td>
<td>Anatomy of the Eye and Associated Structures</td>
<td>3 2 0</td>
</tr>
</tbody>
</table>

#### Year III

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 301</td>
<td>Vertebrate Physiology</td>
<td>3 3 0</td>
</tr>
<tr>
<td>Psychology 280</td>
<td>Statistical Methods in Psychology</td>
<td>3 1 0</td>
</tr>
<tr>
<td>Optometry 300*</td>
<td>Binocular Relations of the Non Strabismic Patient</td>
<td>3 3 0</td>
</tr>
<tr>
<td>Optometry 301</td>
<td>Physiological Optics</td>
<td>3 3 0</td>
</tr>
<tr>
<td>Optometry 302</td>
<td>Optometrical Optics</td>
<td>3 3 0</td>
</tr>
<tr>
<td>Optometry 305</td>
<td>General Pathology</td>
<td>3 1 0</td>
</tr>
<tr>
<td>Optometry 306*</td>
<td>Advanced Geometrical Optics</td>
<td>3 3 0</td>
</tr>
</tbody>
</table>

#### Year IV

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychology 211*</td>
<td>Developmental Psychology</td>
<td>3 0 0</td>
</tr>
<tr>
<td>Psychology 212*</td>
<td>Socialization Processes in the Child</td>
<td>3 0 0</td>
</tr>
<tr>
<td>Optometry 400</td>
<td>Clinical Optometry</td>
<td>3 3 0</td>
</tr>
<tr>
<td>Optometry 401</td>
<td>Physiological Optics</td>
<td>3 3 0</td>
</tr>
<tr>
<td>Optometry 402</td>
<td>Optometrical Optics</td>
<td>1 2 0</td>
</tr>
<tr>
<td>Optometry 404</td>
<td>Physiology of Visual Systems</td>
<td>2 2 0</td>
</tr>
<tr>
<td>Optometry 405</td>
<td>Ocular Pathology</td>
<td>2 1 0</td>
</tr>
<tr>
<td>Optometry 407*</td>
<td>Optometrical Specialties</td>
<td>3 3 0</td>
</tr>
<tr>
<td>Optometry 408</td>
<td>Optometry Clinic</td>
<td>0 0 4</td>
</tr>
<tr>
<td>Optometry 409</td>
<td>Summer Clinic</td>
<td>60 hours</td>
</tr>
<tr>
<td>Optometry 432*</td>
<td>Light and Illumination</td>
<td>2 2 0</td>
</tr>
</tbody>
</table>

#### Year V

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optometry 500</td>
<td>Advanced Clinical Optometry</td>
<td>3 0 0</td>
</tr>
<tr>
<td>Optometry 501</td>
<td>Physiological Optics</td>
<td>0 3 0</td>
</tr>
<tr>
<td>Optometry 502</td>
<td>Optometrical Optics</td>
<td>0 2 0</td>
</tr>
<tr>
<td>Optometry 504*</td>
<td>Genetics</td>
<td>2 0 0</td>
</tr>
<tr>
<td>Optometry 506</td>
<td>Optometrical Jurisprudence and Praxis</td>
<td>2 0 0</td>
</tr>
<tr>
<td>Optometry 507</td>
<td>Public Health Optometry</td>
<td>2 2 0</td>
</tr>
<tr>
<td>Optometry 508</td>
<td>Optometry Clinic</td>
<td>0 0 22</td>
</tr>
<tr>
<td>Optometry 509*</td>
<td>Pharmacology</td>
<td>2 0 0</td>
</tr>
</tbody>
</table>

* Indicates a one term course.

### The General Science Programme

The General Science Programme is available as a three-or four-year option in all departments. Graduates of the four-year programme who have taken appropriate courses 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 a College of Education in Ontario with specialization in a single subject. Depending on the option chosen, 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 programme has been completed. A student who has graduated from the three-year programme may apply to register for the four-year programme; 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 programme who have taken the required courses are qualified to apply for admission to medical schools in Ontario. Students who have passed the first year of the programme with appropriate choice of courses are qualified to apply for admission to a dental school. Graduates are also eligible for admission to the Type B course at a College of Education in Ontario or for various industrial positions such as senior laboratory technicians, technical sales representatives, and so forth.

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, 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.

The curriculum after Year I is arranged as follows:

### Three-Year Programme

<table>
<thead>
<tr>
<th>Year</th>
<th>Major Field</th>
<th>Minor Fields†</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>2 courses</td>
<td>3 courses</td>
<td>5 courses</td>
</tr>
<tr>
<td>III</td>
<td>2 courses</td>
<td>3 courses</td>
<td>5 courses</td>
</tr>
</tbody>
</table>

### Four-Year Programme

<table>
<thead>
<tr>
<th>Year</th>
<th>Major Field</th>
<th>Minor Fields†</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>2 courses</td>
<td>3 courses</td>
<td>5 courses</td>
</tr>
<tr>
<td>III</td>
<td>2 or 3 courses</td>
<td>2 or 3 courses</td>
<td>5 courses</td>
</tr>
<tr>
<td>IV</td>
<td>2 or 3 courses</td>
<td>2 or 3 courses</td>
<td>5 courses</td>
</tr>
</tbody>
</table>

†Minor fields must be courses for which the student is qualified and must be chosen from other than the student's major field of study. No more than one course from each of the following minor fields should be selected in a given year: Biology, Chemistry, Earth Sciences, Physics, Mathematics, an Arts Elective. At least one non-science course must be chosen. (The term "course" denotes a full-year course; two half-year or term courses are the equivalent of one full-year course).

### Extra Courses

The following regulations apply to both General and Honours programmes. An extra course 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 the second term, but before the final examinations, it will appear on the transcript as “Incomplete.” The mark in the extra course will not be averaged with those from the required programme for overall standing.

There will be no supplemental privileges with extra courses.

### Recommended Programmes

The selection of courses in upper years will be restricted partly by limitations imposed by the timetable, and partly by the necessity in many courses 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 courses may be taken provided they fit the student’s timetable and are approved by his departmental chairman.

**Biology Major**

**Year I**
Including Biology 131 or 132

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

**Three-year programme**

**Year III**
*Two of:* Biology 333, 334, 335, 337  
Chemistry 337  
Earth Sciences 130 or a non-Biology Science Elective  
Arts or Mathematics Elective

**Four-year programme**

**Year III**
Two or three† of: Biology 333, 334, 335, 337  
Chemistry 337  
Earth Sciences 130 or a non-Biology Science Elective if only two Biology courses chosen.  
Arts or Mathematics Elective.

†Students wishing to qualify for the Ontario Department of Education Type-A certificate must choose three courses in Biology or take a third Biology course as an extra course.

**Year IV**
Three Biology courses acceptable to the Biology Department  
Chemistry 437  
Arts or Mathematics Elective

**Chemistry Major**

**Year I**
Including Mathematics 131
Year II
Chemistry 236, 242
One of: Mathematics 236 (required for four-year programme),
Physics 237
One of: Physics 242, Biology 233, 234,
235†, Earth Sciences 130 or 230
Arts Elective**

Three-year programme
Year III
Chemistry 325
One of: Chemistry 241, 337
One of: Physics 235, Biology 231
One of: Mathematics 233 or 243, Earth Sciences 330 or 340
Arts Elective**

Four-year programme
Year III
Chemistry 241, 235
Physics 235, or 242 (if not taken previously)
One of: Biology 231
   Mathematics 233 or 243
   Chemistry 336‡ or 337
   Earth Sciences 330 or 340
Arts Elective**

Year IV
Chemistry 341, 335 (3 hours lab.)
One of: Chemistry 336‡, 337, or 440
One other course in Biology, Earth Sciences,
Mathematics or Physics acceptable to
the Department of Chemistry
Arts Elective**

†Biology 235 preferred. Biology 233, 234 may be taken if timetable permits.
**Mathematics elective may be chosen if no other Mathematics course selected in the same year.
‡Chemistry 336 must be taken in Year III or Year IV.

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-1965 Grade 13 Biology or equivalent, or by special arrangement.
General Science Programmes

Year II
Two of: Chemistry 241, Physics 200, Biology 231, Mathematics 243.
Arts Elective: English 240 is strongly recommended.

Three-year programme
Year III
Two of: Earth Sciences 330, 334, 335, 340.
Two of: Chemistry 242, Biology 234, Physics 237, Mathematics 132.
Arts Elective.

Four-year programme
Year III
Two or three of: Earth Sciences 330, 334, 335, 340.
One or two of: Chemistry 242, Biology 234, Physics 237, Mathematics 132.
Arts Elective.

Year IV
One or two Science Courses.
Arts Elective.
*Half courses: 2 of these make the equivalent of one course selection.

Physics Building

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Physics Major

Year I
Including Mathematics 131

Year II
One of: Mathematics 132, 236, 237
One of: Chemistry 236, Biology 231
Arts Elective

Three-year programme
Year III
Physics 339
One of: Physics 237, 332, 338
One of: Mathematics 229, 243
One of: Chemistry 231, 325
Arts or Mathematics Elective

Four-year programme
Year III
Physics 339 or 334
One or two of: Physics 237, 332, 335, 338, 316* and 317*
One or two of: Mathematics 229 or 243; Chemistry 231 or 325
Arts or Mathematics Elective

Year IV
Two or three of: Physics 237, 331, 332, 335, 336, 338, 416* and 417*, 434 (if 334 was taken in Year III), or 441
One or two of: Science options not previously elected, or other courses in Earth Sciences, Chemistry, or Biology acceptable to the Physics Department
Arts or Mathematics Elective
The School of Physical and Health Education
School of Physical and Health Education

The School of Physical and Health Education was formed in 1966 and consists of two departments. The Department of Physical and Health Education administers the academic and research programmes of the School and the Department of Athletics conducts programmes of Inter-collegiate and Intra-mural Athletics, and a service programme in physical education for all students, faculty and staff.

An honours programme in Physical and Health Education is offered on the co-operative basis.

The co-operative programme has been designed to provide professional preparation for persons planning to enter one of the many areas open in physical education, health education and recreation. Courses are offered in the Department of Physical and Health Education and in the Faculties of Arts and Science. Sufficient elective courses are offered to permit considerable latitude to the individual in preparing for his chosen career.

The programme meets the requirements for admission to the Type "A" Certificate course at a College of Education in Ontario.

The co-operative course gives the student an opportunity, unique in Canada, to gain experience in several of the career fields open to Physical Education graduates. Work opportunities are planned in educational institutions, community recreation departments and private agencies such as the YM-YWCA. Arrangements for work assignments are made through the Co-ordination Department of the University, which provides a liaison between the campus and the field. The co-operative programme, besides presenting an opportunity for practical experience and financial assistance, enables the student to assess the several career areas and to bring a more mature outlook to his formal university preparation.

University of Waterloo Warriors

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The School of Physical and Health Education

The academic programme emphasizes the biological sciences and extensive laboratory facilities permit the senior students to encounter at first hand the problems inherent in human physical activity. Features of the programme include a camping skills school and a ski school.

Degrees

Upon successful completion of the co-operative programme the honours degree of Bachelor of Physical and Health Education, (B.P.H.E.) is awarded by the University.

Co-operative Programme

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

<table>
<thead>
<tr>
<th>1968</th>
<th>1969</th>
<th>1970</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Winter</td>
<td>Fall</td>
</tr>
<tr>
<td>First Term</td>
<td>Second Term</td>
<td>Third Term</td>
</tr>
<tr>
<td></td>
<td>Work Period</td>
<td>Work Period</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fourth Term</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Work Period</td>
</tr>
<tr>
<td>Winter</td>
<td>1971</td>
<td>Fall</td>
</tr>
<tr>
<td>Fifth Term</td>
<td>Winter</td>
<td>Fall</td>
</tr>
<tr>
<td></td>
<td>Spring</td>
<td>Winter</td>
</tr>
<tr>
<td></td>
<td>Work Period</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. Year II students are required to attend the Camping Skills School conducted in September prior to the commencement of the regular academic programme. 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 School of Physical and Health Education should be made as early in the year as possible. Students currently enrolled full time in Ontario Grade 13 must apply on the “General Application for Admission to University” form which can be obtained from the Secondary School. All other applicants may obtain application forms directly from 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 have been submitted. Applicants currently enrolled in Ontario Grade 13 and who wish to be considered for Early Final Admission must apply before March 15, 1968. All other applicants must apply and have submitted all the necessary documents by August 1, 1968. Persons applying after this date cannot be guaranteed consideration of their application.
Admission to Year I
In order to qualify for admission to the first year of the Physical and Health Education programme, the applicant should have completed Ontario Grade 13 or its equivalent, showing a minimum overall average of 60% in the seven required credits. For applicants who have taken more than one year to complete the work of Grade 13, a somewhat higher average may be required.

Standing is required in seven Grade 13 credits as follows:
(a) A minimum of four credits chosen from:
   - English
   - Mathematics
   - one language other than English
   Three additional credits chosen wherever possible in accordance with the student's proposed major field of study.

or
(b) Five credits from Chemistry
   - Physics
   - Mathematics A
   - Mathematics B or Biology
   Two additional credits should be chosen from English, languages other than English, Geography, History or, if not chosen above, Biology or Mathematics B.

Additional credits can be selected from any of the optional subjects offered at the Grade 13 level with the qualification that no more than one of the following may be counted as an "additional" credit: Accountancy Practice, Art, Home Economics, Mathematics of Investment, Music, or Secretarial Practice. The marks received in one of these subjects 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 credit" on the same terms as these subjects except the marks received will not be computed in the average.

Note 1
Ontario Tests for Admission to College and University (OACU)
All Grade 13 applicants will be required to submit the results of the Ontario Scholastic Aptitude Test and of such Ontario Achievement Tests as are offered in Grade 13 credits presented for admission.

Note 2
If English is not chosen as a Grade 13 subject offered for admission, applicants must have standing in English at the Grade 12 level.

Note 3
The University will use the following definition of credits for admission purposes.
3 credits - Mathematics A and Mathematics B combined
2 credits - all language subjects, Mathematics A
1 credit - all other subjects

Early Final Admission
Students enrolled full time in Ontario Grade 13 will be considered for Early Final Admission. To be eligible for consideration, applicants must arrange to have the
"General Application for Admission to University" form submitted by March 15, 1968. Consideration of candidates for Early Final Admission will be based on the Secondary School record, the Principal's Recommendation, and the results of the Ontario Scholastic Aptitude Test and specified Achievement Tests. Successful applicants may expect to be notified after May 15, 1968, of their acceptance and will be asked to indicate their decision by June 15, 1968. Those applicants who are not offered Early Final Admission will be considered on the basis of the Grade 13 final results and will be notified as soon as possible after the release of the Grade 13 results.

**Note**

All applicants will be required to complete Grade 13 to the satisfaction of the Secondary School Principal.

The following certificates, recognized as being equivalent to the Ontario Grade 13 certificate, may be accepted insofar as they meet the admission requirements of the University of Waterloo in subjects and percentages:

<table>
<thead>
<tr>
<th>Province/Region</th>
<th>Certificate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alberta</td>
<td>Senior Matriculation (Grade 12)</td>
</tr>
<tr>
<td>British Columbia</td>
<td>Senior Matriculation (Grade 13)</td>
</tr>
<tr>
<td>Manitoba</td>
<td>Senior Matriculation (Grade 12)</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>Senior Matriculation (Grade 13)</td>
</tr>
<tr>
<td>Newfoundland</td>
<td>Year 1 Memorial University</td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>Senior Matriculation (Grade 12)</td>
</tr>
<tr>
<td>Prince Edward Island</td>
<td>Third Year Certificate from Prince of Wales College</td>
</tr>
<tr>
<td>Quebec</td>
<td>McGill Senior Matriculation or Quebec Senior High School Leaving Certificate</td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>Senior Matriculation (Grade 12)</td>
</tr>
<tr>
<td>England and Wales, West Indies</td>
<td>The General Certificate of Education 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.</td>
</tr>
<tr>
<td>East and West Africa</td>
<td></td>
</tr>
<tr>
<td>Scotland</td>
<td>The Scottish Certificate of Education</td>
</tr>
<tr>
<td>United States of America</td>
<td>High School Graduation plus an additional year of formal study in subjects comparable to Ontario Grade 13</td>
</tr>
</tbody>
</table>

**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 may apply to enter as an adult student. It is recommended that applicants attempt to obtain standing in at least one Ontario Grade 13 level subject or its equivalent. These subjects should relate to the programme to which applicants wish to study at Univer-
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

September 11, 12 and 13 School of Physical and Health Education.

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

Refer to Section X page 380

Examinations and Promotions

The Faculty constitutes the examining body for all University Examinations. The arrangement of the co-operative physical and health education programme is shown on page 131. The first two terms, or semesters, comprise the “First year” and courses that extend over the full two terms will have final examinations at the end of the second term. Any other courses that are of single term duration will have final examinations at the end of the term.

The following regulations govern the conduct of examinations and the promotions policy of the School of Physical and Health Education 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. (a) Standing in individual subjects will be granted by letter grade as follows:
### Examination and Promotions

#### Range of Marks

<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</td>
<td>S</td>
</tr>
<tr>
<td>Supplemental Allowed</td>
<td>F</td>
</tr>
<tr>
<td>Below 50 No Supplemental Allowed</td>
<td>F</td>
</tr>
</tbody>
</table>

(b) Standing in a year's programme is to be interpreted as follows:

<table>
<thead>
<tr>
<th>Range of Marks</th>
<th>Standing</th>
</tr>
</thead>
<tbody>
<tr>
<td>75-100</td>
<td>First Class Honours</td>
</tr>
<tr>
<td>66-74</td>
<td>Second Class Honours</td>
</tr>
<tr>
<td>60-65</td>
<td>Third Class Honours</td>
</tr>
<tr>
<td>Below 60</td>
<td>Failure</td>
</tr>
<tr>
<td>Supplemental Allowed</td>
<td>Conditional</td>
</tr>
</tbody>
</table>

3. In order to enter the third and subsequent terms a student must maintain an overall average of 60% and a minimum average of 60% in physical education courses of the term. Students failing to secure these averages 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.

4. All failing papers will be reread before marks are published.

5. To be eligible for supplemental examinations the student must have a final over-all average of 60% and an average of 60% in the physical education courses. Supplemental examinations will be written in the term immediately following that in which the respective final examinations were written with the exception of an exam written at the end of first term in year one. A student may not write supplemental examinations to raise the standing in subjects already passed.

6. 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 approval of the Examinations and Promotions Committee and the Department of Physical and Health Education. 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.

7. 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.

8. 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.
9. A student may not repeat a given year or term more than once. Degree requirements must be fulfilled in not more than 11 terms of resident study.

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

### Academic Programmes

<table>
<thead>
<tr>
<th>Term # 1 (Fall)</th>
<th>Lect.</th>
<th>Lab.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychology 110</td>
<td>Introductory Psychology</td>
<td>3</td>
</tr>
<tr>
<td>Biology 131</td>
<td>An Introduction to Biology</td>
<td>2</td>
</tr>
<tr>
<td>P.E. 100</td>
<td>Introduction to Physical Education and Recreation</td>
<td>3</td>
</tr>
<tr>
<td>P.E. 385</td>
<td>Basic Skills</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Three Electives</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Term # 2 (Winter)</th>
<th>Lect.</th>
<th>Lab.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychology 110</td>
<td>Introductory Psychology</td>
<td>3</td>
</tr>
<tr>
<td>Biology 131</td>
<td>An Introduction to Biology</td>
<td>2</td>
</tr>
<tr>
<td>P.E. 101</td>
<td>Institutional Physical Education and Recreation</td>
<td>3</td>
</tr>
<tr>
<td>P.E. 385</td>
<td>Basic Skills</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Three Electives</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Term # 3 (Fall)</th>
<th>Lect.</th>
<th>Lab.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 16</td>
<td>Introductory to General Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>P.E. 200</td>
<td>Human Anatomy</td>
<td>3</td>
</tr>
<tr>
<td>P.E. 220</td>
<td>Comparative Programmes in Physical Education and Recreation</td>
<td>3</td>
</tr>
<tr>
<td>P.E. 385</td>
<td>Basic Skills</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>†Three Electives</td>
<td>3</td>
</tr>
</tbody>
</table>

†English 101 must be included if not selected as an elective.

<table>
<thead>
<tr>
<th>Term # 4 (Spring)</th>
<th>Lect.</th>
<th>Lab.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychology 211</td>
<td>Developmental Psychology</td>
<td>3</td>
</tr>
<tr>
<td>Biochem. 37</td>
<td>Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>P.E. 210</td>
<td>Kinesiology</td>
<td>3</td>
</tr>
<tr>
<td>P.E. 230</td>
<td>Administration of Facilities</td>
<td>3</td>
</tr>
<tr>
<td>P.E. 240</td>
<td>Basic Movement Education</td>
<td>2</td>
</tr>
<tr>
<td>P.E. 250</td>
<td>Care and Prevention of Athletic Injuries</td>
<td>2</td>
</tr>
<tr>
<td>P.E. 385</td>
<td>Basic Skills</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Term # 5 (Winter)</th>
<th>Lect.</th>
<th>Lab.</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.E. 300</td>
<td>Anatomy and Physiology (Part I)</td>
<td>3</td>
</tr>
<tr>
<td>P.E. 320</td>
<td>Adapted Physical Education</td>
<td>2</td>
</tr>
<tr>
<td>P.E. 330</td>
<td>Measurement and Evaluation</td>
<td>2</td>
</tr>
</tbody>
</table>
### Academic Programmes

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.E. 385</td>
<td>Basic Skills</td>
<td></td>
</tr>
<tr>
<td></td>
<td>†Three Electives</td>
<td></td>
</tr>
<tr>
<td></td>
<td>†English 101 must be included if not selected as an elective.</td>
<td></td>
</tr>
</tbody>
</table>

**Term # 6 (Fall)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.E. 310</td>
<td>Anatomy and Physiology (Part II)</td>
<td>3</td>
</tr>
<tr>
<td>P.E. 110</td>
<td>Administration of Physical Education and Recreation</td>
<td>3</td>
</tr>
<tr>
<td>P.E. 350</td>
<td>Research Methods and Materials</td>
<td>3</td>
</tr>
<tr>
<td>P.E. 360</td>
<td>Health Foundations (Part I)</td>
<td>3</td>
</tr>
<tr>
<td>P.E. 385</td>
<td>Basic Skills</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Two Electives</td>
<td></td>
</tr>
</tbody>
</table>

**Term # 7 (Spring)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychology 212</td>
<td>Social Motivation</td>
<td>3</td>
</tr>
<tr>
<td>P.E. 400</td>
<td>Physiology of Exercise (Part I)</td>
<td>3</td>
</tr>
<tr>
<td>P.E. 420</td>
<td>Physical Growth and Development</td>
<td>3</td>
</tr>
<tr>
<td>P.E. 430</td>
<td>Health Foundations (Part II)</td>
<td>3</td>
</tr>
<tr>
<td>P.E. 440</td>
<td>Research Project</td>
<td>1</td>
</tr>
<tr>
<td>P.E. 450</td>
<td>Coaching Foundations</td>
<td>3</td>
</tr>
<tr>
<td>P.E. 485</td>
<td>Basic Skills</td>
<td></td>
</tr>
</tbody>
</table>

**Term # 8 (Winter)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.E. 410</td>
<td>Physiology of Exercise (Part II)</td>
<td>3</td>
</tr>
<tr>
<td>P.E. 440</td>
<td>Research Project</td>
<td>1</td>
</tr>
<tr>
<td>P.E. 460</td>
<td>Seminar in Health</td>
<td>3</td>
</tr>
<tr>
<td>P.E. 470</td>
<td>Seminar in Physical Education &amp; Recreation</td>
<td>3</td>
</tr>
<tr>
<td>P.E. 485</td>
<td>Advanced Skills</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Two Electives</td>
<td></td>
</tr>
</tbody>
</table>

**Electives**

The student must choose seven electives from either the Faculty of Arts or the Faculty of Science. For those students entering the teaching profession they would be advised to take either: (i) five full courses in one subject area and two in another or (ii) four full courses in one subject area and three in another. The selection of courses for these minor areas, in either Arts or Science, will be determined by the entrance background of the student and in consultation with the departments concerned.
VII

Graduate Studies
Degrees

Courses leading to the degree of Master of Arts (M.A.) are offered in English, French, Geography, German, History, Philosophy, Political Science, Psychology, Russian, Sociology and Anthropology.

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

Courses leading to the degree of Master of Mathematics (M.Math.) are offered in Mathematics.

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

Courses leading to the degree of Master of Philosophy (M.Phil.) are offered in English, German, History, Mathematics and Philosophy.

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

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

Co-operative Graduate Programme in Engineering—see page 52.

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 Graduate Studies Committee of his Faculty 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 the degree requirements.

Requirements for the Master of Philosophy Degree

The Master of Philosophy degree is especially designed as a scholarly degree intermediate between the Masters and Ph.D.
Graduate Studies

The normal pattern in proceeding to the M.Phil. Degree is B.A. (or B.Math.), M.Phil., whereas to the Ph.D. degree it is Bachelor's Degree, Master's Degree, Ph.D. The candidate must have an adequate knowledge of at least one language other than English as specified by his department. Six 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 by the Graduate Studies Committee of the appropriate Faculty.

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 Graduate Studies Committee of his Faculty to be read and judged by at least two members of the University Faculty. The candidate shall defend his thesis in an oral examination before a Committee appointed by the Graduate Studies Committee of his Faculty.

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 three years from the Bachelor's 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 Studies Committee of his Faculty through his department. If the petition should be granted, the Committee 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 Studies Committee of his Faculty through his department for permission to make this change in his programme. If the petition should be granted, the Graduate Studies Committee of his Faculty will specify the requirements which he must fulfill in order to receive 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 Graduate Council, 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 Doctor of Philosophy 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 by the Graduate Studies Committee of the appropriate Faculty.

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 Graduate Studies Committee of his Faculty, to be read and judged by at least two members of the university faculty and an outside examiner, who will be appointed on the advice of the Department by the Dean of Graduate Studies. The candidate shall defend his thesis in an oral examination before a Committee appointed by the Dean of Graduate Studies. This Committee shall consist of the thesis supervisor, the two members of the university faculty appointed to read and judge the thesis, the external examiner (whose attendance is encouraged although not required) and a member of the university faculty from outside the department in which the student is enrolled. This latter member is to be appointed on the recommendation of the Graduate Studies Committee. The Committee will select its chairman and will be the final arbiter on the acceptability of the thesis.

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 Dean of Graduate Studies at least four months prior to the normal date for completion of degree requirements.

Admission and Registration

General

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

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.

Admission to Graduate Studies cannot be granted until all requirements have been met and all documents submitted.

Applicants for Graduate Study must be admitted by the Graduate Studies Committee of the appropriate Faculty. Students who, in the opinion of that Committee of the appropriate Faculty, have insufficient background to permit them to complete the requirements for the Master's 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 Committee regardless of the institution at which the candidate has completed his previous work. At the discretion of the Committee, an applicant may be required to write a set of qualifying examinations.

Definitions

The following definitions are applicable to prospective applicants and to students currently enrolled in graduate studies at the University of Waterloo. Graduate students from other universities who spend a resident period at the University of Waterloo but are not candidates for a Waterloo degree will pay fees as per regular graduate students.

Classification of graduate students is made by the Graduate Admissions Committee for each respective Faculty.

Regular Full-Time Graduate Students:
Students possessing an Honours Bachelor's Degree or equivalent with such standing that they have been accepted by a Faculty Graduate Committee to study for a higher degree.

A full-time graduate student is taken to mean a graduate student enrolled for more than the equivalent of a one term course in any given term.

Qualifying (Full Time) Students:
Students possessing a university degree, who, in the opinion of the Faculty Graduate Committee concerned, may not yet be prepared to undertake graduate study. All, or part, of their programme will consist of undergraduate studies. These students are not candidates for a degree. Completion of the work of the qualifying year does not automatically entitle a student to proceed toward a higher degree. In exceptional cases a student may remain in this class for two (2) years. If it is apparent at the end of the first or second year, that the student is not qualified to proceed to a degree, he may be refused enrolment in Graduate Studies, but will be granted a Certificate of Attendance for the time he has spent at the University of Waterloo.

Regular Part-Time Graduate Students:
Students admitted as regular graduate students, but who, with the permission of the Faculty Graduate Committee concerned, are studying for a graduate degree on a
part-time basis. A part-time graduate student is taken to mean a graduate student enrolled for not more than the equivalent of a one-term course in any given term.

**Special Part-Time Graduate Students:**
Students possessing a university degree who are taking one or more graduate courses but are not intending to proceed to a degree or a diploma. (Students who obtain credits in this category and subsequently decide to proceed to a degree will pay fees according to their category at that time.)

**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 Graduate Admissions Committee for each respective Faculty.

**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 will be required to take either "The English Proficiency Test" 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, or the "Test of English as a Foreign Language" administered by the Educational Testing Service of Princeton University.

**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.

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

<table>
<thead>
<tr>
<th>Grade</th>
<th>Range</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.

Certain graduate courses (designated "no letter grade" in the Calendar) carry no letter grades and will be marked "Credit", or "No credit".

**Fees**
Refer to Section X page 380

**Registration (Fall Term)**
September 23 Monday Graduate Studies.

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

Course Descriptions
Undergraduate Course Descriptions

101. Introduction to Zoology: The structure and functioning of animals with particular reference to mammals. A survey of the types of animals illustrating evolution and those types which are of special interest to man.
2 lectures, 3 hours laboratory.
(This is a terminal course and it is not available to students in the Faculty of Science, except in Optometry. Similarly it is not suitable for students of Physical Education who wish to proceed to a minor in Biology.)

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 13 Biology or equivalent and have passed Grade 13 Chemistry. Selected topics in elementary biology.
2 lectures, 3 hours laboratory.

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 those from other departments. Not available for students whose major field is Biology except as an extra course)

233t. 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, 4 hours laboratory (20 laboratory periods)

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.


2 lectures, 3 hours laboratory.

301. Vertebrate Physiology: The physiology of the major organ systems of the vertebrate body, with emphasis on the human. The topics discussed include circulation, respiration, digestion and nutrition, metabolism, muscle, nervous system, special senses, and the endocrine system.

Prerequisites: Biology 101 or 131 or 132.

2 lectures, 3 hours laboratory

Primarily for students of Optometry but available to others whose major or minor field is not Biology.)

333t. 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.

334t. Evolution and Systematics: An exploration of current concepts in evolution and systematics, with particular reference to the plant kingdom.

Prerequisite: Biology 234.

2 lectures, 3 hours laboratory.

335. Microbiology I: Detailed study of microorganisms. The cultural, morphological, structural and biochemical characteristics of bacteria.

Prerequisite: Biology 235.

2 lectures, 3 hours laboratory.

†By special arrangement these courses can be taken in 2 sequential halves by students in co-operative programs.
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 and Electrophysiology: Selected topics and techniques in neurophysiology, and physiology.
Prerequisite: Biology 301 or 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.
*Prerequisites: 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 and special groups related to food and fermentation microbiology.
*Prerequisite: Biology 235.*
2 lectures, 3 hours laboratory.

499. **Senior Honours 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. Before selecting this course students must obtain approval for doing so from both the professor under whose direction they wish to work and the chairman of Biology.

**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, 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.
- 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 fluvial forage fishes.
- Developmental genetics of Protozoa and Nematodes.
- Taxonomy and ecology of microfungi.
Comparative studies of numerical phenetics (computer toxonomy) and phylogenetically based taxonomy in selected groups of plants and animals. Developmental studies in Fungi Imperfecti.

Comparative neurophysiology.
Carbon metabolism in facultative bacteria and their control mechanisms.
Properties of microorganisms related to the food and fermentation industries.
Colonization of small aquatic habitats.
Ontogeny of bottom fauna and plankton of lakes.
Helminths of freshwater fishes.
Fauna and flora of Pleistocene ponds of the Toronto area.
Mineral nutrition of higher plants and mechanisms of seed dormancy.
Cytology and development of lower plants.

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.


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


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.


613. Mycology. Critical discussions of selected mycological topics—taxonomy, ecology, plant pathology.

615. Limnology for Engineers: A lecture, seminar and practical course providing a study of the aquatic environment with special reference to the effects of modern man. 1 term.

617. Advanced Neurophysiology. Discussion of selected topics pertaining to structure and function in the neurosystems.

618. Advanced Microbial Physiology. Discussion of selected topics in microbial physiology.

621. Advanced Animal Physiology II. Critical discussion of selected topics in animal physiology.

622. Advanced Plant Physiology II. Critical discussion of selected topics in plant physiology.

667. Molecular Biology. Selected topics in molecular biology will be presented at an advanced level with the aim of evaluating recent work and developments. Basic concepts and interrelationships will be emphasized.

Department of Chemical Engineering

D.S. Scott, B.Sc., M.Sc. (Alberta), Ph.D. (Illinois).  Professor
T.L. Batke, B.A.Sc., M.A.Sc., Ph.D. (Toronto).  Chairman of the Department
Professor
T.L. Batke, B.A.Sc., M.A.Sc., Ph.D. (Toronto).  Vice-President, University Development
Professor
F.A.L. Dullien, Dipl.Ing. (Budapest Technical University).  Professor
M.A.Sc., Ph.D. (British Columbia)
P.M. Reilly, B.A.Sc., D.I.C., Ph.D. (London), F.S.S.  Professor
G.A. Truner, B.Sc.(London), Ph.D. (Manchester).  Professor
B.M.E. van der Hoff, Ing. (Amsterdam), Ir. (Delft).  Professor
A.H. Heatley, B.A.Sc., M.A., Ph.D. (Toronto).  Professor Emeritus
L.E. Bodnar, Ph.D. (McMaster).  Associate Professor
J.J. Byerlye, B.A.Sc., M.A.Sc. (Toronto), Ph.D. (British Columbia).  Associate Professor
K. Enns, B.A.Sc., LL.B., M.A.Sc. (Toronto), Ph.D. (Toronto).  Associate Professor
T.Z. Fahidy, B.Sc. (Hon.), M.Sc. (Queen's) Ph.D. (Illinois).  Associate Professor
J.D. Ford, B.A.Sc., M.A.Sc. (Toronto).  Associate Professor
C.E. Gall, B.A.Sc. (Toronto), M.Sc. (Queen's).  Associate Professor
R.Y-M. Huang, B.Sc. (National Taiwan University), M.A.Sc., Ph.D. (Toronto).  Associate Professor
D.C.T. Pie, B.Eng. (McGill), M.Sc. (Queen's), Ph.D. (McGill).  Associate Professor
P.L. Silveston, B.S., M.S. (Massachusetts Inst. of Tech), Dr.Ing. (Munich).  Associate Professor
M. Moo Young, B.Sc. (London), M.A.Sc. (Toronto), Ph.D (London).  Associate Professor
C.M. Burns, B.A.Sc., M.A.Sc. (Toronto), Ph.D. (Brooklyn Polytechnic Inst.).  Assistant Professor
G.D. Fulford, B.Sc., Ph.D. (Birmingham).  Assistant Professor
R.R. Hudgins, B.A.Sc., M.A.Sc. (Toronto), Ph.D. (Princeton).  Assistant Professor
W.H. Ray, B.A., B.S. (Ch.E.) (Rice), Ph.D. (Minnesota).  Assistant Professor
J.M. Scharer, B.Sc., Ph.D. (Pennsylvania).  Assistant Professor

Undergraduate Course Descriptions

2 lectures, 3 hours lab.—two terms.
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.

17. Applied Mathematics I. Laplace Transforms, introduction to vector analysis and matrix algebra, formulation of ordinary and partial differential equations describing physical systems.
3 lectures, one term.

2 lectures, 3 hours problems, alternate weeks.

Prerequisite: G.E. 32.
3 lectures, one term.

Prerequisite: Ch.E. 22.
3 lectures, one term.

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.
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 homogeneous 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.

51. **Process Dynamics and Control I.** Block and signal flow diagrams, proportional-integral-derivative controllers, frequency response techniques, analytical and graphical stability criteria, Introduction to modern control theory.

Prerequisite: Math. 31, Ch.E. 22

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.

12 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.

80. **Introduction of Polymer Science.** Basic concepts of polymer chemistry, classification of polymers, introductory physical chemistry of polymers, organic chemistry of polymerization reactions, reactions of polymers, naturally occurring polymers.

3 lectures, one term.
81. Physical Chemistry of Polymers. Polymer solutions, molecular characterization of polymers, molecular weight distributions, morphology and crystallinity in polymers, reaction kinetics and mechanisms of addition and condensation polymerization, polymer structure and physical properties.
Prerequisite: Ch.E. 80.
3 lectures, one term.

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.

95. Seminar. Study and presentation of material in recent literature.
1 hour, one term.

98. Research and Design Project I.
3 hours, one term.

99. Research and Design Project II.
Prerequisite: ChE 98.
6 hours, one term.

535. Estimation of Properties of Gases and Liquids The activities of the chemical or process engineer have often been referred to as “molecular engineering”. One of his basic needs is reliable quantitative data on the physical, chemical and thermodynamic properties of pure substances and mixtures. This course is intended to familiarize the student with the most up-to-date methods available for the estimation of certain of the more important properties of gases and liquids in cases where experimental values are not to be found. Prediction is usually based on correlations of a form suggested in part by theory, with empirical constants based on experimental data.
Prerequisite: ChE 32.
3 lectures, one term.

543. Reaction Kinetics III. Kinetics of heterogeneous and catalytic reactions; design and scale up of heterogeneous reactors.
Prerequisite: ChE 42.
3 lectures, one term.

552. Process Dynamics and Control II. Analog computation, time domain analysis, control of complex chemical systems.
Prerequisite: Ch.E. 51
3 lectures, one term.
554. **Chemical Engineering Analysis.** More rigorous treatment of vector and matrix algebra, integral transform techniques for solution of equations describing physical systems, applications to chemical processes.  
*Prerequisite: Permission of Instructor*  
3 lectures, one term.

587. **Metallurgy of Iron and Steel.** A study of Iron and Steel making from a Physical-Chemical approach using the interrelationships of physics and chemistry to understand structural, thermodynamic and kinetic factors. Some of the material to be included—Physical Nature of Solution, Metal-Slag Reactions, Slag Theory, Non-Equilibrium Conditions, Steel Making Processes, Carbon-Oxygen reactions, Impurity problems and Reaction of the Blast Furnace.

590. **Biochemical Engineering Processes.** Introduction to the application of Chemical Engineering principles to the processing of materials of biological character or origin. Methods of solving problems imposed by biological character or origin. Methods of solving problems imposed by biological and related factors on process design in the manufacturing industries. Food and beverage. Enzymes, Antibiotics, Vitamins, Effluent disposal.  
3 lectures, one term.

3 lectures, 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 general and 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.
Department of Chemical Engineering

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 four units of which must be Ch.E. 600, 642, 650, and 672. Other courses may be chosen either from outside Departments or from other Chemical 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 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 major areas of investigation, which are listed below. In addition to work in these fields, a wide variety of research is carried out in less intensively developed areas. Major areas of research interest are:

1. Biochemical Engineering—Heat transfer, mass transfer, and fluid flow in biological processes of industrial interest; chemical engineering design of fermentation, food processing, and waste treatment facilities.

2. Chemical Kinetics and Catalysis—Investigation of reaction rates in inorganic and organic systems, selectivity studies in catalysis, homogeneous catalysis, heat and mass transfer in heterogeneous systems, chemical reaction engineering.

3. Process Control and Dynamics—Simulation, process control theory, applications of control theory to actual chemical systems, computer control, process analysis and dynamics, operations research, optimal design, control of chemical plants.
4. Transport Phenomena—Heat and mass transfer in gas-solid, gas liquid, liquid-liquid and other multiphase systems. Concurrent flow transport processes, boundary layer theory, turbulence at mobile interfaces, condensing vapor heat transfer, microwave heating, frequency response methods, diffusion studies, etc.

5. Polymer Science—Diffusion through modified membranes, radiation graft polymerization, emulsion polymerization, stress relationships in elastomers, physical properties of polymers, etc.

6. Chemical Metallurgy—Hydrometallurgical processes, solid state reactions, mineral beneficiation, powder and solids handling technology pelletization, reactivity of solids.

Details of Graduate Courses
All courses are one term, and except for those listed under "Special Topics," are given every year.

The following four courses are intended to serve as advanced core courses giving fairly broad coverage in a field. It is expected that all graduate students will normally take one or more of these four before proceeding to more specialized graduate course work.

600. Theory and Applications of Transport Phenomenon. Evaluation of molecular transport properties, Equations of mass heat and momentum transport, boundary layer and turbulence theory, application to analysis of flow systems, heat transfer equipment, and mass transfer operations.
3 lectures, one term.

3 lectures, one term.

3 lectures, one term.

672. Advanced Mathematics in Chemical Engineering. Review of fundamental concepts and methods of mathematical analysis with applications in Chemical Engineering. Topics covered will be selected from Advanced Calculus, Vector Analysis, Tensor Analysis, Matrix Algebra and Calculus, Ordinary and Partial Differential equations, numerical techniques. The emphasis will be placed on the general usefulness of the methods in a wide variety of research and design problems.
Prerequisite: Permission of Instructor.
3 lectures, one term.
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 the students' advisors. The courses described below are of a broader scope than those listed as Special Topics in Groups A, B or C.

602 Processing and Properties of Solids. Particle and pore size analysis, conveying of solids in fluids, heat and mass transfer in beds of solids, behaviour of dense beds of fine solids.
3 lectures, one term.

624. Liquid-fluid Transfer Processes. An advanced survey of gas-liquid and liquid-liquid heat and mass transfer operations in flowing systems. Special emphasis will be placed on one or more of the following topics: transfer mechanisms at fluid-liquid interfaces, drop and bubble phenomena, cascade theory of separation processes, transfer processes in two-phase tube flow, packed column behaviour, mass and heat transfer during mixing, boiling and condensation phenomena.
3 lectures, one term.

3 lectures, one term.

3 lectures, one term.

641. Chemical Reactors for Heterogeneous 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 of heterogeneous catalytic and non-catalytic reactors.

3 lectures, one term.

673. Advanced Mathematics in Engineering Research. Generalizes and extends the techniques of Ch.E. 672.
Prerequisite: Ch.E. 672.
3 lectures, one term.

3 lectures, one term.
Prerequisite: Ch.E. 680
3 lectures, one term.

Prerequisite: Ch.E. 690.
3 lectures, one term.

Prerequisite: Ch.E. 682 and 683.

686. Hydrometallurgy. General discussion of hydrometallurgical systems; ionic processes in aqueous solutions, thermodynamics and kinetics of leaching, precipitation, and reduction processes; design problems encountered in hydrometallurgical operations.
3 lectures, one term.

Co-operative Chemical Engineering student on work term assignment

160
687. Theoretical Chemical Metallurgy. The application of physicochemical principles to chemical metallurgy; thermodynamic equilibria of heterogeneous processes, electrolytic and electrode reactions, theory of rate processes and their application to process metallurgy.
3 lectures, one term.


Special Topics

Group A—(Topics in Transport Theory)

705. Particle-Fluid Dynamics

707. Non-Newtonian Flow

715. Radiant Heat Transfer

716. Heat Transfer in Two Phase Systems

724. Use of Transient and Frequency Response to measure Physical Quantities

725. Gas-Liquid Mass Transfer Processes

726. Dissolution and Crystallization

727. Ion Exchange

Group B—(Topics in Thermodynamics and Chemical Kinetics)

735. Advanced Thermodynamics

736. Surface Chemistry

745. Physical Processes in Heterogeneous Catalysis

746. Kinetics of Consecutive and Chain Reactions

747. Kinetics of Biological Systems

748. Residence Time Distributions, Reactor Flow Models and Reactor Stability
Group C—(Topics in Control Theory and Applied Mathematics)

754. Mathematical modeling of Chemical Processes

755. Analysis of Non-linear Processes

756. Control of Complex Processes

757. Optimization Problems in Chemical Processes

765. Basic Statistics in Engineering

766. Topics in Advanced Process Control

767. Special Topics in Analysis of Processes

768. Advanced Statistics in Engineering

797. 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.

801. Oral Examination of the Thesis for the Ph.D.

802. Graduate Seminar

803. Research Proposal for Ph.D.

804. Russian or German language proficiency for Ph.D.
Department of Chemistry

H.G. McLeod, M.A., Ph.D. (Toronto)  Professor and Chairman of Department
W.F. Forbes, D.I.C., Ph.D., D.Sc. (London)  Professor
W.A.E. McBryde, M.A. (Toronto), Ph.D. (Virginia)  Professor

Dean of the Faculty of Science

H.D. Sharma, M.Sc. (Delhi), Ph.D. (California)  Professor
T. Viswanatha, M.Sc., Ph.D. (Mysore)  Professor
R.H.F. Manske, M.Sc. (Queen's), Ph.D. (Manchester), D.Sc. (Manchester), D.Sc. (McMaster), F.R.S.C.  Senior Lecturer
G.F. Atkinson, M.A., Ph.D. (Toronto)  Associate Professor
D.A. Brisin (Mrs.), B.Sc. (Alberta), Ph.D. (Toronto)  Associate Professor
J.B. Capindale, M.A., D.Phil. (Oxford)  Associate Professor
W.L. Elsdon, M.Sc. (Western), Ph.D. (McGill)  Associate Professor
R.M. Guest, M.A. (Western), Ph.D. (McGill)  Associate Professor
D.E. Irish, B.Sc. (Western), M.Sc. (McMaster), Ph.D. (Chicago)  Associate Professor
F.W. Karasek, B.S. (Elmhurst), Ph.D. (Oregon State)  Associate Professor
J.L. Koppel, B.A., Ph.D. (Toronto)  Associate Professor
D. MacKay, B.Sc., Ph.D. (Aberdeen)  Associate Professor
A.D. Maynes, M.Sc., Ph.D. (Toronto)  Associate Professor
J.R. Mills, M.A. (Toronto), Ph.D. (Illinois)  Associate Professor
J.B. Moffat, B.A., Ph.D. (Toronto)  Associate Professor
G.J. Palenik, B.Sc. (Illinois), Ph.D. (Southern California)  Associate Professor
A. Rudin, B.Sc. (Alberta), Ph.D. (Northwestern)  Associate Professor
J.G. Smith, B.Sc., M.Sc., Ph.D. (Toronto)  Associate Professor
G.E. Toogood, B.Sc., Ph.D. (Nottingham)  Associate Professor
R.G. Woolford, M.Sc. (Western), Ph.D. (Illinois)  Associate Professor

Associate Dean of the Faculty of Science

A. Balasubramanian, M.Sc. (Madras), Ph.D. (Indian Institute of Science)  Assistant Professor
A.J. Carty, B.Sc., Ph.D. (Nottingham)  Assistant Professor
B.O. Fraser-Reid, M.Sc. (Queen's), Ph.D. (Alberta)  Assistant Professor
R.J. Friesen, M.Sc. (Manitoba)  Assistant Professor
T.E. Gough, B.Sc., Ph.D. (Leicester)  Assistant Professor
V.A. Snieckus, B.Sc. (Alberta), M.S. (California), Ph.D. (Oregon)  Assistant Professor

Undergraduate Course Descriptions

Details of the undergraduate programmes offered by the Faculty of Science are to be found on page 108.

3 lectures, 3 hours laboratory alternate weeks, two terms.

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.

31. Elementary Chemical Spectroscopy
3 lectures, one term.

35. Electrochemistry. Electrolysis, electrolytic conductance and transport; reversible and irreversible electrode potentials; thermodynamics of electrolytic solutions. Introduction to electroanalytical methods. Application of electro-chemistry to selected electrolytic processes and to the study of metallic corrosion.
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, alternate weeks, 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 16 or 36.
3 lectures, one term.

164
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.
2 lectures, 1 tutorial, 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.
2 lectures, 1 tutorial, 3 hours laboratory.

200.* Radiochemistry. Stability rules for atomic nuclei; modes of decay of radioisotopes; radiations and their detection methods; nuclear reactions applied to activation analysis; radiation induced chemical reactions; use of radioisotopes in science and industry as tracers and radiation sources.
2 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 lectures, 3 hours laboratory, one term.

3 lectures, 9 hours laboratory, one term.

Liquid-vapour equilibria.
3 lectures, 3 hours laboratory, one term.

206.* Introductory Organic Chemistry. Basic Chemistry and structure of the important classes of aliphatic and aromatic compounds.
3 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.

216.* Introduction to Organic and Biochemistry. A general survey of the important principles and applications of organic and biochemistry for Optometry students only.
3 lectures, Winter 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 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 systematic chemistry of the non-transition elements.
2 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 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 lectures, 3 hours laboratory, one term.

3 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 lectures, 3 hours laboratory, one term.

307.* Introductory Biochemistry. Carbohydrates; proteins; nucleic acids; lipids; metabolism of these compounds.
3 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 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 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 lectures, 3 hours laboratory.

2 lectures, 6 hours laboratory.

336. Organic Chemistry II: Correlation between electronic structure and chemical properties and reactivity; stereochemistry; synthetic methods, especially enolate and re-
lated condensations, and cyclo-addition reactions; carbohydrate and peptide chemistry.
2 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).

341. Inorganic and Nuclear Chemistry. The chemistry of the transition elements. Introduction to nuclear and radiochemistry.
2 lectures, 3 hours laboratory (except for Honours Chemistry and Physics students)

400.* Electrochemistry and Corrosion. Electrolytic conductance and transport; thermodynamics of electrolytic solutions; electrode potentials; the measurement of pH; metallic corrosion.
3 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 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 polymer molecules; degradation; solution properties of crystalline and amorphous polymers; molecular weight distributions.
3 lectures, 3 hours laboratory, one term.

405.* Surface Chemistry. An introduction to the physical chemistry of surfaces. Properties of surfaces; quantitative description of a surface; interaction between phases at a surface. Thermodynamic treatment of surfaces; physical adsorption; chemisorption. Practical applications of surface chemistry in chemical industry.
3 lectures, 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 lectures, 3 hours laboratory, one term.

1 lecture, 3 hours laboratory, one term.

410*. Applied Chemistry Seminar.
1 hour seminar, 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 lectures, 3 hours laboratory, one term.
413*. Properties of Polymers. Behaviour of polymers: types of mechanical behaviour, flow and relaxation mechanism, birefringence, orientation and recovery; glass transitions; crystallisation and properties of crystalline polymers; introduction to theory of high elasticity.
3 lectures, 3 hours laboratory, one term.

3 lectures, 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 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; magnetochemistry; interpretation of electronic spectra.
2 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 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.
9 hours per week for Honours Chemistry students, 6 hours for Honours Chemistry (Mathematics or Physics Option), 3 hours for Honours Chemistry and Physics students.

440. 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, 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 of endeavour as listed.

Major Areas of Research

Analytical Chemistry - Chemical instrumentation based on analog modules and on direct digital control; 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; analysis of rocks, minerals and meteorites.

Inorganic Chemistry - studies on inorganic complexes in solution, magnetic susceptibility measurements of metallic complexes; structure determination by X-ray diffraction methods; solutions of metals in molten salts and other non-aqueous media; the chemistry of the lanthanides in non-aqueous solvents; isotopic exchange reactions, ion exchange kinetics and equilibria, nuclear chemistry.

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; synthesis of natural products (especially alkaloids) and N-heteroaromatic substances; spectroscopic studies (using infrared, ultraviolet, c.s.r. and n.m.r. techniques) of molecular conformation and hydrogen bonding; synthesis and characterization of film-forming polymers; photochemistry; carbohydrate chemistry.

Biochemistry - effects of radiation on proteins and amino acids as studied by electron spin resonance and other techniques; the aging process; the role of free radicals in tobacco smoke carcinogenesis; 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, methods, and the physical nature of the chemical bond; 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; viscous and elastic properties of thermoplastics; influence of molecular structure and morphology on mechanical properties of polymers.

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, programmes 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 radiocaehemical assay, tracers in chemical applications; radiochemical techniques and radiation chemistry.

615. Physical Chemistry of High Polymers. Selected topics in the field.

620. Resonance Spectroscopy. Nuclear and electron magnetic resonance spectroscopy; basic principles, derivation and solution of the Bloch Equations, first and second-order interpretation of nuclear magnetic resonance spectra. The application of these techniques and of double irradiation experiments to selected chemical problems.

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; steriods 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 stereochemistry and chemical reactivity of saturated and unsaturated 3-, 4-, 5-, 6- and 7-membered carbocyclic systems, including the decalins and perhydrophenanthrenes. Elimination reactions. Aromaticity, including a study of valence bond isomers and the annulenes, and homoaromaticity. Reaction mechanism studies utilising isotope effects and transition state concepts. Woodward-Hoffmann rules. Classical and nonclassical carbonium ion theories.

647. **Selected Topics in Physical Biochemistry.** Discussion of several related fields covering the application of spectroscopic methods to biochemistry; ultracentrifugation; light scattering; and tracer chemistry.

655. **Chemical Kinetics.** Statistical methods applied to the kinetic molecular theory and to the treatment of interacting systems. The kinetics of homogenous reactions in gases with emphasis on unimolecular reactions, and of reactions in condensed phases.

656. **Synthetic Methods of Organic Chemistry.** A discussion of classical and newer concepts in the synthesis of organic compounds with emphasis placed on the fundamental behaviour patterns. An integration of experimental facts and modern theories is presented.

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.


666. **Organic Spectroscopy.** Introduction to ultraviolet, infrared, and resonance spectroscopy, with emphasis on applications to studies of organic molecules.

675. **Selected Topics in Physical Chemistry.** Discussion of specialized topics in thermodynamics, electrochemistry, surface phenomena and quantum chemistry at an advanced level.


699. **Thesis.**
Undergraduate Course Descriptions


232. Economics and Social Sciences. (a) Demand and Supply, market places, marginal analysis, cost-benefit analysis engineering economy. (b) Introduction to the social sciences and series of guest lectures by outstanding men in sociology, psychology, engineering, philosophy, management, etc.


301. 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 superposition, energy theorems, theories of failure, elastic and inelastic analysis of unsymmetrical bending, shear centre, torsion of cellular members, columns and stability, and virtual work.


304. Structural Analysis. Statically indeterminate structures: analysis of beams, frames, arches, space frames and trusses. Influence lines and maximum internal forces.


322. **Engineering Analysis.** Formulation and solution of various eigenvalue equilibrium and propagation problems in discrete and continuous systems. Topics include equations of mathematical physics, separation of variables, eigenvalues and eigen function, numerical methods, calculus of variations, Raleigh-Ritz, Galerkin and other approximate methods.


361. **Urban Planning.** A systematic approach to urban planning. Goals, objectives and criteria, plan alternatives, optimization and plan implementation. Theories of urban growth and development. A group planning project.

371. **Geology for Engineers** An introductory course in geology with emphasis on topics related to civil engineering; mineralogy and petrology, structural geology, geomorphology (especially glacial geology). Aggregates: properties and occurrence. Field trips.


400. **Project.** 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.

401. **Structural Steel.** The design of structural elements in steel. Beams, tension and compression members, connections and plates.

402. **Reinforced Concrete I.** The behaviour, analysis and design of sections and structural members in reinforced concrete. Discussion of standard recommendations.

452. **Water Resources Engineering.** The physical, chemical and biological basis 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 the measurement of water quality and treatment process control.


481. **Engineering Law.** General introduction to law and the Common Law legal systems; formation of contracts, effect of mistake on contracts, interpretation of contracts, breach of contracts, legal remedies; scope and content of technical specifications; sale of goods; introduction to the Law of Agency; the Tort of Negligence, professional negligence; some aspects of restrictive trade practices; introduction to Patent Law.

500. **Project.** An independent piece of engineering work, usually not entailing experimentation, under the direction of a faculty member.


**Graduate and Research Programmes**

Both co-operative and conventional graduate study leading to the degree of Master of Applied Science (M.A.Sc.) or Doctor of Philosophy (Ph.D.) can be undertaken in Civil Engineering. At present, there are five major areas of study in which specialization may be undertaken: Structural Engineering and Applied Mechanics, Soil Mechanics and Geotechnical Engineering, Water Resources and Sanitary Engineering, Transportation Planning and Engineering, and Hydraulics and Water Resources Systems Planning.

† **Structural Engineering and Applied Mechanics.** Major subdivisions of study are applied mechanics, structural mechanics, concrete structures, properties of materials, experimental mechanics, and stochastic systems. Graduate courses in this area are CE 605 to 635 inclusive; other courses may be offered in the 700 series.

Current research includes studies in structural stability and dynamics, large deflections of membranes, elastic and inelastic continua, structural response to random excitation, hydroelasticity, analysis and design of reinforced and prestressed concrete
Department of Civil Engineering

structures, structural optimization, computer aided design of structures, strength and safety of structures, analysis of latticed space structures, strength of pressure vessels, plastic behaviour of shells, mechanisms of fatigue failure in materials, longwave photoelasticity, photoelastic techniques in fatigue and flow problems, and nonlinear stochastic processes.

Transportation Planning and Engineering. The major areas of study are urban transportation planning, transportation systems analysis, highway planning and engineering, traffic engineering and air transport planning. The graduate courses offered within the group are CE 640 to 649 inclusive. Additional courses are available in urban and regional planning, economics, sociology and operations research.

Current research activities include investigations in transportation systems analysis, urban transportation analysis methods, urban land use models, economic analysis of transportation systems, intercity air transportation of persons and goods and studies of bituminous materials.

Soil Mechanics and Geotechnical Engineering. Major subdivisions of study in this area are soil mechanics, foundation engineering and engineering geology. Graduate courses CE 650, 658 and 664 are offered regularly. Additional special graduate courses may be offered if there is sufficient demand.

Current activities include studies on the yielding of soils, settlement of structures, model testing, seepage and engineering geology.

Water Resources and Sanitary Engineering. Graduate course offerings in this area are CE 671 to 675 inclusive and CE 791 and CE 792. Supporting courses are available in biology, hydraulic chemistry and other related fields.

At the present time, research involves work on the kinetics of biological waste treatment (aerobic and anaerobic), specific industrial waste treatment problems, the use of coal for waste treatment, and evaluation of the applicability of trickling filters for waste treatment in cold climates. Both laboratory-scale and pilot plant facilities are being used in these studies. The Department has several well-equipped laboratories that are used for demonstrations, teaching and research. Biological and chemical plant units are used to study and evaluate new methods to improve water and waste quality.

Hydraulics and Water Resources Systems Planning. The available courses are CE 685, 686, 687, 688, 689, 791 and 792. Courses in associated areas of fluid mechanics, soil mechanics, planning and economics are also available.

Current research in this area lies in the fields of open channel hydraulics, sediment transport, hydroelastic vibrations and water resources systems planning.

Graduate Course Descriptions


626. Advanced Analytical Mechanics. Fundamental dynamical theorems and their application to advanced problems; generalized co-ordinates; Lagrange's equation; fixed and moving constraints; non-holonomic systems; principle of least action; introduction to qualitative and quantitative methods of nonlinear analysis; stability; parametric excitation.

Prerequisite CE 627.


635. Special Problems of Experimental Mechanics. Recent advances in the field of experimental methods for evaluation of strength of structures, of strain and stress fields, for investigation of dynamic behaviour of structures, for investigation of propagation and interference of stress waves in solids and pressure waves in fluids. (Lectures and Laboratory).
636. Experimental Stress Analysis. Relations between stress state, strain state and mode of failure of a structure. Static and dynamic problems. Direct methods, model methods, similarity criteria. Theory and technique of the main methods of stress analysis: displacement and strain measurements by means of mechanical, electric, and optical transducers, (mechanical, optical, electric, photoelastic and moiré gages); brittle coatings; measurements of changes of mechanical, electromagnetic and thermodynamic properties (photoelasticity, x-ray techniques, ultrasonic techniques, temperature measurements). Principles of designing and choice of measuring systems. Recording techniques. Evaluation and analysis of results. (Lectures and Laboratory).


646. Geometric Design. Design standards and geometric design of highway alignment, grade, sight distance and cross section by class of highway. Design of intersections and interchanges. Design of planned access facilities in rural and urban areas.


649. **Airport Engineering and Planning.** Civil aviation, air traffic control, financing of airports. The role of the airport in the transportation system. Planning considerations. Demand predictions current problems in air transportation planning and engineering.

650. **Advanced Soil Mechanics I.** Steady state seepage of fluids through porous media. Stress distribution due to static boundary loads of a soil mass. General theory of consolidation.

658. **Soil Engineering** (Case Histories). A critical study by the consideration of case histories of the current procedures of design and construction of foundations, earth retaining structures and earth slopes.

664. **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 soil surveys.

671. **Water Resources Engineering I.** The physical and chemical unit operations and processes utilized in water and waste-water treatment systems.

672. **Water Resources Engineering II.** The principles of biological oxidation. The biological unit processes utilized in the treatment of domestic and industrial waste waters.

673. **Water Resources Engineering III.** Advanced laboratory-water quality measurement and process control. A series of laboratory experiments on the various unit operations and processes of water and waste-water treatment. Stream pollution investigations. Lecture programme in Chemistry and Applied Microbiology (two terms).

674. **Water Resources Engineering IV.** Design and operation of water and waste water treatment systems. Water quality criteria. Effect of waste discharge on receiving waters. This course is the integration of the material covered in Water Resources Engineering I, II and III leading to the development of functional designs for water and waste water treatment systems.

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.

676. **Environmental Health Engineering.** The engineering control of man's environment to protect his health and promote his well-being. Some topics covered include communicable diseases, epidemiology, air pollution, noise, lighting, industrial poisons and ionizing radiations.


700 to 790 Special Advanced Courses and Directed Studies.

791, 792 Engineering Project.

801 Oral examination of the Thesis for the Ph.D.

803 Comprehensive examination (As determined by the Department).

804 Language requirement for the Ph.D. (As determined by the Department).

808 Research thesis for the M. A. Sc. degree.

809 Research thesis for the Ph.D. degree.
Department of Classics and Romance Languages

R.L. Myers, B.A. (Western), M.A., Ph.D. (Johns Hopkins), Professor
Chairman of the Department

K.M. Abbott, B.A. (Harvard), Ph.D. (Illinois) Visiting Professor

J.R. Finn, C.R., B.A. (Western), M.A. (Toronto), Ph.D. (Illinois) Professor

B.J. Graf, C.R., M.A. (Western) Professor

J.C. McKegney, B.A. (Western), M.A. (Oregon), Ph.D. (Washington) Diploma (Santander) Professor

D. Walter (Mrs.), B.A., M.A., (Queen’s) Professor

A. Ages, B.A. (Carleton), M.A., Ph.D. (Ohio State) Associate Professor

J.J. Biname, L. en Phil. rom., Agrégé (Brussels) Deputy Chairman

E. Grey, B.A. (Texas Western), M.A. (Colorado), Ph.D. (Harvard) Associate Professor

P.G. Keleher, C.R., M.A. (St. Mary’s, Kentucky) Executive Secretary

P. Keresztes, M.A. (Toronto), Ph.D. (Graz) Associate Professor

J.T. Ralston, C.R., B.A. (Western), M.A. (Laval), Ph.D. (Catholic U. of America) Associate Professor

J.B. Bullbrook, C.R., B.A. (Western), M.A. (Laval) Assistant Professor J

C.M. Fernandez (Mrs.), Lic. en Arq. (Madrid), M.A. (Tulane) Assistant Professor

J.F. Gounard, Baccalaureat (Bordeaux), Hypo-Khagne (Bordeaux), Licence-es-Lettres (Bordeaux) Assistant Professor

J. Lafrance (Miss), B.Paed., M.A. (Laval) Assistant Professor

Sister M. Stella, S.S.N.D., B.A. (Toronto), M.A. (Catholic U.) Assistant Professor J

R.L. Porter, B.A. (McMaster), M.A. (Princeton) Assistant Professor

R.J. Fournier (Mrs.), B.A. (Toronto), M.A. (Western) Lecturer

H.S. Fournier (Mrs.), B.A. (Toronto), M.A. (Western) Lecturer

S. Haag (Mrs.), B.A., M.A. (Queen’s) M.Phil. (Toronto) Lecturer


W.H. Schnarr, C.R. B.A. (St. Mary’s, Kentucky) Lecturer

O. Romanyszyn, B.A. (Waterloo) Lecturer

C.C. Abbott (Mrs.), B.A., M.A. (Ohio State) Lecturer (Part-time) R

M. Watkins (Mrs.), B.A. Lecturer (Part-time)

General Remarks

1. The number of lectures per week shown after certain course descriptions is an attempt to indicate the “normal”. The instructor will determine how often his particular class will meet.

2. In choosing his courses each year, the student should always bear in mind the requirements of the profession he intends to enter after graduation. The members of the department are at all times willing to advise the student if he so wishes.

3. Course numbers ending in 5, indicate a fall-term course, those ending in 6, indicate a winter-term course. Course numbers ending in 0 indicate a full (two-term) course.
Undergraduate Courses

Classics

Classical and Mediaeval 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. Three lectures.

252*. Roman History. A military, political, social, economic survey of Rome from earliest times to the Empire’s fall. Three lectures.

255*. Mediaeval Civilization. Study of mediaeval literature, art, architecture, music and other expressive forms. The periods from late antiquity to the High Middle Ages will be studied. Three lectures.

256*. Mediaeval Civilization. Study of mediaeval literature, art, architecture, music and other expressive forms. The periods from the High Middle Ages to the Renaissance and Reformation will be studied. Three lectures.

265*. Classical Literature in Translation I. Greek and Roman Epic and Drama.

266*. Classical Literature in Translation II. Classical Satire, Historiography and Verse.

350 Classical Art and Archaeology. A survey of art and architecture from the Aegean age through the Roman Empire. Three lectures.

365*. Problems in Greek History I. A detailed study of a selection of problems in Greek History.

366*. Problems in Greek History II. A detailed study of a selection of problems in Greek History.

370. Myth, Religion and Art. Deities, myths, and sagas correlated with literature, religion, philosophy and art from the 6th century B.C. to the 4th century A.D. Three lectures.

375*. Problems in Roman History I. A detailed study of a selection of problems in Roman History.

376*. Problems in Roman History II. A detailed study of a selection of problems in Roman History.
Greek

1-50. Introductory Greek.  
Four 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 1-50 or permission.  
Four lectures.

250. Language Study. Composition, translation, basic grammar with intensive analysis of selected prose works.  
Three lectures.

265*. History and Historiography. Selections from Herodotus.

266*. Lyric and Elegiac Poetry. Selections from Lyric and Elegiac Poets.

350. Language Study. Composition, translation, advanced grammar, with intensive analysis of selected literary works, including verse.  
Three lectures.

365*. History and Historiography. Selections from Thucydides.


375*. Drama. Selections from Aeschylus and Sophocles and Aristophanes.

376*. Literary Criticism. Selections from Plato's *Gorgias* and *Phaedrus* and Aristotle's *Poetics*.

450. Advanced Language Study. Changing styles of Greek authors, historical view of syntax, with composition and translation adapted to individual needs.  
Three lectures.


475* Oratory. Selections from Demosthenes, *Philippics 1; Olynthiacs*; Antiphon, Andocides, Lysias, Isocrates, and Isaeus.

476*. Biography. Plutarch *Demosthenes and Timoleon*.

Latin

1-50. Introductory Latin.  
Three lectures.
100. Literature of the Republic. Catullus (selections): Cicero, Pro Archia; Vergil, Eclogues (selections), and Aeneid I. Prerequisite: Grade 13 Latin, or Latin 1-50 or permission.
Three lectures.

250. Language Study. Composition, translation, basic grammar with intensive analysis of selected works.
Three lectures.


266*. Epic. Vergil, Aeneid ii, iv, vi.

350. Language Study. Composition, translation, advanced grammar, with intensive analysis of selected literary works, including verse.
Three lectures.

365*. History and Historiography. Livy, xxi, xxii; Res Gestae.


376*. Elegiac Poetry. Selections from Tibullus, Propertius and Ovid.

385*. Silver Age i. Seneca, Medea, selections from the Letters; Petronius, and Cena Trimalchionis.

386*. Silver Age ii. Apuleius, Apologia, selections from the Metamorphoses.

395*. Medieval Latin Literature from Gregory of Tours to Abelard. Selected readings in various genres such as drama and the Cambridge Songs. (Not offered 1968-69).

396*. Medieval Latin Literature from the twelfth century to the Renaissance. Selected readings in various genres such as the chroniclers and the Goliardic Songs. (Not offered 1968-69).

450. Advanced Language Study. Changing styles of Latin authors, historical view of syntax, with composition and translation adapted to individual needs.
Three lectures.

465*. Philosophy. Lucretius, De Rerum Natura. i, iii, & v (selections); Cicero, De Officiis (selections).

466*. Satire. Horace, Satires (selections); Juvenal, Satires (selections).

475*. Comedy. Plautus, Rudens; Terence, Phormio.

476*. Historiography and Literary Criticism. Tacitus. Annals xi - xvi (selections); Quintilian x.
485*. Historical Monograph i. Sallust, Catiline; Seneca, Apocolocyntosis.

486*. Historical Monograph ii. Tacitus, Agricola; Suetonius, Caligula.

490. Senior Seminar on selected topics such as epigraphy, textual criticism, remains of old Latin. Topics selected will be related as far as possible to individual student interest.

Romance Languages

French

100. French language and literature. An intensive training course in conversational French with lectures and readings of French literary masterpieces.

Language training. This portion of the course will consist of structural grammar and intensive oral training. Two periods each week will be devoted to the programmed “Active review of French” (Politzer and Hagiwara); one period each week will be devoted to newspaper reading, discussion, general conversation.

Literary training: This portion of the course will consist of three 20 minute T.V. lectures weekly on the literary texts being studied, followed by a discussion period.

Three lectures.

250. Structural grammar, intensive language training, and writing practice.

Prerequisite: French 100.

Three lectures.

245*. Classical literature of social commentary. The social and political situation in 17th century France as interpreted and illustrated by Molière, La Fontaine, La Bruyère, Saint-Simon, etc.

246*. Enlightenment literature of social commentary. The social and political situation in 18th century France as interpreted and illustrated by Lesage, Prévost, Rousseau, Voltaire, Beaumarchais, etc.

265*. Nineteenth century literature of social commentary. The social and political situation in 19th century France as interpreted and illustrated by Balzac, Zola, etc.

266*. Contemporary literature of social commentary. The social and political situation in 20th century France as interpreted and illustrated by Mauriac, Péguy, Sartre, etc.

325*. French theatre before 1850. A study of French theatre of the baroque, rococo and romantic periods. Special attention will be given to Corneille, Racine, Marivaux, Hugo and Musset.

326*. French theatre after 1850. A study of the major developments in French drama since 1850. Special attention will be given to le théâtre libre, Maeterlinck, Claudel, Cocteau, Sartre, Ionesco, Beckett, etc.


350. Techniques of audio-visual aids, with composition, translation and oral practice.
Prerequisite: French 250.
Three lectures.


366*. French Canadian poetry and theatre. A study of the major French Canadian poets and dramatists.

425*. Medieval French language and literature. An introduction to the problems of medieval French language and readings from the major literary texts of the period.

435*. French prose of the Renaissance. Particular attention will be paid to the aesthetics of prose in the period. Readings in the conteurs, Rabelais, and Montaigne, etc.

436*. French poetry of the Renaissance. Particular attention will be given to the aesthetics of poetry in the period. Readings in Marot, the Pléiade, the baroque poets, etc.

446*. The genius of French prose. A study of five major prose stylists of the 17th, 18th and 19th centuries: Pascal, Diderot, Voltaire, Stendhal, and Flaubert.

Prerequisite: French 350.
Three lectures.

Prerequisite: French 350.
Three lectures.


485* Principles of French criticism. A systematic survey of the major schools of French criticism from the classical to the modern periods.

486* Senior Seminar on approved topics.
The following courses are administered by St. Jerome's College.

275*J. Survey of French Literature from 1550-1660: Pléiade, Malherbe, Baroque period, Corneille, Molière, Pascal.

276*J. Survey of French Literature from 1660 to the Revolution: La Fontaine, Racine, Boileau, minor genres of classicism, novels and comedies to the Revolution.

315*J. French literature from 1900 to 1930. A survey of the main developments in the French novel, theatre, and poetry of the early twentieth century. Special attention is given to Gide, Claudel, Proust, Mauriac, and the Surrealists.

316*J. French literature from 1930 to present. A survey of the main developments in French literature from 1930 to present with special emphasis on Malraux, Giraudoux, Sartre, Anouilh, Camus and Sarraute.


Italian

The following courses are administered by St. Jerome's College.

1-50J. Introduction to Italian. Intensive drill in the fundamentals of grammar and conversation. The language laboratory will be used regularly.
Five lectures.

100J. Intermediate Italian. Intensive training in spoken and written Italian. Readings in Italian literature.
Three lectures.

Spanish

1-50. Introduction to Spanish. Intensive drill in the fundamentals of grammar and composition. The language laboratory will be used regularly.
Five lectures. Conducted largely in Spanish.

100. Intermediate Spanish. For students with some knowledge of Spanish. The language laboratory will be used regularly.
Prerequisite: Spanish 1-50 or Grade XIII Spanish.
Four lectures. Conducted largely in Spanish.

210. Spanish Civilization. A study in English of the main historical and cultural currents in Spain and Spanish America.
Three lectures.

250. Composition and Conversation. Selections from representative works of major Spanish authors. Oral practice and composition.
Prerequisite: Spanish 100
Three lectures. (Conducted in Spanish).
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276*. Drama of the Nineteenth Century. A study in the development of the drama from the Duque de Rivas to Echegaray. Three lectures. (Conducted in Spanish).

295*. The Novel of the Nineteenth Century. A study of the literary currents of the past century such as the costumbrista movement, realism and naturalism. Three lectures. (Conducted in Spanish).


315*. Spanish Lyrics from Garcilaso to Góngora. Conceptism and Culteranism.


325*. The Prose of the Golden Age. A study of the Quijote and other major works of Cervantes.


350. Advanced Composition and Conversation. Writing of essays based on critical examination of selected plays and novels; discussion, in Spanish, of these works. Prerequisite: Spanish 250. Two lectures.

385*. Survey of Spanish American Poetry. A study of the major poets from La Araucana to the beginning of the Modernista movement.

386*. Modern Spanish American Poetry. A study of Spanish American poetry from the Modernista movement to the present.

395*. Spanish American Prose. A critical study of Spanish American prose works from the Cortés letters to the works of Sarmiento.

396*. Spanish American Prose. A critical study of masterpieces in prose from Sarmiento to the present.


416*. Drama and Poetry of the Generation of '98. A general view of Spanish poetry and drama from Antonio Machado to Juan Ramón Jiménez.
425*. Twentieth Century Movements in Spanish Poetry. A study of poetical works from Garcia Lorca to Rafael Alberti.

426*. Contemporary Spanish Novel. The development of Spanish fiction from Cela to Sender.

450. Senior Spanish Composition and Conversation. This course will provide intensive practice in spoken Spanish on the advanced level. 
Two lectures.

Two lectures.

495*. The Novel in Mexico. Principal stress will be placed on novels dealing with the Mexican Revolution.

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 Mediaeval French Literature

603 Literature of the Renaissance in France

604 Reading Course in approved topics

606 Classical Tragedy in Seventeenth Century France

607 Comedy at the time of Molière

608 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 French Novel

612 Voltaire and the Age of Enlightenment

620 Twentieth Century French Literature

625 The Literature of French Canada
626 Gongorismo and its antecedents in Spanish Literature

627 The indígena novel in Spanish America

650 Supervised Reading in Selected areas of French Literature.
(Not to be counted toward completion of M.A. course requirements.)

699 Thesis.
Department of Design

G.N. Soulis, B.A.Sc. (Toronto)  Professor and Chairman of the Department
T.M. Fraser, M.B., Ch.B. (Edinburgh) M.Sc. (Ohio State)  Professor
M.L. Constant, B.Sc. (Toronto)  Associate Professor
V.K. Handa, (Calcutta), B.Sc. (Eng.) (London) M.Sc. (Queen's), M.Sc., Ph.D. (Waterloo)  (Design and Civil Engineering) Associate Professor
P.H.O.N. Roe, B.A.Sc. (Toronto), M.Sc., Ph.D. (Waterloo),  Associate Professor
P.L. Seeley, B.A.Sc. (Toronto)  Associate Professor
P.H. Meincke, B.Sc. (Manitoba)  Assistant Professor
B.L. Wills, B.A.Sc., M.A.Sc. (Waterloo)  Assistant Professor
M. Kramen, Diploma in Visual Communication (Hochschule fur Gestaltung, Ulm) Ph.D. (Michigan State)  Adjunct Professor
C.K.G. Hahn  Lecturer
B.H. Henderson  Special Lecturer

Environmental Studies—Architecture

T.E. Bjornstad, B.Arch. (Iowa State)  Associate Professor
H.N. Sharon, B.Arch., D.P.L.G. (Bucharest)  Associate Professor
C. Aasen, B.Arch. (Manitoba), M.A.Sc. (Waterloo)  Part-time Lecturer
R.S. Frew, Cert. Architecture (Glasgow), B.Arch. (Manitoba), M.A.Sc. (Waterloo)  Part-time Lecturer
A.C. Parsons, A.O.C.A. (Ontario College of Art), B.I.D. (Syracuse), M.A.Sc. (Waterloo)  Part-time Lecturer

Courses Offered

Courses number 601 and above are divided into two groups. **Group A** subjects have an emphasis on the theory and methodology of design, while **Group B** subjects emphasize the practical application of the theory and methodology in specific problem situations. All courses in the department are one semester courses; the lecture and laboratory hours are determined by individual instructors.

Graduate Courses

**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.
Department of Design


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.


700-720 Architectural & Spatial

720-740 Product Manufacturing Design

740-760 Communications

760-780 Other

801 Oral Examination of the Research Thesis for the Ph.D.

803 Comprehensive Examination for the Ph.D.

804 Language Requirement for the Ph.D.

808 Research thesis for the Master's degree

809 Research thesis for the Ph.D.

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.

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.

Courses numbered 600's are offered on a regular basis. Courses numbered 700 are arranged as needed by groups of students & faculty wishes.

Environmental Studies—Architecture

ES10 Design Problems Level I
Problems which require the observation of simple events which can be modeled by simple graphical, mathematical, simulative or verbal techniques. Manipulation of the models for the purpose of determining the changes necessary to modify subsequent events toward the fulfilling of some defined objectives. Problems involving the spatial arrangement of components as related to qualitative and quantitative aspects of form, symmetry, structure, etc. Problems related to the functional interaction of components also approached qualitatively and quantitatively.
1st and 2nd term open time assignment with at least 8 hours per week in which advice and discussion is available from the faculty.

ES100 Introduction to mechanics, wave motion and heat, including vectors, rectilinear motion, plane motion, work, energy, linear and rotational motion, sound waves, heat and elementary thermo-dynamics, introductory topics in optics and sound.
Introduction to Mechanics of Solids, statics and resistance of materials, equilibrium, rigid and deformable bodies, introduction to stress and strain.
1st and second term 4 hours per week.

ES110 Introduction to Calculus, functions and limits, the derivative differentiation formulae, tangents, rates, extremes, definite integrals, fundamental theorem of integral calculus. Applications to area, volume, moments of inertia, etc. Formal integration and applications to physical problems.
Introduction to Measurement, measurement units, concept of accuracy, precision, systematic and random errors. Introduction to probability, normal distribution functions, elementary sampling.
1st and second term, 4 hrs. per week.

ES120 Introduction to the Physiological characteristics of man. Human anatomy including cardiovascular and respiratory dynamics, bioenergetics and metabolism, electrophysiological responses, physiology of perception and audition, human response to stress and introduction to man-environment simulation and models. Human response
to temperature, humidity, noise, vibration, acceleration and toxic contamination.
Introduction to psychological characteristics of man learning, motivation, emotion,
sensation, perception, on individual differences. Discussion of techniques of psychological observation and measurement.
1st and 2nd terms, 3 hrs. per week.

**ES130** The History of the Physical Environment. The development of artifacts, structures and mechanisms as they form the physical environment of particular cultures. The development of the arts, sciences and technologies as they relate to the creation of the physical environment.
Visual fundamentals such as colour, texture, space, symmetry, as they relate to cultural periods and development.
1st and 2nd term, 3 hrs per week.

**ES140** The nature of the design process, principles of problem identification, analysis and concept creation. Introduction to planning of the design process, feasibility and concept development. Use of simulation and modeling.
1st and 2nd terms, 2 hrs per week.

**ES150** Skill and practice work related to drawing, sketching, drafting and communication.
Introduction to calculating devices such as desk calculators and simple computer programmes.
1st & 2nd term, 4 hrs. 1st term, 3 hrs. 2nd term per week.
Department of Earth Sciences

P.F. Karrow, B.Sc. (Queen's), Ph.D. (Illinois)  
Associate Professor and Chairman of the Department

E.C. Appleyard, B.Sc. (Western), M.Sc. (Queen's), Ph.D. (Cambridge)  
Associate Professor

C.R. Barnes, B.Sc. (Birmingham), Ph.D. (Ottawa)  
Assistant Professor

D.E. Lawson, B.Sc., M.Sc. (New Brunswick)  
Assistant Professor

Assistant Professor

D.L. Salter, B.Sc., Ph.D. (Southampton)  
Assistant Professor

Undergraduate Course Descriptions

Details of the undergraduate programmes offered by the Faculty of Science are to be found on page 108.

130. Introductory Geology. An elementary introduction to rocks, minerals, and fossils, geological processes and their effects, structural geology, economic geology, and historical geology. Map study. Field trips.
2 lectures, 3 hours laboratory.

2 lectures and 2 hours laboratory.

231.* Mineralogy. (Half course—primarily for Geography students.) Content comprises the first half of E.Sc. 230.

2 lectures, 2 hours laboratory, winter term.

237.* Field Geology. An introduction to surveying instruments and methods, drawing, cartography, and photogrammetry. Includes a two-week field camp at the end of second or third year.
4 hours laboratory, fall term.

238.* Historical Geology. The historical development of North America with a systematic review of the Precambrian, Paleozoic, Mesozoic, and Cenozoic stratigraphy and orogenesis.
2 lectures, 2 hours laboratory, winter term.

240.* Geomorphology. The origin and classification of landforms. Weathering and soil formation. Erosional and depositional processes. Laboratory study of topographic
2 lectures, 2 hours laboratory. Prerequisite: E.Sc. 230.

334. 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.

2 lectures, 3 hours laboratory.

2 lectures.

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.

2 lectures, 2 hours laboratory - seminar.

432. Precambrian geology. The geology, tectonics, stratigraphy, ore deposits, and history of the Canadian Precambrian Shield. Other Precambrian rocks in North American and other shield areas throughout the World.
2 lectures, 2 hours laboratory, winter term.
434. *Biostratigraphy.* A study of selected fossil groups to illustrate the application of paleontological data in solving stratigraphic problems. Methods of differentiation and correlation of rock units on the basis of their fossil assemblages. Types of paleontological zones. Field trips.
2 lectures, 2 hours laboratory, fall term.

435. *Seminar.* Oral and written presentation of special topics in the general field of geology.
2 hour seminar, alternate weeks.

436. *Honours Thesis.* Each student will work under the direction of a member of the Department on a short research project. The results of this will be presented in thesis form and will be critically examined by members of this and, where pertinent, other departments.

2 lectures, 2 hours laboratory.

2 lectures, 1 hour problems, fall term.

2 lectures, 1 hour problems, winter term.

440. *Quaternary Geology.* Stratigraphy and history of the Quaternary Period with emphasis on glaciation. Laboratory studies on glacial deposits. Field trips. A previous course in geomorphology is recommended.
2 lectures, 3 hour laboratory, fall term.
Department of Economics

J.S. Minas, B.A. (Wayne) Ph.D. (Illinois)  
*Professor*  
*Acting Chairman of the Department, Dean of Faculty of Arts*

S.S. Sengupta, M.A., D.Phil. (Calcutta)  
*Visiting Professor*

P.B. Healey, B.A. (Western) M.B.A. (Detroit), M.A. (Michigan)  
*Associate Professor*

*Ph.D. (Michigan State)*  
*Deputy Chairman*

N.E. Lavigne, C.R., B.A. (Western), M.Comm. (Ottawa), M.B.A. (Detroit)  
*Associate Professor*

K.M.H. Bennett, B.A., M.A. (Queen's)  
*Assistant Professor*

S.G. Clarke, B.A., M.A. (Queen's)  
*Assistant Professor*

L.P. Fletcher, B.Comm. (Mount Allison), A.M., Ph.D. (Brown)  
*Assistant Professor*

S.W. Kardasz, B.A. (Loyola)  
*Assistant Professor*

R.R. Kerton, B.Comm. (Toronto), M.A. (Carleton),  
*Assistant Professor*

W.R. Needham, B.Comm. (Carleton), M.A., Ph.D. (Queen's)  
*Assistant Professor Executive Secretary*

Notes
(1) The number of courses offered in a particular year will not necessarily include all of those listed below.
(2) The number of hours or lectures shown after the course descriptions is an attempt to indicate the "normal"; each instructor determines how often his particular class will meet.

*Lecture in the Department of Economics*
Undergraduate Courses

15. Principles of Economics. A one-term course in the elementary principles of economics developed to serve the special needs of students in the co-operative programs, who do not plan to take other courses in economic theory. The subject matter will cover both the economics of the firm and the economics of the nation. Topics will include the determination of price by supply and demand, the modern theory of income, employment and prices, government fiscal policy, and the theory of the firm.

Each term. 3 lectures.

Economics 101, 102 comprise the regular sequence of courses in introductory economics for students majoring in this field, and for other students who plan to do additional work in economics.

101*. Introduction to Economics. The first half of the course includes the discussion of the central problems of every economic society, the functioning of a mixed capitalistic enterprise system, the economic role of government, the determination of national income, the banking system, and government fiscal and monetary policy.

3 lectures.

102*. Introduction to Economics. Subjects to be discussed in this half of the course include the composition and pricing of national output, pricing of productive factors and income distribution, international trade and finance, and current economic problems.

Prerequisite: Economics 101. 3 lectures.


3 lectures.

111.* Mathematical Foundations of Economics I. Compositions, Decomposition and Counting; partitions of a given set; generating functions; problems of assigning objects to places; partitions and compositions.

Prerequisite: Economics 110*

3 lectures.

201*. Intermediate Price Theory. Theory of consumer demand; production theory; equilibrium of the firm; market structures; the pricing of productive factors.

Prerequisite: Economics 102. 3 lectures. (Half course).

202*. Intermediate Macro-economic Theory. The social accounts; the modern theory of the determination of income and employment; inflation; introduction to the theory of growth.

Prerequisite: Economics 101. 3 lectures. (Half course).

203*. General Equilibrium Theory I. Theory of individual and group demand for one and several commodities, theory of individual and group production and supply under various types of market structure.

Prerequisite: Economics 102*.
204.* General Equilibrium Theory I. Theory of price formation; the transition to dynamics. Some aspects of welfare economics.
Prerequisite: Economics 203.

205.* General Equilibrium Theory II. Theory of capital and investment; Theories of general equilibrium of employment, output, price and money; processes of adjustments to changes in parameters and relationships.
Prerequisite: Economics 102.

206.* General Equilibrium Theory II. Theories of business fluctuations; models of growth and technological change.
Prerequisite: Economics 205

230. Money and Banking. A study of the Canadian banking system with reference to the American and British systems; monetary theory and Canadian monetary policy since 1935.
Prerequisite: Economics 102.

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.

256.* Introduction to Financial Accounting. Recording transactions; preparation and analysis of financial statements; accounting for inventories, fixed assets, liabilities, and share-holders’ equity.
Prerequisite: Economics 15 or 101. 2 lectures, 2 hours laboratory. (Half course. Fall term).

257*. Introduction to Managerial Accounting. Systems of Cost Accounting, analysis of cost variances, budgeting, break-even analysis, the problem of changing price levels.
Prerequisite: Economics 256. 2 lectures and 2 hours laboratory. (Half course. Winter term).

261.* European Economic History. Selected topics in European economic development in the Medieval period. 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.
(Half course. Fall term; 2 lectures, 1 hour discussion).

262.* European Economic History. Selected topics in European economic development in the modern period. Particular emphasis is placed on a comparative analysis of the economic development of the countries of Europe, particularly England, France and Germany.
(Half course; Winter term, 2 lectures, 1 hour discussion).

300. Statistical Methods. Frequency distributions; measures of central tendency, dispersion, skewness and kurtosis; probability theory; tests of hypotheses; sampling tech-
310. Intermediate Accounting. The objective of this course is to provide an in depth analysis of accounting procedures and the rationale behind these procedures. A study is made of the reporting process, matching of costs and revenues, money value items, capital determination and presentation, and accounting for internal management.

315. Corporate Finance. The general problem of financing business activities; the financial organization and control of corporations, liquidations and reorganizations; the operation of capital markets.

Prerequisite: Economics 256.

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.

Prerequisite: Economics 102, 3 lectures.

371*-374. Special Subjects. One or more half courses will be offered at different times as announced by the department.

Prerequisite: Consent of instructor.
385. **Business Cycles.** Study of changes in the levels of national output; theories of the business cycle; proposals for controlling economic fluctuations.  
*Prerequisite: Economics 202.*

400. **Advanced Economic Theory.** An advanced treatment of selected topics in economics.  
*Prerequisite: Economics 201, 202.*

421.* **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.  
*Prerequisite: Economics 201, 202. 3 lectures. (Half course).*

440. **History of Economic Thought.** A survey of the historical development of economic theory.  
*Prerequisite: Economics 201, 202.*

450. **Economics of Development.** The problem of economic development; theories of growth; the significance for economic development of capital accumulation, technology, natural resources and population. Allocation of investment resources; the role of economic institutions; public policies to stimulate economic development.  
*Prerequisite: Economics 201, 202. 3 lectures.*

460. **Econometrics.** Theory of estimation of structural parameters in simultaneous-equation systems; efficiency of estimating techniques; statistical estimation of supply and demand functions; forecasting, testing of hypotheses and related problems.  
*Prerequisite: Economics 201, 202. 300 or equivalent. 3 lectures.*

465.* **Security Analysis and Investment Policy.** This course is designed to relate corporate financing priorities and an individuals investment policy. The first part of the course includes a study of analytical techniques for the appraisal of corporate and government securities, security price movements, indentures, sources and interpretation of information and the technical character of security markets. The second part of the course studies the management of portfolios of individuals and institutional investors, the relation of investment policy to individual acquirement, and national securities policy.  
*Prerequisite: Economics 365. 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.  
*Prerequisite: Economics 201, 202. 3 lectures.*

475*-478. **Special Subjects.** A series of half courses to be offered at different times as announced by the department.
480. **Comparative Economic Systems.** An analytical comparison of resource-allocation methods, growth and development under socialist and capitalist systems.

*Prerequisite: Economics 201, 202, or permission of Instructor. 3 lectures.*

491*-499. **Special Studies.** Research and reading courses under the direction of individual instructors.

*Admission by consent of instructor.*

**Graduate Studies.**

The Department of Economics is planning to introduce a graduate programme leading to the degree of Master of Arts in Economics. Information regarding this programme is obtainable from the Department.

3 lectures, 3 hours alternate tutorial and laboratory, one term.

12. Electrical Circuits. Review of resistive circuits; voltage-current relationships, Kirchhoff's laws, mesh current and node voltage equations; Thevenin's, Norton, and Su-
perposition theorems; time-domain analysis of R, L, C networks; phasors, sinusoidal voltages and currents and frequency-domain analysis; power and energy; transients and S-domain analysis; electrical measurements.

**Prerequisites:** Math 12, Math 21

Chemical Engineering: 2 hours lectures, 2 hours tutorial, one term
Electrical Engineering: 3 hours lectures, 3 hours laboratory, 2 hours tutorial, one term
Mechanical Engineering: 2 hours lectures, 3 hours laboratory every other week, 2 hours tutorial, one term.


**Prerequisite:** EE 12
3 hours lectures, 3 hours laboratory every third week.
1 hour tutorial, one term.

14. Electromagnetics. Introduction to magnetic and electromagnetic fields; electromagnetic forces and induction; Biot-Savart, Ampere's, Faraday's and Lenz' laws; self- and mutual-inductance; transformers; materials; reluctance and magnetic circuits; introduction to d.c. and a.c. motors and generators.

**Prerequisite:** EE 12, 3 hours lectures, 2 hours tutorials, 3 hours laboratory every other week, one term.


**Prerequisites:** Math 33 or equivalent
3 lectures per week, one term.


**Prerequisite:** Math 31, Math 32.
3 lectures, 3 hours laboratory alternate weeks, one term.


**Prerequisite:** EE 25.
3 lectures, 3 hours laboratory every third week, one term.
28. **Communication Theory.** Relations 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.

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 14*  
3 lectures, 3 hours laboratory, one term.

33. **Physical Electronics.** Introduction to statistical mechanics, elementary band theory of solids, intrinsic and extrinsic semiconductors, minority carrier charge dynamics, physical principles of the operation of the p-n junction and the junction transistor.  
2 lectures, 3 hours laboratory alternate weeks, one term.

34. **Physical Properties of Materials.** Crystal structure and the common lattices, x-ray and electron diffraction analysis, chemical binding. Dielectrics: the origin of electrical polarization, dipole relaxation and dielectric losses, ferro-electrics. Magnetics: the atomic origin of diamagnetism and paramagnetism, paramagnetic resonance, ferromagnetism, magnetic anisotropies, domains, magnetization curves of bulk material, antiferromagnetism, ferrimagnetism and ferrites.  
3 lectures, one term.

35. **Solid State Electronics.** A study of the basic physical principles underlying the operation of some of the important solid state devices, including an introduction to quantum electronics and a discussion of the maser and the laser; an introduction to the phenomenon of superconductivity and a discussion of superconductive devices; band theory of semiconductors and a discussion of some of the modern semiconductor devices.  
3 lectures, one term.

*Prerequisite: GE 12.*  
2 lectures, 1 hour tutorial, 3 hours laboratory alternate weeks, one term.

44. **Pulse and Switching Circuits.** Switching characteristics of electronic devices; non-sinusoidal wave generation and shaping; gates, voltage and current sweeps, multivibrator, blocking oscillator.  
*Prerequisites: EE 42, EE 52*  
3 hours lectures, 3 hours laboratory every third week, one term.

*2 lectures, 1 hour tutorial, 3 hours laboratory alternate weeks, one term.*


*Prerequisite: EE 51
2 lectures, 1 hour tutorial, 3 hours laboratory alternate weeks, one term.*

61. **Electrodynamic Energy Conversion.** Introduction to energy conversion with special emphasis on electromechanical energy converters, linear and rotary. Physical magnetic and electrostatic circuits: statically and dynamically coupled magnetic circuits.

*Prerequisites: EE 12, 13
2 lectures 1 hour tutorial 3 hours laboratory alternate weeks, one term.*

62. **Electromechanics.** 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
2 lectures, 1 hour tutorial, 3 hours laboratory alternate weeks, one term.*


*3 lectures, 3 hours laboratory alternate weeks, one term.*


*Prerequisite: EE 13, Math 33, Math 34.
3 lectures, 1 hour tutorial, one term.*

77. **Transmission Lines and Waveguides.** Representation of transmission line by the four line parameters. Derivation of the differential equations. Sinusoidal analysis; characteristic impedance, propagation constant, phase velocity. Terminated lines; reflection coefficient, standing wave ratio, impedance matching. Use of the Smith Chart. Telephone and power lines. Introduction to waveguides, TM and TE modes in rectangular guides, guide wavelength cutoff frequency, attenuation. The transmission line-waveguide analogy.

*3 lectures, 3 hours laboratory alternate weeks, one term.*
81. Control Systems I. Time domain and transfer function models for components and systems; response of linear systems through transient analysis; s-plane methods, and frequency domain methods; stability criteria; performance specifications; feedback system design and compensation.  
Prerequisite: EE 81  
3 lectures, 3 hours laboratory every third week

99. Project. An engineering assignment requiring the student to demonstrate initiative and assume responsibility. The student will select a project at the end of the IIIB term from an approved list prepared by the Department. A short progress report at the end of the IVA term and a full report at the end of the IVB term are required. The project mark will be equivalent to two normal one term courses.  
2 hours per week first term, 6 hours per week second term, 2 terms.

Prerequisite: EE 21, EE 26.  
3 lectures, one term.

543. Network Theory II. Review of linear graph properties, state equation formulation, solution and stability by analog and digital methods, network design by computer techniques.  
Prerequisite: EE 42.  
3 lectures, one term.

3 lectures, one term.

578. Microwave Engineering. Antenna theory; electromagnetic potentials, retarded potentials, dipole radiation, antenna arrays, pattern synthesis, microwave antennas, sky waves, ground waves. Microwave scattering theory; scattering matrix, resonators, microwave transmission devices and components. Microwave electronics; klystrons, travelling wave amplifiers, backward wave oscillator, magnetrons.  
Prerequisite: EE 76.  
3 lectures, one term.

582. Control Systems II. Further study of process dynamics and examples of control systems design from electrical, mechanical and chemical engineering. Introduction to the computer control of industrial processes.  
Prerequisite: EE 81.  
3 lectures, one term.
Graduate and Research Programme

Graduate credit is measured in units. A one-term course at the graduate level counts as one unit. Two units are given to graduate courses extending over two terms (certain mathematics and science courses). Credit units required for specific programmes are discussed in separate sections for the M.A.Sc. and Ph.D. degree, below.

Equivalent credit may be given to students transferring from other recognized universities for appropriate graduate courses previously taken, up to a maximum of two units. Certain senior undergraduate courses at this University may be taken for graduate credit at ½ unit (1 unit for the EE 500 series) of graduate credit per term-course, up to a maximum of two units.

The normal academic load is four units per term for a full-time student. Five units may be taken with special permission only. Students involved in part-time employment at the University or otherwise, must take a reduced academic load, as detailed in the separate section on financial assistance below.

A Faculty Advisor is appointed to supervise the programme of study of each graduate student. A new student must meet with his advisor prior to graduate course registration to arrange his course-work programme and discuss his research interests. The progress of the student will be reviewed at least once each term by the advisor. Any changes in either course-work or research programme must be specifically approved prior to registration in the subsequent term.

An Electrical Engineering Student studying antenna patterns
Master's Degree Programmes

The objective of the Master's Degree programme (M.A.Sc.) in Electrical Engineering is to demonstrate individual accomplishment of a high professional and academic standard. The candidate, with approval of his advisor, may elect to submit either a research thesis as a portion of the requirements, or an engineering project report of a professional calibre on a design or theoretical application problem.

The complete programme submitted for the M.A.Sc. degree must consist of at least ten units of graduate credit. Suitable courses offered by other departments may be taken, as appropriate.

A research thesis may be submitted for five units of graduate credit under EE 699. The topic of the thesis and the choice of the remaining required five units of graduate-course work are arranged by the student and his Faculty Advisor. Each student's programme is subject to approval by the Graduate Studies Committee of the Department. The student must remain registered without interruption in EE 699 until the thesis is submitted. The research work leading to the thesis must be performed under the direction of the Faculty Advisor, and is finally approved and accepted by him.

An Engineering Project Report may be submitted for two units of graduate credit under EE 698. The topic of the report and the remaining eight units of graduate-course work are arranged by the student and his Faculty Advisor for approval by the Graduate Studies Committee. The work leading to the report must be performed under the direction of the Advisor and be acceptable to him. Credit may not be obtained for both EE 698 and EE 699.

The time limitations for a Master's degree are four consecutive academic years for all course work and project or thesis requirements to be completed. The normal programme involves three terms of full-time study, which must be extended if three or fewer units per term are taken.

Academic performance must be sufficient that the student receives an average grade of B (66-74%) or more in the course-work portion of his approved study programme. At any time, a student may be required to withdraw from the programme if he receives a grade of C, (60-66%) or less, in more than one course in Electrical Engineering, or in more than a total of two course units, including minor fields.

English language requirement: A student whose mastery of spoken English is inadequate may be required to take a non-credit course in English and to pay an additional fee of approximately $25.

The Ph.D. Degree Programme

The primary objective of the Ph.D. programme is the accomplishment of independent and original research work and reporting thereon in a research thesis. The subsidiary requirements are completion of a suitable course-work programme, passing a comprehensive examination, demonstration of reading knowledge of a foreign language, and receiving a satisfactory review by a supervising committee. All of these must be construed as contributing to the competent performance of the research objective.

Admission to the Ph.D. programme is based upon the student's academic record and evidence of ability to pursue independent research. Students must satisfy the requirements of the comprehensive examination as set out in paragraph five. No candidate will be admitted to the Ph.D. programme before a Faculty Advisor willing to supervise the candidate's research is appointed.
Minimum registration requirements for the Ph.D. degree are of two academic years from the Master's degree level, or equivalent. The maximum time allowed is five consecutive academic years from the same level. Part-time programmes are not encouraged, and students may normally satisfy only the subsidiary requirements of the programme on a non-resident basis. A minimum of three terms of full-time resident study are required in those cases where all other requirements have previously been met on a part-time basis.

The course-work associated with the Ph.D. programme is intended to provide a foundation for advanced learning in the general field of study as well as for competent research performance in some specific area. While there is no fixed requirement as to the number of credit units to be taken, aside from a usual maximum of eight units, the Advisor and the supervisory committee for each candidate will consider the level and adequacy of each candidate's preparation in drawing up his specific programme.

The Comprehensive Examination; The form of this examination varies with the applicant's background: 1. Candidates holding master's degrees from this university will have an oral examination. 2. Candidates having master's degrees awarded mainly by thesis and able to present themselves for examination, may elect to be examined orally on their thesis topic. 3. Candidates may submit their results in the "Advanced test in engineering" of the 'Graduate record examination'. * 4. Candidates may request permission to register for the M.A.Sc. If accepted they will then be required to follow three graduate courses in their first term and to obtain at least a 70% average. Successful candidates will then be registered retroactively for the Ph.D.

The foreign language requirement is satisfied by demonstrating proficiency in reading and translating into English, technical literature in either German, Russian or French.

*The G.R.E. is administered by: 'Graduate Record Examinations', Educational testing service, 1947 Centre St., Berkeley, California, U.S.A. The applicant must personally arrange and pay for the test ($8 U.S.). Test centres exist at major cities in most countries.

Graduate Course Descriptions

One term.

2 hours lectures, one term.
603. 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.
Prerequisite: EE 602.
2 hours lectures. One term.

One term.

Prerequisite: EE 83.
2 hours lectures. 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, super-gain, pattern synthesis.
One term.

One term.
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 cascode, differential, operational, feedback, Darlington, etc., are included and are applied in the analysis of more complex circuits. Shortcut methods are introduced, based on these concepts.
Prerequisite: EE 42 and EE 52.
One term.

612. Advanced Electronics 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, Bloch 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.

One term.

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 overall system configurations; criteria for optimum performance including reliability, costs, convenience, availability, and economic factors.
Prerequisite: EE 83. 2 hours per week. one term.

216

Prerequisite: EE 614. One term.

619. Electroacoustics. Physical and physiological fundamentals of audio vibrations; properties and applications of electroacoustic transducers; analysis and measurement of sound; recording and reproduction of sound, synthesis of sound.

One term.


One term.

626. Semiconductor Device Characteristics. Resumé of physics of semi-conductors leading to d.c. and small signal a.c. characteristics of junction diodes. Discussion of depletion layer capacitance, diffusion capacitance, high level injection, charge storage and recovery, breakdown. Discussion of above the effects in transistors, transit time, base width modulation, base resistance, drift transistor. Special attention will be paid to recent devices such as varactor diodes, step recovery diodes, field effect transistors.

One term.


EE 628. Classical, Quantum and Statistical Mechanics II. The operator formalism of quantum mechanics, angular momentum, the hydrogen atom, spin, many particle systems, the Pauli principle, perturbation theory for time independent systems, treatment of degeneracy, perturbation theory for time dependent systems, transition probabilities. Classical statistical mechanics, the concept of ensembles, the microcanonical, canonical and grand canonical ensembles, Quantum statistical mechanics, the density matrix, ensembles in quantum statistical mechanics, the partition function, the most probable distribution, Fermi-Dirac, Bose Einstein and Maxwell-Boltzmann systems.


EE 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.

One term.

Prerequisite: M51. 2 hours lectures, one term.

One term.

EE 636. System Identification. Use of steady state and dynamical models external modeling including regression analysis and use of z-transform formulations. Test signals and the correlation techniques, orthogonality properties. Internal modeling, parameter estimation, numerical minimization procedures, nonlinear parameter and state estimation using extensions of Kalman filter theory.
One term.
637. **Variational Methods in Control Engineering.** Performance criteria, classical calculus of variations, dynamic programming, digital control systems, continuous forms of dynamic programming, multivariable control systems. Pontryagin's Principle with examples, the two point boundary problem, computer control of processes.

*One term.*

EE 640. **Sampled Data and Digital Control.** The sampling process, reconstruction of sampled signals, digital integration, smoothing and predicting, z-transform, analysis of sampled data systems, state variable approach, signals, word lengths and quantization errors.

*Prerequisite: EE 634, may be taken simultaneously.*

*One term.*


*3 Lectures, One term.*

EE 643. **Antenna Theory and Techniques.** Topics selected from representative types and techniques of antennas: linear and travelling wave antennas, horns and lenses, reflector types of antennas: interferometers and antenna arrays; antenna measurements; data processing for radio astronomy antennas.

*Prerequisite: EE 609 or equivalent.*

*One term.*

EE 650. **Generalized Theory of Electromechanical Energy Conversion.** Rotational transducers and energy relations; G matrix; power flow; transformations and power invariance; generalized theory applied to real machines; electrical transient performance, transient reactances, fault conditions, sustained small oscillations; excitation and transient performance of synchronous machines.

*One term.*

EE 651. **Topics in High-Voltage Engineering-1.** Determination of the electric field for different electrode configurations. Surge voltages, their origin and effects. Laboratory generation of high voltages. Measurements.

*One term.*

EE 652. **Power Systems.** Investigation of the static and dynamic characteristics of complete systems taken as a unit. Derivation and utilization of system parameters for computer studies of fault conditions, static load capabilities, dynamic stability and most economic operating point. Sequence parameters are developed and the sequence networks used in unbalanced load studies and relaying.

*Prerequisites: EE 62, EE 71.*

*One term.*
EE 653. Static Power Conversion and Control Devices. Analysis and design of power solid state and linear and non-linear magnetic devices. Separately or in combinations, these devices cover the field of power conversion and control not handled by rotating conversion equipment. Particular emphasis will be given to the field of non-linear magnetic devices and the analysis of circuits containing them. 
One term.

One term.

708. Topics in Information Theory

721. Radio Propagation Studies

723. Topics in Quantum Electronics

724. Experimental Techniques for Solids

791. Engineering Project 1

792. Engineering Project 11

801. Oral Examination for Ph. D.

803. Comprehensive Examination for Ph.D.

804. Language Requirement for Ph.D.

808. Research Thesis for Master's Degree.

809. Research Thesis for Ph.D.
Department Of English

W.U. Ober, B.A. (Washington and Lee), Ph.D. (Indiana)  
Professor
Chairman of the Department

E.M. Boyd (Miss), A.B. (Grinnell), M.A. (Chicago), Ph.D. (Columbia)  
(Roberts Fellow)  
Professor

Professor

D.R. Galloway, B.A., M.A. (Cambridge)  
Professor

C.F. MacRae, B.A. (Western), M.A. (McMaster) Ph.D. (Toronto)  
Professor

W.K. Thomas, M.A., Ph.D. (Toronto)  
Professor

E. Perry, B.A. (Hons.) (King's College, London), B.A. (Queen's), M.A. (Toronto), 
Professor Emeritus (Brandon University)  
Professorial Associate

A.I. Dust, M.A., Ph.D. (Illinois)  
Associate Professor

J.C. Gray, B.A. (Washington State), M.A. (Connecticut), Ph.D. (Syracuse)  
Associate Professor

H.E. Haworth (Mrs.), B.A. (Rollins), M.A. Ph.D. (Illinois)  
Associate Professor

B.N. Honeyford, B.A., Ph.D. (Toronto)  
Associate Professor

K. Ledbetter, A.B. (Central College, Mo.), M.A., Ph.D. (Illinois)  
Associate Professor

R. Leviisky (Mrs.), B.S.Ed. (Central Missouri S.C.), M.S.Ed. (Illinois Normal), Ph.D. (Missouri)  
Associate Professor

W.R. Martin, M.A., D. Litt. et Phil. (South Africa)  
Associate Professor

J.S. Stone, M.A. (British Columbia)  
Associate Professor

R.R. Dubinski, B.A., M.A. (Western)  
Assistant Professor

R.N. Gosselink, B.A. (Kansas), M.A., Ph.D. (Colorado)  
Assistant Professor

P.M. Hinchcliffe, B.A. (British Columbia), M.A. (Toronto), Ph.D. (Toronto)  
Assistant Professor

H.M. Logan, A.B. (Franklin and Marshall), Ph.D. (Pennsylvania)  
Assistant Professor

A.M. MacQuarrie, B.A. (Acadia), M.A. (Toronto)  
Assistant Professor

E.F. Shields (Miss), B.A. (Chesterhill), M.A. (Villanova), Ph.D. (Illinois)  
Assistant Professor

Sister M. Leon, S.S.N.D., B.A. (Toronto), M.A. (Detroit)  
Assistant Professor

H. Tuyn, M.A. (Utrecht and Oxon.)  
Assistant Professor

I. Ahmad, M.A. (Allahabad), M.A. (Toronto)  
Lecturer

P.D. Beam, B.A. (Waterloo), M.A. (McMaster)  
Lecturer

M.J. Estok, B.A., M.A. (Saskatchewan)  
Lecturer

D.L. Hedges, B.A. (Northeastern, Okla.), M.A. (Arkansas)  
Lecturer

N.M. Hodge, B.A. (Waterloo)  
Lecturer

D. Letson, B.A. (Waterloo), M.A. (McMaster)  
Lecturer

R. Lister (Mrs.), B.A., M.A. (Toronto)  
Lecturer

M.G. Thyssell (Mrs.), M.A. (Montana)  
Lecturer

E.M. Uram, C.R., B.A. (Western), M.A. (St. Louis)  
Lecturer

R. Wiljer, B.A. (Waterloo)  
Lecturer
English Honours Programmes


English Major In General Arts

Recommended Programme

Year I
- English 101
- Philosophy 100 or equivalent
- One of French 100, German 100, Latin 100
- Three other courses in accord with the general regulations of the Arts Faculty (see p. 10)

Year II
- English 251, 360
- Three other courses

Year III
- Three approved English courses, of which at least one shall be chosen from English 270, 350, 370, 380, 452*/453*
- Two other courses

Undergraduate Courses

Restrictions: With the exception of 16*, 17*, 50J, and 130 all the following courses are Honours courses, but are also open to students enrolled in General programmes. English 190, however, is not open to English majors; English 225, 240, 325, and 335 may not be included in fulfilling minimum course requirements for any English programme.

Note 1: In English programme descriptions, the word “course” means one full course or two half courses.

Note 2: The “normal” number of lectures per week in each course is three; however, each instructor determines how often his particular class will meet.

Note 3: A dagger (†) following a course description indicates that the course is tentatively scheduled for the session 1968-69.

16*. English Literature I. Designed for students in Applied Physics, Applied Chemistry, 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. Poetry and drama will be emphasized.†
17*. **English Literature II.** Similar to 16 above, with the emphasis on fiction.†

101. **The Art and Themes of Literature.** A study, through representative works, of the major genres, modes, and methods of literature, and its principal recurring themes. For all first-year Arts students electing English.†

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).†

190*. **Shakespeare.** A study of selected plays. Designed for students in programmes other than English.†

211*. **The Novel I.** A study of the principal techniques, movements and themes in the English novel.†

212*. **The Novel II.** Similar to 211 above, using different writers, novels, and emphasis.†

216*. **The Development of Drama to 1660.** A study of the origins and development of English drama, with special concentration on sixteenth-century and early seventeenth-century non-Shakespearean drama.†

221*. **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.†

225. **Principles of Dramatic Production I.** An introduction to directing, acting, and staging, with practical experience in the University’s Theatre of the Arts.†

230*. **Poetry I.** A study of English poetry before 1800.†

231*. **Poetry II.** English poetry after 1800.†

236*. **Literature of Ideas I.** This course, which deals chiefly with the moral implications of political thought, is designed both to stimulate controversy and to improve the student’s ability to express himself in clear, organized fashion. Students are required to write essays and seminar papers on the topics discussed.†

237*. **Literature of Ideas II.** Similar to 236 above, with concentration on philosophic and scientific thought.

240. **The Use of English.** The use and abuse of present-day English as a spoken and written language. The search for criteria in evaluating different means of communication such as journalese, technical jargon, slang and colloquialisms. The bearing of structure, semantics and imagery on clear expression and its practical application in effective writing.

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 Mediaeval and Renaissance critics. The other part provides a training in the application of critical principles to the works of literature.†
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.†

270. Middle English. A study of Middle English literature with special emphasis on the works of Chaucer.†


282*. Later Sixteenth-Century Non-Dramatic Literature. A study of the non-dramatic literature of the last two decades of the sixteenth century, with special emphasis on Sidney and on Spenser's Faerie Queene.†

311*. Literature of Canada. A survey of Canadian poetry and prose.†

312*. Literature of the Commonwealth. A survey of Australasian poetry and prose, with some consideration of the literatures, in English, from South Africa and the West Indies.†

320*. Fictional Prose, Not Including the Novel. The mutations of prose style and form as seen in the "romance" writers such as Malory, Sidney, Bunyan, Swift; in the Novella and picaresque writers such as Nashe and Defoe; in the short story and novelette writers such as Poe, Conrad, and Faulkner.

321*. Personal and Utilitarian Prose. The mutations of prose style and form as seen in writers of biography and autobiography such as Boswell, Franklin, Strachey; letter writers such as Chesterfield, Keats, Dickinson; essayists such as Bacon, Burton, Ruckin, Orwell; and writers of scientific, historical, and philosophical prose such as Browne, Darwin, Macaulay, Trevelyan.†

325. Principles of Dramatic Production II. This course extends the work of English 225 and gives attention to technical aspects of voice, movement, lighting, etc., as well as an historical perspective. Prerequisite: consent of instructor.†

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.†

341*. Early American Literature. An examination of the American character as shaped in the seventeenth and eighteenth centuries, with some attention to selected later works.†

342*. The American "Renaissance". A consideration of the so-called "American Renaissance," with particular attention to the works of Hawthorne and Melville.†

343*. American Literature, 1865-1914. American prose of the late nineteenth century, with concentration on such major figures as Twain, James, and Crane.†
344*. Recent American Literature. A survey of major American writers since World War I, especially Frost, Eliot, Hemingway, and Faulkner.†

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.†

360. Drama to 1642. The life and works of Shakespeare, with the rise of the drama and dramatic form, the work and influence of Shakespeare's predecessors, and the post-Shakespearean drama to the closing of the theatres.†

365*. Selected Studies. Designed to provide a study in depth of problems and/or authors selected by the instructor. May be repeated for credit. Prerequisite: consent of instructor.†

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.†

380. The Romantic Movement. An historical and critical study, in seminars, of the principles and practice of the English Romantic authors from Blake to Keats, with primary emphasis on poetry.†

385. Contemporary Literature. Same description as English 385R.
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.

425. Elizabethan Stage Production. The development of the early theatres (c.1500-c.1642), with attention to the structure of the Academic, Court, and Public theatres; to the organization and personnel of the dramatic companies; to different methods of staging in the various types of theatres; and to representative plays of the period. Includes practical work in the theatre.

452*. Literature of the Victorian Age I. 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) and on writers of critical prose works of lasting significance (e.g. Newman, Ruskin.)

453*. Literature of the Victorian Age II. Similar in scope to 452 above, but with emphasis on the more important novelists (e.g. Dickens, Thackeray, Eliot) and on writers of general prose (e.g. Mill, Huxley).

456. Literature and History of the Victorian Age. A literary and historical survey of Victorian England through authors and works that have major significance in both fields. The student will be encouraged to use several approaches and forms of evaluations of this material. He will be obliged to register in English 456 or in History 456 and to direct and concentrate his studies accordingly.

460. Twentieth-Century British Literature. A critical study of works by Shaw, Conrad, Yeats, Eliot, Joyce, Lawrence, and others of the modern period. (Note: students electing English 460 may not enroll for credit in English 461 or 462; conversely, students electing English 461 and/or 462 may not enroll for credit in English 460.)

461*. Twentieth-Century British Novel and Drama. A critical study of the works of such authors as Conrad, Joyce, Woolf, Lawrence, Shaw, Synge, and O’Casey.

462*. Twentieth-Century British Poetry and Criticism. A critical study of the poetry of such authors as Hopkins, Yeats, Eliot, Auden, and Thomas, with a consideration of the major literary criticism of the period.

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.

475. Linguistics and English Grammar. An interpretation of linguistics and its application in the English classroom to the study of grammar and language. The course will provide an introduction to descriptive and historical linguistics and the principles of linguistic analysis. It will include an evaluation of English grammars ranging from the traditional to the structural and transformational-generative.

495. Supervision of Senior Honours Essay.
The following courses are administered by St. Jerome's College.

50J. Preliminary Year English. General literature and composition, analogous to the Ontario Grade 13 curriculum.†

331*J. American and Canadian Literature I. A survey of North American English literature from the beginnings in the seventeenth century until after the American Civil War and Confederation in Canada, with some attention to cultural history.†

332*J. American and Canadian Literature II. A survey of American and English Canadian literature from the latter portion of the nineteenth century until today, with some attention to cultural history.†

The following courses are administered by Renison College:

240R. Same description as English 240.

385R. Contemporary Literature. A study of such writers as Graham Greene, Evelyn Waugh, Aldous Huxley, Henry Green, Kingsley Amis, Irwin Shaw, John O'Hara, Edward Albee and Harold Pinter. An examination of the anti-hero and the stream of consciousness from the psychoanalytical novel to the theatre of the absurd.

Graduate Courses

The Department of English offers courses leading to the degree Master of Arts and to the degree Master of Philosophy. (The departmental graduate brochure provides details of the requirements for these degrees.) The courses marked with a dagger are tentatively scheduled for the session 1968-69.

601*. Studies in Bibliographic Method. Work on individual bibliographic problems, with a study of book manufacture, manuscripts and their relation to the printed text, editorial problems, and literary forgeries. (No letter grade).†

603*. Practical Criticism. Instruction and supervised practice in the art of reading closely, interpreting, and evaluating. (No letter grade).†

605*. Beowulf. A study of Beowulf as a work of literature. A knowledge of Old English is a prerequisite for admission to this course.

606*. Piers Plowman. After a glance at late Fourteenth-Century literature, especially the alliterative revival, the study of the complete poem in its three texts.

607. Chaucer. A study of the works of Chaucer, with emphasis on The Canterbury Tales and Troilus and Criseyde.

608*. Mediaeval Drama. After a cursory consideration of the ancient theatre and its cessation, a study of the rise of the drama in the tenth century until the sixteenth century, using principally English examples. The church music-play, the mystery, the miracle, the morality, and the interlude will be examined from the approaches of the textual critic, the musicologist, the literary historian, and the literary critic.†
610*. Spenser. A study of the works of Spenser, with emphasis on The Faerie Queene.

615. Shakespeare I. A study of the comedies, problem plays, and poems.

616. Shakespeare II. A study of the histories and tragedies.†

620*. Jacobean Drama. A study of selected dramatic works of Jonson, Webster, and Ford.†


625. Milton. A study of the poetry of Milton. Some attention will be given to selected prose works.†

627*. Drama of the Restoration. The chief comedies and tragedies of the period 1660-1707.

630. Satire. A study of the early development of satire, an intensive examination of its flowering in the Restoration and Augustan periods, and a survey of the contributions made to it by such later writers as Burns, Byron, Peacock, Huxley, Orwell, and Auden. Attention will be paid to varying purposes, to the genesis of major works, and especially to methods and devices.†

632*. The Periodical Essay in the Eighteenth Century. A study of the origins of the literary periodical essay, an intensive examination of The Spectator, and a survey of the contributions to the genre made by such later writers as Johnson and Goldsmith.

635*. Fielding. A study of a few of Fielding’s plays for the dramatic techniques he carried over to the novel, and a close examination of his various works of fiction: their genesis, their art forms, and their methods.†

636*. Johnson and his Circle. A study of the literary theories, writings, and relations of Johnson, Boswell, and their circle.


640. Wordsworth and Coleridge. A study of the poetry and prose of Wordsworth and Coleridge, with emphasis on the period of close association of the two poets.†


645*. Byron. A study of the poetry of Byron, with emphasis on Don Juan.

647*. Jane Austen: Novelist. Her place in the development of the novel; her work in relation to the Romantic Revival; an analysis of Jane Austen criticism.

228
650. Studies in Victorian Poetry. A complete survey of the poetry of Tennyson, Browning, and Arnold, in relation to the thought of the Victorian Age.†


654. Late Victorian Poets. A study of the poetry of Swinburne, D. G. Rossetti, Meredith, Morris, Clough, and the poets of the 1890’s.

656. The Victorian Novel. A study of the principal works of such novelists as Dickens, Thackeray, Eliot, Meredith, and Hardy.

660. Antebellum American Literature. After some attention to the colonial beginnings, the course will centre on such authors as Irving, Poe, Hawthorne, Emerson, Thoreau, Melville, and Whitman.

665. The Rise of Realism in American Literature. A study of the works of such authors as Dickinson, Howells, Crane, Twain, and James.

670. The Twentieth-Century British Novel. A study of the works of such novelists as James, Conrad, Lawrence, Joyce, Forster, and Woolf.

671*. D. H. Lawrence. A study of the work of D. H. Lawrence, with emphasis on the major novels.†

672. Twentieth-Century British Poetry. A study of the works of such poets as Hopkins, Yeats, Eliot, Lawrence, Owen, and Auden.

673*. Yeats. A study of Yeats’ work, with emphasis on the later poetry.

677. Twentieth-Century Drama. A study of the major drama of the twentieth century.

680. Twentieth-Century American Fiction. A study of the works of such authors as Hemingway, Faulkner, Dos Passos, and Steinbeck.†


685. Studies in Canadian History and Letters. A study of the major works and movements in Canadian literature, seen in the context of social and political developments. (Given in conjunction with the Department of History).†

687*. Studies in Australian Poetry. A study of the works of the major Australian poets, seen in the context of Australian literary history as a whole and compared with Canadian literary development.

695*. Special Studies. Studies in a specific author, genre, or period.†

696. Special Studies. Studies in a specific author, genre, or period.†

697. M.A. Thesis.†

698. M.Phil. Thesis.†
Fine Arts

Nancy-Lou Patterson, (Mrs.) B.A. (Washington)  
Assistant Professor and Acting Chairman

Rosalind A. Beard, B.A. (Liverpool), M.A. (Alberta)  
Assistant Professor

Helen Martens, B.A., M.A. (Minnesota)  
Assistant Professor

Notes:
Fine Arts is a programme of service courses in Art, Film, and Music, together with related courses cross-listed from other departments.

Students from any faculty may take courses in Fine Arts on an elective basis with the consent of their departments, or as a part of their regular programme where their departments so direct.

Students interested in Art are encouraged to consider the following courses: Classical Civilization 350, Classical Civilization 370, Philosophy 331, and Sociology 312*.

Undergraduate Courses

Art

100. Introduction to World Art. A comparative survey of the history of world art, from prehistoric times to the present, emphasizing visual form as an expression of its historical and cultural context. The major works of world art and architecture (including non-Western art) will be examined and discussed, using slides.
3 lectures.

101. Fundamentals of Visual Art. An introduction to the fundamental principles and concepts of visual art, through a series of experimental studio projects in two and three dimensional materials and media, with an examination of contemporary theories of visual perception, and the dynamics of visual form, using class discussion, films, studio participation, and independent projects.
4 hours studio work weekly.

200. Modern Art. A study of the art of the nineteenth and twentieth centuries, examining the origins and directions of modern art from neo-classicism through the most recent trends, tracing the various movements and analysing the works of outstanding individual artists, using slides, films, readings from related literature, and student presentations.
3 lectures.

220*. Western Religious Art. An introductory survey of the visual art and architecture of Judaism and Christianity in the Common Era. The development and subsequent changes of style in places of worship and ceremonial objects and ornaments, and the changing forms of religious expression through visual art, will be studied.
3 lectures.
230*. (Anthropology 230*.) Primitive Art. A study of Paleolithic, Mesolithic, and Neolithic world art, aspects of Bronze Age Europe, Asia, and the Near East, the art of the African continent, the North and South-American Indians in pre-Columbian and colonial times, and Australia-Oceania, together with related fields such as folk art, naive art, and child art.
3 lectures.

Film

100. History of Film A history of film including analysis and criticism: history of films, styles, convention, and experiments; comparisons of film and literature, film and music, and film and painting; film as a practical, social, entertainment, and educational instrument. 4 hours weekly (including screening time).

110. Film Forms. A study of film forms: scriptwriting, the medium, creation of ideas, the documentary and the poetic aspects of film, photography (including opportunity for students to experiment with film which they provide, use, and process at their own expense), and methodology.
2 hours weekly (plus 4 hours project work outside of class).

Music

101*G. Introduction to Music I. Examination, by means of listening and analysis, of various styles of music ranging from early Christian Chant to electronic and computer music. Compositions to be studied include major forms such as sonata, symphony, opera, mass, etc., as well as smaller forms such as lieder. Special emphasis will be placed upon reasons for stylistic changes.

102*G. Introduction to Music II. Same as above. Prerequisite 101 or consent of the instructor.

111*G. History of Music. From the classical Greek Period (5th Century to 1750 A.D.).

112*G. History of Music. The music of the period from 1750 to the present.

311*G. Bach to Beethoven. The development of cantata, oratorio, mass and opera, concerto and symphony in the compositions of Bach, Haydn, Mozart, and Beethoven.

312*G. Music of the Romantic Period (1800 to 1900). A study of the compositions of Wagner, Chopin, Schumann, Schubert, Wolf, and others. Particular attention is placed on the affinity between music and literature.
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 tutorial

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.
3 hrs lectures, 1 hr problems

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.

2 hours, one term.

3 hours per week

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.
3 hours per week

23. Measurement. (First term) Measurement Laboratory. Use of design morphology in development of measurement techniques for specific problems illustrating other
Year I courses:

3 hours laboratory, alternate weeks.


2 lectures.

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.

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).


3 hours lectures.

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.


2 lectures, 2 hours tutorials.


2 lectures, 1 hour tutorial.

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, 3 hours laboratory. Alternate weeks.
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.

2 hrs lectures 3 hrs laboratory alternate weeks

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 medieval 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, 1 hr tutorial

*Engineering Graphics Laboratory*
Department of Geography and Planning

R.R. Krueger, B.A. (Western), M.A. (Western), Ph.D. (Indiana)  Professor

Helen Abell, (Miss) B.H.Sc. (Cornell), M.Sc. (Cornell), Ph.D. (Cornell)  Professor

A. de Vos, M.Sc. (Wisconsin), Ph.D. (Wisconsin)  Professor

A. Diem, B.A. (Wayne State), M.A. (Clark), Ph.D. (Michigan)  Professor

D.K. Erb, B.Sc. (Western), M.A. (Toronto), Ph.D. (McGill)  Professor

L.O. Gertler, B.A. (Queen's), M.A. (Toronto), Planning (McGill)  Professor

R.S. Dorney, B.Sc. (Wisconsin), M.Sc. (Wisconsin), Ph.D. (Wisconsin)  Associate Professor

J.T. Horton, B.A. (Wheaton), M.A. (Northwestern)  Associate Professor

R.M. Irving, B.A. (Toronto), M.A. (Toronto), Ph.D. (Minnesota)  Associate Professor

L.H. Russwurm, B.A. (Western), M.A. (Western), Ph.D. (Illinois)  Associate Professor


A.G. McLellan, B.Sc. (Glasgow), Ph.D. (Glasgow)  Assistant Professor

R.A. Murdie, B.A. (Waterloo), M.A. (Chicago)  Assistant Professor

C. Nirmaladevi (Miss), B.A. (Madras), M.A. (Harvard), Ph.D. (Harvard)  Assistant Professor

E.R. Officer, B.A. (British Columbia), M.A. (Wisconsin)  Assistant Professor

Notes

1. General Geography Programme. Students majoring in Geography are required to take Geography 100*/101* and in consultation with the Department select additional courses from Geography 210*, 211*, 220, 251*, 321*, 322*, 331*, 332*, 341 and 345* to complete their programmes. Students desiring a course in planning may choose to replace the equivalent of one full Geography course with any two of: Planning 156*, 342*, 343* and 344*. Only in exceptional cases will a student be considered for a fourth year make-up programme beyond the General Degree.

2. Honours Geography Programme. The Honour Geography programme as indicated on page 32 is the standard prescription. Students desiring a planning course as one of their options outside Geography may select from Planning 342*, 343*, 344*. The programme for each student must be arranged in consultation with the Department.

3. Honours Urban and Regional Planning Programme. The Honours Planning programme as indicated on page 33 is the standard prescription. The programme for each student must be arranged in consultation with the Department.

4. M.A. in Geography. Master of Arts candidates in Geography must take three graduate courses in addition to submitting a thesis. Two courses must be in Geography, the third may be in Planning or a related discipline. All programmes must be arranged in consultation with the Department.

5. M.A. in Regional Planning and Resource Development. Master of Arts candidates in Regional Planning must take three graduate courses in addition to submitting a thesis. All programmes must be arranged in consultation with the Department.
6. **Ph.D. in Geography, and Ph.D. in Regional Planning and Resource Development.** Ph.D. candidates must complete work equivalent to the Department's requirements for the M.A. degree and three additional graduate courses. Other courses may be prescribed for individual candidates as deemed necessary. The doctoral dissertation forms a major part of the programme.

7. Students in other disciplines, having taken Geography 101*-100* and desiring additional courses may select from Geography 251*, 321*, 322*, 331*, 332*, 341*, 341, 348*, and Planning 342* and/or 343*. Entrance to other courses requires consent of instructor.

8. Not all the courses listed below are offered each year. Students should consult the Department prior to registration.

9. Course numbers followed by an asterisk (eg. 101*) indicate a half-course.

10. The number of hours of lectures shown after the course description is an attempt to indicate the “normal”; each instructor determines how often his particular class meets.

**Undergraduate Courses**

**Geography**

15. Survey of Geography. This one term course presents a general review of the field of geography, its scope, approach, and basis concepts. The primary aim is to provide the student with background material, readings, resources 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; urban growth and land use planning.

3 lectures (one term).

100*. Introduction to Physical Geography. An introduction to geography with an emphasis on a systematic examination of the elements of the natural environment including landforms, soils, natural vegetation, weather and climate. The distribution and casual interrelationships of these elements are stressed as well as their significance in the human habitat.

2 lectures, 2 hours lab for Geography and Planning Honours students and Geography Majors; other students will replace lab with one-hour discussion session. Given in winter term - this course will normally follow Geography 101*.

101*. Introduction to Human Geography. An introduction to the historical development and the present status of human geography. Selected aspects of economic, political, and urban geography. Regional analysis and applied geography. 2 lectures, 2 hours lab for Geography and Planning Honours students and Geography Majors; other students will replace lab with one-hour discussion session.
Note
Geography 101*-100*, or its equivalent, is normally a prerequisite for other courses in Geography. Permission of the instructor is necessary where this requirement cannot be met.

210*. Economic Geography—World Resources. Nature and occurrence of world resources and problems of resource development; production, distribution and consumption patterns; analysis of agricultural industry on a world scale; rural settlement and agricultural problems.
2 lectures, 2 hours lab. (Given in winter term—normally this course will follow Geography 211*)

211*. Economic Geography—World Industries. World patterns of population and industry; analysis of major industrial regions; location factors underlying selected primary and secondary industries; structure of world trade.
2 lectures, 2 hours lab. (Given in fall term).

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 interrelationships. Among the many factors which are discussed are the utilization of natural resources, the effects of increasing population density, the occcupance 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 lab.

250. Urban Geography. A description and analysis of the geographic characteristics and relationships of urban centres, their origin, development, distribution, functions, internal structure and economic, social and political organization. Analysis of selected urban problems and policies.
3 lectures, 2 hours seminar and/or lab.

251*. Introduction to Urban Geography Processes and problems of urban development in North America. Basic analytical techniques of urban geography. 
No prerequisite.
3 lectures.

260*. Cartography. Cartographic principles, techniques, and basic mapping procedures; scales, map projections and design analysis for cartographic presentation, drafting.
Prerequisite: Honours Geography or Planning students only.
3 hours seminar and/or lab. (Given in fall and winter terms).

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.
Prerequisite: Honours Geography or Planning students only.
3 hours laboratory, seminar and field work (Given in fall and winter terms.)
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.
Prerequisite: Honours Geography students, or consent of instructor.
2 lectures, 2 hours lab. (Given in fall term).

Prerequisite: Honours Geography students, or consent of instructor.
2 lectures, 2 hours lab. (Given in winter term—normally this course will follow Geography 300*).


Note: Geography 321* is designed particularly for students majoring in Geography (General Course) and for students in other disciplines.
3 lectures (Given in fall term).

322*. Regional Geography of Anglo-America II: Canada. Introduction to regional analysis and the study of the environmental ecosystem and its physical and human subsystems in Canada. Selected problems in land utilization, urbanization, regional and resource development.

Note: Geography 322* is designed particularly for students majoring in Geography (General Course) and for students in other disciplines. 3 lectures (Given in winter term—normally this course will follow Geography 321*).

331*. Cultural Geography I. Analysis of man's use of the earth's surface as revealed by a geographic study of selected examples of cultures, culture areas, cultural landscape and human geography.

Note: Geography 331* is designed particularly for students majoring in Geography (General Course) and for students in other disciplines.
3 lectures. (Given in fall term).

332*. Cultural Geography II. Population geography and its relationship to demography and human ecology. Analysis of the growth, diffusion, and distribution of human populations throughout the world, and an explanation of how and why people have adapted to their physical and cultural environments in different world regions.

Note: Geography 332* is designed particularly for students majoring in Geography (General Course) and for students in other disciplines.
3 lectures (Given in winter term—normally this course will follow Geography 331*).
341. Historical Geography of Canada and the United States. The changing geographies of settlement and resource use from the Discoveries to the present. Emphasis upon Canada and Canadian-American interrelationships.
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 organizations of states, external relations, and geo-politics.
3 lectures. Winter term.

Prerequisite: Honours Geography or Planning or consent of instructor.
2 lectures, 2 hours lab. (Given in fall term).

375. Geographical Research Methods. The nature of geographical research; geographic bibliography; report writing; sample research projects, descriptive and inferential statistics as applied to problems in geography. At least one half of the course will be devoted to the use of statistics in geographic research.
Prerequisite: Honours Geography and Planning students only.
2 lectures, 1 hour seminar.

381*. Seminar on Subfields of Geography. Seminar discussion on the major subfields of geography not covered in the mandatory core of courses; inventory, and prospects of geographical research. Guest lectures will be arranged. Review of Senior Honours Essay and selection of topics.
Prerequisite: Honours Geography students only.
3 hours seminar. (Given in winter term).

400. Advanced Geomorphology. Advanced Geomorphology. Advanced study of geomorphologic processes, morphometric analysis, and applied geomorphology. Students will select specific problem areas which will be subjected to field, laboratory, and literary examination.
Prerequisites: Geography 275*, 300* and Earth Sc. 130.
3 hours seminar and/or lab.

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: Geography 275*, 300* and Earth Sc. 130.
3 hours seminar and/or lab.

Prerequisite: Geography 260*.
2 hours seminar and/or tutorial.
Prerequisite: Geography 375, or equivalent, and consent of instructor.
3 hours seminar and/or tutorial.

420-432. Geographic Analysis of Selected World Regions. Detailed study of physical, cultural, economic and political geography; geographic basis of current problems. 
Prerequisite: Honours Geography students, or consent of instructor.
3 lectures.

420. Canada
421. Europe and the Mediterranean.
423. Eastern Europe.
424. Soviet Union.
425. Middle East.
427. Latin America.
428. United States of America.
429. Asia.
431. Polar Lands
432. Oceania.

430. Field Research in Regional Geography. A detailed analysis of a selected region in Canada or the United States with major emphasis upon a field examination of the region (2-3 weeks duration) in the spring. 
Prerequisite: Fourth year Honours Geography students, or consent of instructor.
2 hours seminar.

3 lectures (Given in fall term).

Geography 452* Problems of Rural Land Use. The application of soil survey information and land classification techniques to rural land use problems. 
3 lectures (Given in winter term—normally this course will follow Geography 451*).

475* Special Readings and Seminar on Selected Topics. Prerequisite: Honours Geography and consent of instructor.
3 hours seminar and/or tutorial.

476. Special Readings and Seminar on Selected Topics. Prerequisite: Honours Geography and consent of instructor.
3 hours seminar and/or tutorial.

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. 
Prerequisite: Honours Geography students only.
3 hours seminar.
Department of Geography and Planning

490. Senior Honours Essay.
3 hours seminar.

491*. Field Research: Methods and Projects. One-week field camp session; preparatory assignments and follow-up seminars with presentation of research papers.
Prerequisite: Honours Geography students only.
2 hours seminar (Given in fall term).

Planning

156*. Introductory Urban and Regional Planning. Planning concepts and principles; the nature, purpose, and scope of land-use planning; elements of economic and social planning theory; introduction to planning survey, analysis and synthesis in rural and urban area; basic principles of design and aesthetics as applied to planning; elementary exercises in planning and design.
2 lectures, 2 hours studio for Geography and Planning Honours; other students will replace 2 hours studio with one hour discussion session. (Given in winter term—normally this course will follow Geography 101*).

255*. Planning Surveys and Analysis: Sources of data for Planning and their analysis. The course will emphasize the sources and methods of collection of rural and urban land use data. Particular attention will be paid to the types of land use information essential to transportation, housing and recreation planning. The setting up of regional and urban land use data banks will also be outlined.
A series of laboratory sessions will be conducted on land use data sources and methods of data collection.
Prerequisite: Honours Planning students only, or consent of instructor.
2 lectures, 2 hours studio. (Given in fall term).

256*. Principles of Environmental Design. Goals, objectives, standards of design; principles of aesthetics as applied to urban and regional planning; architectural composition, civic and landscape design; the functional requirements of space and buildings in relation to their distribution, size, arrangement, form and relative cost; articulation of design in a master plan; social economic and political problems in implementing good design; construction and layout; models sketching, perspective, proportions, presentation technique.
Prerequisite: Honours Planning students only, or consent of instructor.
2 lectures, 2 hours studio. (Given in winter term—normally this course will follow Planning 255*).

332*. The Sociology of Regions. Basic concepts of sociology; occupational and concomitant social adjustments of rural society in response to forces of urbanization and industrialization; social movements generated within the farm population.
3 lectures (Given in fall term).
Prerequisite: Honours Planning students (Yr III only), or consent of instructor.
333*. The Sociology of Regional Planning. Power structures, basic social institutions, attitudes and values related to the implementation of regional plans; regional development of human and natural resources in Canada and abroad.
3 lectures (Given in winter term—normally this course will follow Planning 332*).
Pre-requisite: Planning 332*. Honours Planning students (Yr III only), or consent of instructor.

342*. Urban, Regional and Resource Planning I: Survey of the Field. This course provides an overview of the field of urban and regional planning. Classic controversies in the field of planning, in its definition and delimitation; the role of public investment criteria and welfare economic criteria in urban and regional planning; the place of planning in a democratic society; the role of interest group and grass-roots politics in planning will be considered. An overview of the techniques of information collection and analysis, and of the tools of implementation available to urban and regional planners will also be provided.

Note: Planning 342* is designed particularly for students in disciplines other than Planning.
3 lectures. (Given in fall term).

343*. Urban, Regional and Resource Planning II: Survey of the Field. The identification and analysis of urban and regional planning problems.

Note: Planning 343* is designed particularly for students in disciplines other than Planning.
3 lectures. (Given in winter term—normally this course will follow Planning 342*).

344*. Principles of Recreational Planning. A systems approach involving the cultural and natural environments as they relate to planning of recreational land uses and facilities. A study of the planning process as it relates to supplying recreational demands in urban-centred regions. Park planning at the local, provincial and national levels.
Prerequisite: Two of Geography 101*, 100* and Planning 156* on consent of instructor.
3 lectures.

357*. Conservation and Resource Development. History of the conservation movement; principles of conservation management and development of resources. Analysis, use and planning of recreational resources.
Prerequisite: Honours Planning and Geography students, or consent of instructor.
3 lectures. (Given in winter term—normally this course will follow Geography 355*).

358*. Regional Planning and Development. The relationship of economic planning to regional planning; principles of planning and development in urban-centred, broad economic and frontier regions; Canadian and international case studies; study of Canadian agencies such as A.R.D.A., and A.P.E.C.; research projects.
Prerequisite: Honours Planning students, or consent of instructor.
2 lectures, 2 hours studio.

404. Seminar on Quantitative Methods in Urban and Regional Planning. Advanced study of selected models of locational structure and methods used in locational analy-
sis. Emphasis on the analysis of urban and regional planning data using multivariate statistical techniques and the computer.

Prerequisite: Geography 375 or equivalent, and consent of instructor.
3 hours seminar and/or tutorial.

456*. Political and Administrative Processes in Urban and Regional Planning. Historical development of planning legislation in various parts of the world; the provincial and federal legislation affecting urban, regional and resource planning in Canada; the statutory planning systems in the provinces; the jurisdiction of provincial bodies and agencies.
Prerequisite: Honours Planning students, or consent of instructor.
3 lectures.

475*. Projects, Problems and Readings in Planning. Special planning projects and problems chosen in consultation with instructor.
Prerequisite: Honours Planning students, or consent of instructor.
3 hours seminar and/or tutorial.

476. Projects, Problems and Readings in Planning. Special planning projects and problems chosen in consultation with instructor.
Prerequisite: Honours Planning students, or consent of instructor.
3 hours seminar and/or tutorial.

480. The Philosophy and Methodology of Urban and Regional Planning. Historical developments of the discipline of planning; current trends in the philosophy and methodology.
Prerequisite: Honours Planning students only.
3 hours seminar.

490. Senior Honours Essay. A research project involving field work, analysing statistical data; written, graphic and cartographic presentation must be in form suitable for publication.
3 hours seminar.

491*. Field Research: Methods and Projects. A one-week field camp session; preparatory assignments, and follow-up seminars with presentation of research papers.
Prerequisite: Honours Planning students only.
2 hours seminar. (Given in fall term).

Graduate Courses

Geography


602. **Air Photo Interpretation.** Advanced studies involving air photo interpretation, use of stereo-plotting instruments, mosaic construction, map production, and applied research.

603. **Planning and Resource Survey Techniques.**
Prerequisites: Geography 375 and Geography 404 or equivalent.

610. **Economic Geography.** Advanced study of selected subfields of Economic Geography, with emphasis on industrial development.

620. **Regional Geography.** A study in depth of the geographic factors pertaining to urban and rural development problems in various regions of the world. One or two problem regions will be studied in depth each year.

621. **Europe and the Mediterranean**

623. **Middle East**

624. **Asia**

625. **Oceania**

626. **Africa**

627. **Latin America**

628. **United States of America**

629. **Polar Lands**

630. **Canada**

631. **Eastern Europe**

632. **Soviet Union**

633. **Field Research in Regional Geography.** A detailed analysis of a selected region in Canada or the United States with major emphasis upon a field examination of the region (2-3 weeks duration) in the Winter. 2 hours seminar.

645. **Political Geography.** A review of contrasting approaches to the field; recent theories and their integration; Geopolitics; quantitative research in Political Geography.

650. **Urban Geography.** An analysis of concepts and theory in urban geography, including regional interaction of cities and city regions, economic base study, central place theory and city classification; urban functions and land use; methods of urban research with emphasis on the use of statistical measurement and computers.

657. Agricultural Land-Use Problems. Physical and human problems associated with agricultural land use in Canada and other selected areas. The role of land-use planning in agriculture, its technique and implementation. The role of geographical research in agricultural and other rural development problems. Original research projects.

675*. Special Readings and Seminar on Selected Topics in Geography.

676. Special Readings and Seminar on Selected Topics in Geography.


Planning

603. Planning and Resource Survey Techniques. 
Prerequisite: Geography 375 and Planning 404 or equivalent.

623*. Sociological Concepts Relevant to Regional Planning. Relevant sociological, economic, political and psychological concepts, social and natural environment, group settlement patterns, rural-urban interdependence, and social systems within a region.

624. Sociological Problems and Projects in the Implementation of Regional Development. The formulation and acceptance of regional development plans (Canada and abroad); principles and problems in inter-group relationships relevant to regional planning and implementation. 
Prerequisite: Planning 623*.

652*. Natural Resource Planning: Policies and Programmes. International, national, and provincial resource planning policies and programmes; legislation dealing with resource allocation and planning; the structure and programmes of national and international agencies; Canadian federal-provincial resource development agreements.

653*. Recreational Resource Planning. Forecasting recreational demands; methods of classifying recreational resources; methods of recreational resource inventory; principles of recreational land management and conservation.


656. The Process of Urban and Regional Planning. An advanced course in the techniques of Urban and Regional Planning. Techniques of population analysis and forecasting, economic base analysis, regional input-output, income and product accounts, capital budgeting principles, and social physics models will be considered within the framework of urban and regional case studies. Analysis will be considered in the framework of the planning process, from goal formulation to implementation of plan in the urban-centred region.

658. Regional Development. The theories of regional development. Regional economic development within a national planning framework. Canadian and international case studies will be used to illustrate classic controversies in the field of regional economic development via efficiency vs income redistribution as goals; concept of growth poles; sociological aspects of regional development; consideration of the relationship between regional economic and environmental planning.

659. Special Problems and Projects. Special planning or resource management problems and projects chosen in consultation with a professor.

675*. Special Readings and Seminar on Selected Planning Topics.

676. Special Readings and Seminar on Selected Planning Topics.

680. Seminar on the Philosophy and Methodology of Regional Planning and Resource Development. The conceptual framework of urban, regional, and resource planning; historical development of concepts and recent trends in methodology; relationship of the discipline of geography to the regional planning concept.

Department of German and Russian

J.W. Dyck, A.B. (Bethel), M.A. (Missouri), Ph.D. (Michigan)  Professor  Chairman of the Department
E. Heier, B.A., M.A. (British Columbia), Ph.D. (Michigan)  Professor  Deputy Chairman
I. Levitsky, A.B. (Rochester), M.A. (Buffalo), Ph.D. (Duke)  Professor (Germ./Russ.)
H. Boeschenstein, Ph.D. (Rostock)  Visiting Professor (German)
H. Hennecke  Visiting Professor
W. Lehmann, Ph.D. (Hamburg)  Visiting Professor (German)
S. Hoefert, B.A., M.A., Ph.D. (Toronto)  Associate Professor (German)
M. Richter, Staatsexamen (Berlin and Bonn), M.A. (Toronto)  Assistant Professor
W. Shelest, Diploma (Munich), M.A. (Ottawa), Ph.D. (Munich)  Assistant Professor (Russian)
A. Zweers, Candidaatsexamen, Doctorandus (Amsterdam)  Assistant Professor (Russian)
M.A. Davies (Mrs.), B.A. (Washington), A. M. (Radcliffe)  Part-Time Lecturer
A. Donskov, B.A., M.A., (British Columbia)  Lecturer
H. Marsden (Mrs.), B.A. (Randolph-Macon), M.A. (Waterloo)  Lecturer
H.W. Panthel, B.A. (Waterloo), M.A. (Cincinnati)  Lecturer

Undergraduate Courses

Notes
1. All courses with the exception of German 10 are one term, (half) courses.

2. Half courses are designed for the convenience of students (Engineering and other Co-operative) who are enrolled in term-programmes. Nevertheless, to obtain credit students must follow up:
   1-51 with 1-52; with 52; 101 with 102;
   251 with 252; 271 with 272;
   351 with 352; 451 with 452.

3. Any other two half (one term) courses constitute one full course.

4. German 271 plus 272 meets the requirement otherwise (see: The General Course; Honours Courses) referred to in the calendar as Culture and Civilization Courses.

5. Except for those numbered below 101, all the following courses are Honours courses, but are also open to students enrolled in General programmes.

German

10. Reading and Translation. This course is designed to assist graduate students in acquiring a reading knowledge of German. Usage and structure of German scientific writings. Translation in fields of specialization.
   Two terms. Lectures arranged.
   Open to graduate students of all departments.
1-51*. Beginner's German. For students with no previous knowledge of German. The elements of German grammar, reading, oral practice, composition. Language Lab for Arts students. Special section for Science students with emphasis on readings and translations of writings in the principal sciences.

One term. 3 lectures; (2 labs for Arts students).
Open to graduate students of all departments.

1-52*. Intermediate German. For students with some knowledge of German. The elements of German grammar, reading, oral practice, composition. Otherwise as 1-51.

One term. 3 lectures; (2 labs for Arts students).
Prerequisite: German 1-51 or equivalent. Permission of instructor.

51*. Scientific German. A review of the fundamentals of grammar is followed by a more advanced study of language 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.

One term. 3 lectures.
Prerequisite: German 1-52 or equivalent. Permission of instructor.

52*. Intermediate Scientific German. Course description as in 51.

One term. 3 lectures.
Prerequisite: German 51 or equivalent. Permission of instructor.

101*. Introduction to German Literary Movements. Reading and interpretation of representative works of major German authors from the beginning to German Classicism. Oral practice, composition, grammar. This course is conducted primarily in German.

One term. 2 lectures; 1 lab.
Prerequisite: Grade 13 German, 1-52 or equivalent. Permission of department chairman.

102*. Introduction to German Literary Movements. Reading and interpretation of representative works of major German authors from Romanticism to the present. Oral practice, composition, grammar. This course is conducted primarily in German.

One term. 2 lectures; 1 lab.
Prerequisite: German 101 or equivalent.

251*. 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.

One term. 3 lectures (mostly in Language Lab.)
Prerequisite: German 102 or equivalent.
Permission of instructor.

252*. Conversation, Composition, Grammar and Phonetics. As 251.

One term. 3 lectures (mostly in Language Lab.)
Prerequisite: German 251 or equivalent.
261*. German Classicism. Reading, interpretation, and critical analysis of representative works (Goethe, Schiller, Kleist, Jean Paul, Hölderlin, etc.)
One term: 3 lectures.
Prerequisite: German 101 and 102 or permission of department chairman.

262*. German Romanticism. Reading, interpretation, and critical analysis of representative works (Novalis, Brentano, Tieck, Eichendorff, etc.).
One term: 3 lectures.
Prerequisite: German 101 and 102 or permission of department chairman.

271*. German Thought and Culture. A study of the major thought movements and masterpieces of philosophy, literature, music, art, etc. to the time of Enlightenment. This course is taught in English.
One term: 3 lectures.
Prerequisite: none.

272*. German Thought and Culture. A study of the major thought movements and masterpieces of philosophy, literature, music, art, etc. from Goethe to the present. This course is taught in English.
One term: 3 lectures.
Prerequisite: none.

351*. Intermediate Conversation and Composition. Written reports on prescribed themes and topics. Oral drill.
One term: 3 lectures
Prerequisite: German 252 or equivalent.

352*. Intermediate Conversation and Composition. As 351.
One term: 3 lectures.
Prerequisite: German 351.

361*. Young Germany and Biedermeier. Reading, interpretation, and critical analysis of prescribed prose, drama and poetry.
One term: 3 lectures.
Prerequisite: German 101 and 102.

362*. Poetic Realism. Reading, interpretation, and critical analysis of prescribed prose, drama and poetry.
One term: 3 lectures
Prerequisite: German 101 and 102.

371*. Modern German Literature. Reading and interpretation of prescribed works from early Naturalism to the Twenties.
One term: 3 lectures.
Prerequisite: German 101 and 102.

372*. Modern German Literature. Reading and interpretation of prescribed works from the Twenties to the present.
One term: 3 lectures.
Prerequisite: German 101 and 102.
381*. Enlightenment. Reading, interpretation, and critical analysis of prescribed prose, drama and poetry (Brockes, Haller, Gellert, Lessing, Wieland, etc.).
One term. 3 lectures.
Prerequisite: German 101 and 102.

382*. Storm and Stress. Reading, interpretation, and critical analysis of prescribed prose, drama and poetry (Klopstock, Herder, Gerstenberg, Lenz, Klinger, etc.).
One term. 3 lectures
Prerequisite: German 101 and 102.

451*. Advanced Conversation, Grammar and Composition. This course is conducted in German and provides intensive practice in spoken and written German on the advanced level.
One term. 3 lectures.
Prerequisite: German 352 or equivalent.

452*. Advanced Conversation, Grammar and Composition. As 451.
Prerequisite: German 451.

461*. Introduction to the History of the German Language with Readings in Middle High German.
One term. 3 lectures.
Prerequisite: German 101 and 102.

462*. Middle High German Literature. Reading and interpretation of prescribed works of the first "Blutezeit" in German literature. (Walther von der Vogelweide, Reinmar der Alte, Morungen, Wolfram von Eschenbach, Gottfried von Strassburg, etc.)
One term. 3 lectures.
Prerequisite: German 101, 102, and 461.

471*. German Poetry. A study of the main thoughts, themes, forms, and schools in German poetry from the beginning to Goethe.
One term. 3 lectures.
Prerequisite: German 101 and 102.

472*. German Poetry. A study of the main thoughts, themes, forms, and schools in German poetry from German Romanticism to the present.
One term. 3 lectures.
Prerequisite: German 101 and 102.

481*. Renaissance. Reading, interpretation, and critical analysis of prescribed prose, drama and poetry (Tepl, Luther, Murner, Sachs, etc.).
One term. 3 lectures.
Prerequisite: German 101 and 102.

482*. Baroque. Reading, interpretation, and critical analysis of prescribed prose, drama and poetry (Fleming, Grimmelshausen, Lohenstein, Gryphius, Hofmannswaldau, Angelus Silesius, Opitz, etc.).
One term. 3 lectures.
Prerequisite: German 101 and 102.
Department of German and Russian

495*-498*. Reading Course in Approved Topics.
One term each. 3 lectures.
Open to fourth year students only.

Russian

Notes:
1. All courses with the exception of Russian 10 are one term (half) courses.
2. Half courses are designed for the convenience of students (Engineering and other Co-operative) who are enrolled in term-programmes. Nevertheless, to obtain credit students must follow up: 1-51 with 1-52; 101 with 102; 251 with 252; 271 with 272; 351 with 352; 381 with 382; 451 with 452.
3. Any other two half (one term) courses constitute one full course.
4. Russian 271 plus 272 meets the requirement otherwise (see: The General Course; Honours Courses) referred to in the calendar as Culture and Civilization Courses.
5. Except for those numbered below 101, all the following courses are Honours courses, but are also open to students enrolled in General programmes.

10. Reading and Translation. This course is designed to assist graduate students in acquiring a reading knowledge of Russian. Usage and structure of Russian scientific writings. Translation in fields of specialization.
Two terms. Lectures arranged.
Open to graduate students of all departments.

1-51*. Beginner’s Russian. For students with no previous knowledge of Russian. The elements of Russian grammar, reading, oral practice, composition. Language Lab for Arts students. Special section for Science students with emphasis on readings and translations of writings in the principal sciences.
One term. 3 lectures; (2 labs. for Arts students).
Open to undergraduate students of all departments.

1-52*. Intermediate Russian. For students with some knowledge of Russian. The elements of Russian grammar, reading, oral practice, composition. Otherwise as 1-51.
Prerequisite: Russian 1-51 or equivalent. Permission of instructor.
One term. 3 lectures; (2 labs. for Arts students).

51*. Scientific Russian. A review of the fundamentals of grammar is followed by a more advanced study of language 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.
One term. 3 lectures.
Prerequisite: Russian 1-52 or equivalent. Permission of instructor.
Prerequisite: Russian 51 or equivalent. Permission of instructor. 
One term. 3 lectures.

101*. Second Year Russian. Reading in selected texts of major Russian authors. Oral 
practice, grammar review, composition. 
Prerequisite: open to all students.
One term. 2 lectures; 1 lab.

102*. Second Year Russian. Course description as in 101. 
Prerequisite: Russian 101 or permission of instructor. 
One term. 2 lectures; 1 lab.

251*. Conversation, Composition, Grammar and Phonetics. This course is conducted 
in Russian and provides intensive practice in spoken Russian. Vocabulary building, 
comprehension, pronunciation and intonation are stressed. 
Prerequisite: Russian 1-52, 102, or equivalent. Permission of instructor. 
One term. 3 lectures (mostly in Lang. Lab.)

252*. Conversation, Composition, Grammar and Phonetics. As 251. 
Prerequisite: Russian 251 or equivalent. 
One term. 3 lectures (mostly in Lang. Lab.)

261*. Introduction to Russian Literary Movements. Reading of representative works 
from Russian Classicism, Romanticism, 19th century Realism, and various periods of 
20th century Russian literature. 
Prerequisite: Russian 102 or permission of instructor. 
One term. 3 lectures.

262*. Introduction to Russian Literary Movements. As 261. 
Prerequisite: Russian 261. 
One term. 3 lectures.

271*. Russian Thought and Culture. A study of the major thought movements and 
masterpieces of philosophy, literature, history, music, art, etc. to 1861. This course is 
taught in English. 
Prerequisite: none. 
One term. 3 lectures.

272*. Russian Thought and Culture. A study of the major thought movements and 
masterpieces of philosophy, literature, history, music, art, etc. from 1861 to the pre-
sent. This course is taught in English. 
Prerequisite: none. 
One term. 3 lectures.

351*. Intermediate Conversation and Composition. Written reports on prescribed 
themes and topics. Oral drill. 
Prerequisite: Russian 252 or equivalent. 
One term. 3 lectures.

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Department of German and Russian

352*. Intermediate Conversation and Composition. As 351.
Prerequisite: Russian 351.
One term. 3 lectures.

361*. Russian Realism. (Aksakov, Gogol, Goncharov, Turgenev, Tolstoy, Ostrovsky)
Reading, interpretation, and critical analysis of prescribed prose and drama.
Prerequisite: Russian 101 and 102.
One term. 3 lectures.

Prerequisite: Russian 101 and 102.
One term. 3 lectures.

371*. The Golden Age of Russian Literature. Reading and interpretation of prescribed prose, drama and poetry from Lomonosov to Pushkin.
Prerequisite: Russian 101 and 102.
One term. 3 lectures.

372*. The Golden Age of Russian Literature. Reading and interpretation of prescribed prose, drama and poetry from Pushkin to the 1860's.
Prerequisite: Russian 101 and 102.
One term. 3 lectures.

381*. The Peoples of the Soviet Union. Especially emphasized will be the study of non-Slav peoples of the Caucasus and Central Asia, European Russia and Siberia 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.
Prerequisite: none.
One term. 3 lectures.

382*. The Peoples of the Soviet Union. As 381.
Prerequisite: Russian 381.
One term. 3 lectures.

391*. Russian Literature in Translation. From Pushkin to Dostoevsky.
Prerequisite: At least one course in any other literature.
One term. 3 lectures.

392*. Russian Literature in Translation. From Chekhov to Pasternak.
Prerequisite: At least one course in any other literature.
One term. 3 lectures.

451*. Advanced Conversation, Grammar and Composition. This course is conducted in Russian and provides intensive practice in spoken Russian on the advanced level.
Prerequisite: Russian 352 or equivalent.
One term. 3 lectures.
452*. Advanced Conversation, Grammar and Composition. As 451.
One term. 3 lectures.

461*. Twentieth Century Russian Literature. (Gorky, Mayakovsky, Olesha, Kataev, Leonov, Tashchenko) Reading, interpretation, and critical analysis of prescribed prose and drama.
Prerequisite: Russian 101, 102.
One term. 3 lectures.

462*. Twentieth Century Russian Literature. (Sholokhov, A. N. Tolstoy, Fadeev, Pasternak, Solzhenitsyn, Kazakov) Reading, interpretation, and critical analysis of prescribed prose and drama.
One term. 3 lectures.
Prerequisite: Russian 461.

471*. The Image of Russia 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.
Prerequisite: none.
One term. 3 lectures.

472*. The Image of Russia and the Russians in Western Thought and Writings. As 391.
Prerequisite: none.
One term. 3 lectures.

481*. Russian Poetry. A study of themes and forms of representative authors of Classicism, Romanticism and Realism (Lomonosov, Derzhavin, Pushkin, Lermontov, Nekrasov, Fet, Tiutchev, etc.).
Prerequisite: Russian 101 and 102.
One term. 3 lectures.

482*. Russian Poetry. A study of themes and forms of representative authors from Symbolism to the present (Blok, Esenin, Mayakovsky, Akhmatova, etc.).
Prerequisite: Russian 101 and 102.
One term. 3 lectures.

495*-498*. Reading course in Approved Topics.
Open for fourth year students only.
One term each. 3 lectures.

Ukrainian

201*. Introduction to Ukrainian Literature. The place of Ukrainian in the Slavic family of languages; review of grammar; reading of texts chosen from the works of Ukrainian authors. (Skovoroda, Kotliarev'sky, Franko, L. Ukrainka, Ryl'sky and others).
Prerequisite: Admission by consent of the instructor.
One term. 3 lectures.
202*. Introduction to Ukrainian Literature. A critical survey of Ukrainian literature from Kotliarev's'ky to the present.  
Prerequisite: Ukrainian 201 or admission by consent of the instructor.  
One term. 3 lectures.

301*. Ukrainian Romanticism. Taras Shevchenko and his Time. Kharkov and Kiev as literary centers; the Brotherhood of SS. Cyril and Methodius; reading and critical interpretation of prescribed prose, drama and poetry. (Shevchenko, Kostomariv, Kulish, and others.).  
Prerequisite: Ukrainian 202 or admission by consent of the instructor.  
One term. 3 lectures.

302*. Ukrainian Romanticism. The literary revival in Western Ukraine. A critical study of the literary movement with special emphasis on the major authors (Shashkevych, Wahylevych, Holovats'kyj and others).  
Prerequisite: Ukrainian 301 or admission by consent of the instructor.  
One term. 3 lectures.

Graduate Courses

German

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**

600*. Russian Literary Criticism. (Problems and methods)

601*. Pushkin or Lermontov.

620. Old Church Slavonic.

621. History of the Russian Language.

630*. Tolstoy.

631*. Dostoevsky.

640*. The Russian Drama.

650*. Contemporary Russian Literature.

651*. Early East Slavic Literature (the epics, the byliny, the chronicles.)

695*-698*. Reading Course in Approved Topics.


**Note:** All 600 courses are one term courses with the exception of 620, 621, and 699.
Department of History

P.G. Cornell, E.D., M.A., Ph.D. (Toronto)  
Chairman of the Department

H. MacKinnon, B.A. (Montreal), Ph.L., S.T.L. (Gregorian), M.A. (Toronto), D.Phil. (Oxon)  
Professor

K.A. MacKirdy, M.A. (British Columbia), Ph.D. (Toronto)  
Professor

A.W. Rees, M.A. (Wales)  
Deputy Chairman

M.T. Cherniavsky, M.A. (Oxon)  
Associate Professor

E.P. Patterson, B.A. (Baylor), M.A. (Kansas), Ph.D. (Washington)  
Associate Professor

Associate Professor

M.J. Craton, B.A., P.G.C.E. (London), Ph.D. (McMaster)  
Assistant Professor

D.A. Davies, B.A., Ph.D. (Washington)  
Assistant Professor

K.R. Davis, B.A. (Toronto) M.A. (Wheaton), Ph.D. (Michigan)  
Assistant Professor

K.D. Eagles, M.A. (Cantab), M.A., Ph.D. (Washington)  
Assistant Professor

L.A. Johnson, B.A. (Waterloo), M.A.M.Phil. (Toronto)  
Assistant Professor

R.C. MacGillivray, B.A. (Queen's), M.A., Ph.D. (Harvard)  
Assistant Professor

S.L. Sandler, B.A. (Houghton), M.A. (Columbia), Ph.D. (London)  
Assistant Professor

H. Schlossberg, B.A. (Bethel), M.A. (Missouri), Ph.D. (Minnesota) (on leave)  
Assistant Professor

J.M. Wahl, C.R., B.A. (Western), M.A. Ph.D. (St. Louis)  
Assistant Professor

T. Barcasy, M.A. (Toronto)  
Lecturer

P.E. Dembski, M.A. (Toronto)  
Lecturer

Z. Rosenberg (Miss), B.A. (New Brunswick), M.A. (Toronto) M.S.L. (St. Michaels)  
Lecturer

Notes
1. Students enrolled in disciplines other than History can be admitted to any History course with the permission of the department.

2. The number of hours assigned to each course in the course descriptions indicates its relative weight and not necessarily the number of weekly meetings. Half courses (meeting for one term only) are designated by an asterisk (*) after the course number.

3. Not all courses listed below are offered each year.

General Course. Students majoring in History should consult the General Course requirements listed on page 19. They will normally choose their courses from History 100, 201/202, 211/212, 231/232, 255, 261/262, 271/272, 291/292, 301/302, 303/304, 311/312, 355/356. In addition, they must fulfill the requirements of History 349.

Honours Course. The Honours History programme recommended on page is the standard prescription. The exact programme for each student will be worked out in consultation with a departmental advisor.
Master of Arts. In History there are two programmes leading to the degree of Master of Arts.

In proceeding to the degree by courses and a thesis the candidate will offer: (a) History 600 (b) a minor field 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.

In proceeding to the degree without a thesis the candidate will offer: (a) History 600 (b) in consultation with the department either two minor fields and a cognate essay, or three minor fields involving major research essays. Subject to departmental approval, one of the fields, may be selected from graduate offerings in another department. The candidate will also be required to have a reading knowledge of an appropriate second language.

Master of Philosophy. The general requirements for the degree of Master of Philosophy as indicated on page 140 apply to the degree in History. The programme of study for each student is defined in consultation with the Department, to meet his individual needs and professional development.

Doctor of Philosophy. The Department of History intends to register students for the Doctor of Philosophy degree commencing with the year 1969-70.

Undergraduate Courses

100. An Historical Introduction to Western Civilization. Designed especially for freshmen, this course examines a selected number of historical topics with the aim of introducing the student to the various ways historians analyze the development of the important ideas and institutions of Western Civilization.
   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. The period 1450-1550 will be studied in some depth, with special emphasis on the cultural history of Renaissance Italy.
   3 hours, lectures and seminars.

201*. Expansion of Europe from the 15th to the 18th Century. Surveys the major explorations, conquests and settlements of the Portuguese, Dutch, French and English empires. The eighteenth century decline of the French, Spanish, and English empires in the new world is outlined.
   3 hours.

202*. Expansion of Europe in the 19th and 20th centuries. Surveys European expansion especially in Africa and Asia and traces the rise of the nationalist-independence movements which culminate in the end of empire in the mid-twentieth century.
   3 hours.

211*. British History to 1714. A survey of the major developments in British history from Julius Caesar to the death of Queen Anne.
   3 hours.

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212*. British History since 1714. A survey of the major developments in British history from the accession of the House of Hanover to the present. 3 hours.

250. History of Medieval Europe. The political, cultural, economic and ecclesiastical development of Europe from 300 to 1300. 3 hours, lectures and seminars.

255. Ancient Civilizations. A survey of the social, political and economic history of Greece and Rome with an introduction to the civilization of the Ancient Near East. 3 lectures.

260. Early Modern European History. History of western continental Europe from the Renaissance to the Enlightenment. 3 hours, lectures and seminars.

261*. Central Europe 1648-1848. The course will cover in some depth selected topics of political, social and economic history from the Peace of Westphalia to the revolutions of 1848. 3 hours.

262*. The Habsburg Monarchy and the Germanic Lands 1848-1900. Special attention will be given to the emergence of nationalism in Central Europe as well as other selected topics of political, social, and economic history. 3 hours.

265*. Canadian History I. Selected topics in the period to 1867. 3 hours, lectures and seminars.

266*. Canadian History II. Selected topics in the period since 1867. 3 hours, lectures and seminars.

271*. South Asia. Economic, social and political repercussions of contact with Europe since 1600. Emphasis will be on events in the Indian subcontinent.

272*. East Asia. The response of China and Japan to the impact of the West during the nineteenth and twentieth centuries. Events in Southeast Asia will be very briefly discussed. 3 hours.

285. Latin American History. 3 hours.

291*. Ancient and Pre-colonial Africa. A study of the political, social and economic history of the major states of sub-Saharan Africa from earliest times to the advent of Europeans. The course includes an examination of the Cushite, Sudanic, Forest, Swahili and Central African states. 3 hours.
292*. Colonial and Independent Africa. A survey of sub-Saharan African history from the coming of the Europeans to the era of independence with emphasis on Ghana, Nigeria, Kenya, Uganda, Zambia and the former Southern Rhodesia. Special attention is given to a comparison of colonial administration and the rise of nationalist-independence movements.
3 hours.

295*. History of the United States to 1865. A survey of American society, politics and thought and of the relations of the United States with the outside world from 1776 to 1865.
3 hours, lectures and seminars.

296*. History of the United States since 1865. A survey of American society, politics and thought of the relations of the United States with the outside world from 1865 to the present.
3 hours, lectures and seminars.

301*. Canadian History to 1867. An analysis of selected issues: New France, Atlantic outlook, Loyalism and the crisis of Empire, rebellion and reconstruction, regional loyalties and the strategy of Confederation.
3 hours, lectures and seminars.

302*. Canadian History since 1867. An analysis of selected issues: westward expansion, regionalism and the crisis of Canadian federalism, framing a foreign policy, French-Canadian nationalism, urbanization and the New Society.
3 hours, lectures and seminars.

303*. American History to 1865. An analysis of selected issues in American history: the Revolution and the rise of the American nation; the era of Jefferson and Jackson; sectionalism, slavery and secession; the Civil War—impact and interpretations.
3 hours.

304* American History since 1865. An analysis of selected issues in American history: Reconstruction and the New South; expansion and industrialisation in the 1870's and 1880's, war with Spain and American Imperialism; the Progressive Movement, 1900-1914; Wilson and Versailles, Normalcy, Depression and the New Deal; the United States at home and abroad since 1945.
3 hours.

311*. Twentieth Century History: The European Phase. An examination of major European countries independently and collectively from the Treaty of Versailles to World War II.
3 hours.

312*. Twentieth Century History: The Extra European Phase. An examination of the recent historical development of three or four of the following key areas in the modern world: Japan (with Korea), China (with Vietnam), Indonesia, India, Africa, the Middle East, Latin America.
3 hours.
313R. War and Revolution in Twentieth Century World History. (Not offered in 1968-69)

321*. Medieval History 476-1100. A consideration of the main political, social, economic and religious themes of the Medieval period.
3 hours.

322*. Medieval History 1100-1500. A consideration of the main political, social, economic and religious themes of the Medieval period.
3 hours.

349. Senior Essay. Required of all History majors in the third year of the general course.
1 hour.

350. Later modern European History. An exposure to important issues of European history since the French Revolution with an emphasis on intellectual and diplomatic themes as well as the more usual political, economic and social aspects.
3 hours, lectures and seminars.

353*. Medieval Church History from 312 to 1122.
3 hours, lectures and seminars.

354*. Medieval Church History from 1122-1449.
3 hours, lectures and seminars. (to be offered in 1968-69)

355*. Russian History 1613-1914. The course will focus on selected themes in the development of the Russian state and society during three hundred years of Romanov rule with special emphasis on the problems besetting Russia after 1861.
3 hours.

356*. Russian History since 1914. The course will focus on selected themes with particular emphasis on the Russian Revolution and the internal development of the USSR.
3 hours.

3 hours, lectures and seminars.

3 hours, lectures and seminars.

3 hours, lectures and seminars.

370. Comparative Studies in Imperialism and Colonization. A comparison of colonial empires, mostly European since the sixteenth century, in which a general study in the
first term is followed by the examination of particular examples in the Caribbean re-
gion, Latin America or Southern Africa in the second term.
3 hours, lectures and seminars.

382. Regional Approach to Canadian History. The historical development of a se-
lected region will be examined in relation to that of the rest of Canada and of neigh-
bouning areas in the United States.
3 hours, lectures and seminars.

3 hours, lectures and seminars.

391. Directed Studies in Special Topics. Study in a limited field under tutorial guid-
ance. A high standard of written work will be expected.

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.

456. Literature and History of the Victorian Age. A literary and historical survey of
Victorian England through authors and works that have major significance in both
fields. The student will be encouraged to use several approaches and forms of evalua-
tion of this material. He will be obliged to register in English 456 or History 456 and
direct and concentrate his study accordingly.

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. The History and Theory of Historical Writing.
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.
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

479. Senior Tutorial in French History.
2 hours

491. Directed Studies in Special Topics.

495. Special Senior Tutorial.

499. Senior Honours Essay. (Required of all History honours students in their fourth year). Defended by an oral examination.

The following courses are administered by Renison College.

231R*. Europe from 1789-1848. The impact of French revolutionary ideology, Bonapartist militarism, and the new technology on the traditional political, social and economic institutions of Europe. Metternich's Conservatism re-examined. The containment of political radicalism, nationalism, and socialism by conservative forces.
3 hours. Fall term.

232R*. Europe from 1848-1901. The emergence of the nation state in Germany and Italy: the spread of industrialism: the population explosion: the expansion of Russia: the second industrial revolution; the "new" imperialism; the European conquest of Africa: the awakening of Japan and China; revolution in Russia; towards World War. 3 hours. Winter term.

The following courses are administered by St. Jerome's College.

246J*. The History of Public and Private Law to 1500. An historical study of the evolution of law and the legal approach. Topics in the history of Roman, Canon and Common Law will be discussed to provide the student with an appreciation of law as it exists today.

247J*. The History of Public and Private Law to 1500. Selected topics in public and private law will be treated. Various lawyers and jurisprudents of the Middle Ages will be studied in greater detail.

Graduate Fields in History

600. The History and Theory of Historical Writing.

610. Canadian History: The Conservative Tradition.
611. Canadian History: The French-Canadian Tradition.

612. Canadian History: Selected Regions.

615. Colonial and Imperial History.

616. Ethnohistory.

619. Modern English History I.

620. Modern English History II.

621. German History.

622. Medieval History.

623. French History.

624. Russian History.

625. Central European History.

626. United States History.


695. Cognate Essay.

Management and Systems Engineering Programme

D. E. Coates, B.A. Sc. (Toronto), M.S. Ph.D. (Illinois)  
Associate Professor
Chairman

F.E. Burke, B.A., (London)  
Associate Professor

P.M. Reilly, B.A. Sc., (Toronto), D.I.C., Ph. D., (London) F.S.S.  
Professor
(Chemical Engineering and Management and Systems Engineering)

Associate Professor
M.A., Ph. D. (Western Reserve)

(Psychology and Management and Systems Engineering)

S.S. Sengupta, M.A., D.Phil., (Calcutta)  
Professor
(Economics and Management and Systems Engineering)

J.J. Munk, B. Eng., (McGill), L.L.B., (Osgoode Hall)  
Adjunct Assistant Professor

J.P.H. Castle, B. Comm., (McGill), C.A.  
Lecturer

B.A. Brown, B.A., (Toronto), M.A., (Toronto)  
Special Lecturer

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.

The Management and Systems Engineering Group views profit and non-profit enterprises as dynamic adaptive systems coupled to larger economic and social systems. In enterprises, convertible resources are employed in purposeful activity. The group is engaged in developing, applying and communicating knowledge concerning the identification and quantitative description of social, economic, and technological environment (usually known as “markets”, “government” and “technology”) as they interact with enterprises; and concerning the operation, description, adaptive re-design, and implementation of enterprise systems; so that corporate purposes can be maximised indefinitely.

This philosophy underlies the continued process of improving management tools and methods involving the group in a range of activities which draw from many academic disciplines and contribute to a variety of corporate tasks.

Research and professional work by Waterloo faculty in closely related fields provide an interdisciplinary environment for Management study: psychology, sociology, manufacturing science, design, transportation, resource and economic planning and management, control systems, computer technology, simulation and econometrics, statistics and optimisation theory, and others.

Both M.A.Sc. and Ph.D. programmes are available. Information on the Master’s programme is given below; and information on the Doctoral programme is available on request.

Requirements for the Master’s Degree

The Master’s degree will be awarded to students who successfully complete eight units of course work: at least four units from the Management and Systems Engineering curriculum, two units of mathematical subjects, and two units from any other Depart-
ment. At least six must be courses for which full graduate credit is given, and an average of 66% must be obtained in the courses submitted.

In addition to course work, the candidate for the M.A.Sc. degree must present a research report, or a project study at a professional level incorporating a substantial application of Management and Systems Engineering techniques to some appropriate real world problem. For students employed off-campus during their period of study, 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. Other students will choose such a problem with the help of faculty. The candidate has, of course, full access to the Library, computational and consultational facilities of the University and its faculty members, for the project.

Students may complete the course-study and project requirements under a variety of conditions of residence and employment: they may be employed on or off-campus, and may attend classes in non-consecutive terms. The programme runs year-round and students may enter in September, January or May. Students who are employed less than half-time and are in residence on the University campus, may carry a maximum course load of four units per term. Students who are employed more than half-time including students holding teaching fellowships, must reduce their course load unless their employment is on a research project related to their degree requirement.

The normal duration of a Master's programme is one calendar year for full-time, resident students; or up to three calendar years for students employed off-campus and taking one course per term.

Students must register each term until their degree requirements are completed. Students not taking courses register in MSE 792 (Project).

Admission

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)
(3) Candidates for resident status should have accumulated at least two year's work experience since high school graduation.

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, candidates for non-resident status must assure themselves of support from their employers, and the Management and Systems Engineering Committee will require some evidence that such support is forthcoming.

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Management and Systems Engineering Programme

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 to the Registrar as soon as they become available. It is preferred that at least one reference from an applicant’s employer be submitted. The Office of the Registrar will notify the candidate of the outcome as soon as it is known.

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. Students receiving financial assistance are required to undertake a programme of studies lasting at least three terms. Students are not eligible for University financial support who are employed off-campus.

Offers of financial assistance are made by the Department about six weeks before the beginning of each term to selected candidates whose applications are complete at those times. Each application is considered at least three terms in sequence and may be renewed.

Course Descriptions

Graduate Course Descriptions
All 600-level courses carry 1 unit of graduate credit and are completed in one term unless otherwise noted.

Notes:
(1) A unit of graduate credit entails an average of ten to twelve hours of work per week for fourteen weeks, including lecture time.
(2) The number of courses offered in a particular calendar year will not necessarily include all, nor only, those listed below.
(3) After the initial meeting at the beginning of each term, lectures are normally scheduled by the lecturer to suit the convenience of himself and his class. Most often, this leads to evening and Saturday times.

Basic Methodology (Senior Undergraduates and Graduates)

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.
Fall term only.

Winter term only.
602*. Mathematical Foundations of Management Science
(a) Vector Algebra to Linear Programming; Variational Methods to Dynamic Programming.
(b) Statistical Decision Theory; Stochastic Processes.

610*. Quantitative Simulations
(a) Introduction to Modelling.
(b) Socioeconomic Systems.

615*. Management Decision-Making Laboratory. Participation in analysis, planning, and decision-making under competitive and fast-time stress using functional and industrial simulations.

618* and 619* People, Machines and Organizations. Interpersonal and group behaviour in systems of people and machines; phenomena of perception, communication, learning, decision-making, morale, conflict resolution, and goal-seeking. Problems in perceiving and modelling behaviour; the human factor in organization design.

Function-oriented Courses

620.* Introduction to Marketing. Techniques in market research, product, and market analysis; modelling of consumer and industrial market behaviour; competitive strategy in marketing planning; distribution systems design; sales forecasting. Economics of information sampling and consumer surveys.

630.* Introduction to Production. Techniques of production planning and control; models of aggregate production and workforce, interaction of production and inventory control; scheduling algorithms.

632.* Operations Research in Processing Industries. Systems representation of single and multi-unit processing facilities, experiment design to measure system parameters; simulations including economic factors; sensitivity analysis, production planning and control; capital resource evaluation; process optimisation.

640.* and 642* Strategies of Research and Development. Review of factors influencing the effect of research and design on a business or national economy. Economic measurement; information flow; organization theory; psychology of discovery and innovation. Case histories of technological changes.

650.* Introduction to Information Processing. 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.

652.* Advanced Information Processing. The nature of a system; system elements and relationships; structuring a business system; management objectives, organizational concepts; the information system; organizing a data processing centre; task force se-
lection and training, hardware selection; satellite computer systems; tele-processing; data linkages and sub-systems; the total system concept.

660.* Introduction to Corporate Finance. Capital Sources; investment psychology, strategic and probabilistic considerations in financial planning.

662.* Advanced Corporate Finance.

665.* Introduction to Corporate Law. Legal concepts as expressed in laws pertaining to company organizations, contracts, securities, and patents. Court administration and procedure. Information retrieval and O.R. applications in legal and legislative procedures.

Advanced Methodology (Advanced Graduates)

680.* Advanced Stochastic models. Properties and characteristics of stochastic models, with emphasis on Markov and Poisson process, queuing theory models and applications.

682.* Network Methods. Advanced network methods, with maximal flow algorithms, as related to production control, plant location.

684.* Advanced Mathematical Programming. Review of non-linear, quadratic, and integer programming, also convex programming. Extension of linear programming with possibly non-linear objective functions and constraints; and integer solutions.

686.* Quantitative Economics and Econometrics. Local, regional and national economic planning for developing and industrial economies, using quantitative models.

Advanced Integrative Courses (Advanced Graduates)


692.* Public Sector Management. Operations and systems analysis in public administration: police, health services, education, monetary and fiscal control, defense, public works. Case studies in governmental and institutional decision-making.


791, 792. Project.

809. Thesis for the Ph.D.
Areas of Special and Continuing Interest

Technological Innovation and Creativity. Information flow, technological history and the satisfaction of demand and supply constraints; human, organisational, and physical factors under control of management; social, legal and economic environmental influences.

Operational Information Systems. Application of computerised information-processing methodology to mechanisation and control of mixed man/machine operations as in marketing, production, accounting, project management; diagnosis of faulty systems.

Simulations, Models, Optimal Decision-making. Development and refinement of mathematical models of systems, and subsystems; application of quantitative and probabilistic methods to decision-making, prediction, and control.

Enterprise and Competitive Strategies. Venture planning and analysis; patent management; financial planning and strategy in growth situations; capital growth optimization; game theory applications; decision-making under competitive stress; optimal resource allocation in public and private operational environment.

Social Science Applications in Management. Interaction between humans, and between humans and machines, in organisations; behavioural patterns and purposes; learning and motivation; perception and decision-making in competition and co-operation.
Faculty of Mathematics

Department of Applied Analysis and Computer Science

D. D. Cowan, B.A.Sc. (Toronto), Ph.D. (Waterloo) Associate Professor
Chairman of the Department

J. Aczel, Ph.D. (Budapest), Habil. D.Sc. (Hung. Ac. of Science) Professor

J.A. Brzoziowski, M.A.Sc. (Toronto), Ph.D. (Princeton) Professor

J.W. Graham, M.A. (Toronto) Professor and Director of Computing Centre

H. Haruki, Ph.D. (Osaka) Professor

M.A. McKiernan, M.A. (Loyola), Ph.D. (Illinois Institute of Technology) Professor

J.D. Lawson, B.A.Sc. (Toronto), Ph.D. (Waterloo) Associate Professor

P. C. Jennings, B.A. (Utah), Ph. D. (Texas) Assistant Professor

(Religion and Mathematics)

R. B. Roden, M.A. (Toronto), Ph. D. (Cambridge) Assistant Professor

(Computing Centre and Mathematics)

J.C. Wilson, B.A.Sc. (Toronto), Ph.D. (Waterloo) Assistant Professor

J.H. Vellinga, B.A. (Western), M.A. (Waterloo) Assistant Professor (Part-time)

P. Brillinger, B.Sc. (McMaster), M.A. (Waterloo) Lecturer

R.S. Cohen (Mrs.), M.Sc. (Technion-Haifa) Lecturer

P.H. Cress, B.Sc. (Toronto), M.Sc. (Waterloo) Lecturer

P.H. Dirkse, M.Sc. (Waterloo) Lecturer

B.O. Nash, B.Sc. (Illinois), M.A. (Waterloo) Lecturer

Č.R. Zarnke, M.A. (Waterloo) Lecturer

B.L. Ehle, B.A. (Whitman College), M.S. (Stanford) Lecturer (Part-time)

Lecture in Faculty of Mathematics

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Department of Applied Mathematics

P. J. Ponzo, M.A. (Toronto), Ph.D. (Illinois)  Associate Professor
Chairman of the Department

H.F. Davis, Ph.D. (Massachusetts Institute of Technology)
(On Sabbatical Leave 1967-1968)  Professor

C.F.A. Beaumont, B.A. (McMaster), M.A. (Toronto)  Associate Professor
and Associate Dean of the Faculty of Mathematics

J. Froese, B.A. (Manitoba), M.A. (Queen's), Ph.D. (British Columbia)  Assistant Professor

G.J. Lastman, M.A. (British Columbia), Ph.D. (Texas)  Assistant Professor

I.J. McGee, B.A.Sc. (Toronto), M.Sc. (Waterloo), Ph.D. (Yale)  Assistant Professor

M.E. Snyder (Mrs.), B.Sc. (Western), M.A.Sc. (Waterloo)  Assistant Professor

J. Wainwright, B.Sc. (Univ. of Natal), Ph.D. (Univ. of South Africa)  Assistant Professor

R.A. Wentzell, B.Sc. (Acadia), Ph.D. (Western)  Assistant Professor

V.M. Bobetic, M.A. (Univ. of Zagreb, Yugoslavia)  Lecturer

F. Burkowski, M.Sc. (Waterloo)  Lecturer

D.I. MacLeod, M.A. (Waterloo)  Lecturer

D.W. Trim, M.Sc. (Waterloo)  Lecturer

B. Wilkinson (Miss), M.Sc. (Waterloo)  Lecturer

Department of Combinatorics and Optimization

G. Berman, Ph.D. (Toronto)  Professor and Chairman of the Department

C. Nash-Williams, Ph.D. (Cambridge)  Professor

W.T. Tutte, Ph.D. (Cambridge) F.R.S.C.  Professor

R.C. Mullin, B.A. (Western), Ph.D. (Waterloo)  Associate Professor

R.A. Honsberger, B.A. (Toronto), M.A. (Waterloo)  Assistant Professor

R.A. Honsberger, B.A. (Toronto), M.A. (Waterloo)  Assistant Professor

U.S.R. Murty, M.A. (Osmania), Ph.D. (Indian Statistical Institute)  Assistant Professor

R.N. Burns, B.Sc. (Toronto), M.A. (Waterloo)  Lecturer

J.W. Dodd, B.A.Sc. (Toronto), M.Sc. (Waterloo)  Lecturer

R.G. Dunkley, B.A. (Western)  Lecturer (Part-time) and Assistant to the Dean

G.B. Faulkner, B.Sc. (Toronto), M.Sc. (Waterloo)  Lecturer

C.E. Haff, B.S. (Stanford)  Lecturer

W.I. Miller, B.A. (Queen's)  Lecturer (Part-time) and Assistant to the Dean

A. Morofke, M.Sc. (Waterloo)  Lecturer

G.N. Robertson, M.Sc. (Manitoba)  Lecturer

Department of Pure Mathematics

D.G. Wertheim, B.A. (McMaster), Ph.D. (Toronto)  Professor
Chairman of the Department

G.E. Cross, M.A. (Dalhousie), Ph.D. (British Columbia)  Professor
Dean of Graduate Studies

K.D. Fryer, B.A. (Western), Ph.D. (Toronto)  Professor
Associate Dean of the Faculty of Mathematics
Faculty of Mathematics

H.H. Crapo, A.B. (Michigan), Ph.D. (Massachusetts Institute of Technology)  
Associate Professor

A. Kerr-Lawson, B.A. (Toronto), S.M. (Chicago), Ph.D. (McMaster)  
(On Sabbatical Leave 1967-1968)  
Associate Professor

R.A. Staal, Ph.D. (Toronto)  
Associate Professor

F.C.Y. Tang, B.Sc. (Hong Kong), M.S. (South Carolina), Ph.D. (Illinois)  
Associate Professor

Associate Professor of Foundation of Mathematics

E.R. Bishop, B.Sc. (Acadia), M.Sc. (Queen's), Ph.D. (McMaster)  
Assistant Professor

L.J. Cummings, B.S. (Roosevelt Univ.), M.S. (DePaul Univ.), Ph.D.  
(British Columbia)  
Assistant Professor

D. Higgs, B.Sc. Hons. (Rand), M.A. (Cantab.)  
Assistant Professor

P. Hoffman, B.A. (Toronto), Ph.D. (Manchester)  
Assistant Professor

D.J. Miller, Ph.D. (McMaster)  
Assistant Professor

E.M. Moskal, B.A. (Toronto), Ph.D. (Illinois)  
Assistant Professor

K.A. Rowe, B.A. (Toronto), M.S. (Wisconsin), Ph.D. (Illinois)  
Assistant Professor

S. Aczel (Mrs.), M.A. (Szeged)  
Assistant Professor (Part-time)

M. Johnson, M. Math. (Waterloo)  
Lecturer

R. Kingsley, M. Math. (Waterloo)  
Lecturer

J. Malzan, M.A. (Toronto)  
Lecturer

B.S. Thomson, B.Sc. (Toronto), M.Sc. (Waterloo)  
Lecturer

J.K. Vranch, M.Sc. (Waterloo)  
Lecturer

R.C. Wilton, M. Math. (Waterloo)  
Lecturer

Department of Statistics

D.A. Sprott, Ph.D. (Toronto)  
Chairman of the Department and Dean of the Faculty of Mathematics  
Professor

Professor (Chemistry and Mathematics)

J.S. Minas, B.A. (Wayne), Ph.D. (Illinois)  
(Philosophy and Mathematics) and Dean of the Faculty of Arts  
Professor

G.W. Bennett, Ph.D. (Adelaide)  
Associate Professor

M.D. Vogel-Sprott, (McMaster), Ph.D. (Toronto)  
Associate Professor (Psychology and Mathematics)

J.G. Kalbfleisch, B.Sc. (Toronto), Ph.D. (Waterloo)  
Assistant Professor (Psychology and Mathematics)

R.V. Thysell, B.S. (Montana), Ph.D. (State University of Iowa)  
Assistant Professor (Psychology and Mathematics)

E. Haag, B.Sc. (Queen's) M.A. (Waterloo)  
Lecturer

J.S. Huang, B.A. (Taiwan Univ.), M.B.A. (Univ. of Georgia)  
Lecturer

J.D. Kalbfleisch, M. Math. (Waterloo)  
Lecturer

J.F. Lawless, M.Sc. (Waterloo)  
Lecturer

A.C. Madgett, B.Sc. (Toronto), M. Phil. (Waterloo)  
Lecturer

C. Springer, M.Sc. (McGill)  
Lecturer

V. Taht, M.A. (Toronto)  
Lecturer

M.R. Wise, B. Math. (Waterloo)  
Lecturer

D.B. Martin, B. Commerce (Manitoba), Associate of Society of Actuaries  
Adjunct Professor

Adjunct Professor

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Visiting Professors

G. Alexitis, Ph.D. (Graz. Austria)  Professor
W. Benz, Ph.D., Habil. (Mainz)  Professor
E. Berz, Ph.D. (University of Munich). Venia Legendi, (University of Giessen)  Professor
E.T. Davies, M.Sc. (Wales), Dottore in Matematica (Rome)  Professor
Ph. D., D.Sc. (London University)  Professor
I. Fenyo, Ph.D., Habil. (Budapest)  Professor
V.P. Godambe, M.Sc. (University of Bombay), Ph.D. (University of London)  Professor
L. Kalmar, Ph.D., D.Sc. (Budapest)  Professor
R.S. Mishra, Ph.D. (University of Delhi, India), D.Sc. (Lucknow University)  Professor
A. Ostrowski, Ph.D. (Göttingen), Dr. Math. h.c. ETH Zürich  Professor
G.P. Paul, Ph.D. (University of Michigan)  Professor
T. Pietrzykowski, M.A. (University of Warsaw), Ph.D. (Polish Academy of Science)  Professor
W. Eichhorn, Dipl. Math., Dipl. Volksw., Dr. rer. nat., D. Habil. (Wurzburg)  Associate Professor
P.K. Kamthan, M.Sc. (Lucknow), Ph.D. (Rajasthan)  Associate Professor
P.L. Kannappan, M.A. (Annamalai), Ph.D. (University of Washington)  Associate Professor
M.E. Watkins, Ph.D. (Yale)  Associate Professor
D. Younger, Ph.D. (Columbia)  Associate Professor
D.Z. Djokovic, Ph.D. (Belgrade) Research  Associate 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. 2 hours lectures, 3 hours laboratory.

Prerequisite: Math 12.
3 lectures, one term.

1 lecture, 2 hours problems, one term.

2 hours problems, one term.

Prerequisite: Math 22.
3 lectures, one term.

Prerequisite: Math 23.
2 lectures, 2 hours problems, one term.

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.

100. **Fundamental Concepts of Mathematics.** A mathematics course in the liberal arts tradition. A selection of mathematical topics in a context of history, philosophy and applications. The growth of the number system: rational, real, complex, hyper-complex and infinite numbers, vectors and matrices; paradoxes and applications. The limit concept, including an introduction to Calculus: Newton and the influence of Newtonian physics. Abstraction, symbolic logic and recent trends in mathematics education. Little is assumed in the way of previous knowledge, but the student should have some affinity for mathematics. The course is library-oriented rather than textbook-oriented and the student is encouraged to find and pursue some interest of his own, subject to approval.

3 lectures.


3 lectures.


2 lectures, one hour problems.

132. **Introduction to Computer Science.** A thorough introduction to algorithms, stored-programme computers and programming languages. Concept and properties of an algorithm, language and notation for describing algorithms. Analysis of computational problems and development of algorithms for their solution. A procedure-oriented language (FORTRAN IV) and machine and assembly languages are used to implement algorithms on the computer.

2 hours lectures, 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.

229. **Linear Algebra.** Vector spaces, matrices, groups of transformations.

3 hours lectures.
Faculty of Mathematics


2 lectures.


3 lectures.


2 lectures, 1 hour problems.

234. (a) **Mechanics 1.** Vector Analysis in orthogonal curvilinear co-ordinates, gradient, divergence, curl. Equations of oscillatory systems. Central forces. Rotation and translation of co-ordinate systems and accelerated reference frames.

2 hours lectures, Fall term.


2 hours lectures, Winter term.

235. (a) **Actuarial Mathematics. Mathematics of Investment:** The theory of rates of interest and discount, annuities and sinking funds; application to financial problems, including the determination of mortgage payments and the price and yield of bonds.

2 hours lectures, Fall term.

(b) **Basic Life Insurance Mathematics:** Applications of probability to problems of life and death. The determination of single and annual premiums for assurances and annuities. Reserves. Company expenses and their incorporation into premium and cash value calculations.

2 hours lectures, Winter term.


2 lectures.


3 lectures.
238. **Applications in Computer Science.** Some numerical methods are introduced in the first term and programmed for the computer using FORTRAN IV. Concepts of Numerical Errors. Methods in Interpolation, numerical integration, solution of nonlinear equations, linear systems of equations.

In the second term non-numeric computing is introduced including simulation, the concept of a list and elementary list processing techniques, sorting, symbol manipulation.

*2 hours lectures, 1 hour problems.*

243. **Statistics for the Sciences.** The topics of Mathematics 233 with particular emphasis on the analysis and interpretation of experimental data and the design of experiments in the Sciences. The more difficult mathematical techniques associated with these problems will be omitted and many examples from Physics, Chemistry, Biology and other natural Sciences will be considered.

*2 hours lectures, 1 hour laboratory.*

300. **Discovery and Invention in Mathematics.** The art and technique of problem solving from the point of view of discovery and invention (heuristic); induction, analogy, pattern generalization, analysis, similarity and plausible reasoning. Problems will be selected from various areas of mathematics including Geometry (Euclid to Hilbert), Algebraic Structure (Groups in Algebra and Geometry), Set Theory (point sets, Boolean Algebra) and Logic.

*2 hours lectures.*


*2 hours lectures.*

330. (a) **Projective Geometry**

(b) **Non-Euclidean Geometry.** Finite geometries, Distance geometry, convex sets.

*3 lectures.*


*3 lectures.*

333. **Differential Equations.** First order differential equations; existence theorems; singular solutions; solution by Laplace Transforms; numerical methods of solutions; solution in series; hypergeometric, Bessel and Legendre functions; introduction to partial differential equations and integral equations.

*2 hours lectures.*


*2 lectures, 2 hours laboratory.*

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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.** (a) An advanced course on problems with single lives. 
3 hours lectures, 1 term.
(b) An advanced course on problems with multiple lives; population and multiple decrement theory. 
3 lectures, 1 term.

*Prerequisite: Mathematics 233 or equivalent.* 
2 hours lectures.

340. **Computer Systems.** A discussion of the hardware and software required in a computer system. Overlapped channels, interrupt facilities, memory protection, buffers, input-output control systems, macro-programming, monitor systems. Relocation schemes, multi-programming, multi-processing, dynamic memory allocation, time-sharing. Special purpose computer systems and simulation of computer systems. Peripheral equipment. Introduction to the theory of sequential machines and the logical design of computers. 
2 lectures.

341. **Abstract Algebra.** Lattices; groups, Lagrange's Theorem, normal subgroups, homomorphisms, permutation groups; rings, ideals and integral domains; modules, tensor products; fields and extensions. 
3 hours lectures.

342. **Real Variable Theory.** Real number system; metric space setting for ideas of continuity, uniform continuity, compactness, convergence, open sets, closed sets, connected sets. Cantor ternary set. Stone-Weierstrass theorem, uniform convergence, equicontinuity. Ascoli’s theorem, fixed point theorems and applications, tangent spaces, differential forms, exterior differentiation, Stokes’ Theorem. Introduction to Lebesgue integration. 
2 hours lectures.

343. **Complex Variable Theory.** Complex numbers; continuity and differentiability, Cauchy-Riemann equations; solution of Laplace equation; bilinear transformations and conformal mapping; power series; integral theorems; Taylor and Laurent expansions; calculus of residues; series solution of differential equations; theory of Laplace transforms; solution of differential equations by integrals. 
2 hours lectures.

3 hours lectures, 1 term.
345. **Topics in Pure Mathematics for Combinatorial Mathematicians.** Elementary introduction to cardinal and ordinal numbers; convexity and its applications to optimization; introduction to the main concepts of projective geometry, metric and topological spaces.

351. **Introduction to Graph Theory and Combinatorical Analysis.** Graphs, paths, arcs, circuits, connected graphs, trees, spanning trees, digraphs, Euler paths, tournaments, complete paths in tournaments, factors of bipartite graphs, Menger’s Theorem and flows in networks, theory of enumeration, generating functions, Ramsey’s Theorem and applications, systems of distinct representatives, Latin squares, balances incomplete block designs and \((v, k, \lambda)\) configurations. Applications to practical problems and other areas of mathematics.

352. **Mathematical Operations Research.** Review of mathematical techniques frequently used in Operations Research; including Monte Carlo Methods, difference equations, Lagrange Multipliers, generating functions, Riemann-Stieltjes integration, Laplace transforms. Introduction to Linear programming, dynamic programming, activity scheduling, queueing and simulation. Applications to production planning, inventory problems, growth and survival models, scheduling problems, replacement policies and reliability optimization of complex systems.

2 hours lectures.


2 hours lectures. Fall term.

(b) **Differential Geometry.** The metric tensor, and elementary differential geometry of surfaces. Introduction to Riemannian geometry; Riemannian curvature, Gaussian curvature and Einstein curvature tensors. Spaces of affine connection and Finsler spaces with application to electromagnetic theory.

2 hours lectures. Winter term.

361. **(a) Calculus of Variations.** Euler-Lagrange Equations, Legendre and Jacobi condition, the E-function. Fields of extremals and sufficient conditions; Hберt’s invariant integral. Parameter invariant single and multiple integral problems; Hamilton-Jacobi theory. Introduction to optimal control problems; introduction to direct methods and partial differential equations.

2 hours lectures. Fall term.

(b) **Mechanics II.** Hamilton’s principle. Lagrangian and canonical Equations of motion. Relativistic mechanics.

2 hours lectures. Winter term.

2 hours lectures.

399. Reading in Mathematics.


2 hours lectures.


2 hours lectures.


2 hours lectures.


2 hours lectures.

425. Introduction to the Theory of Numbers.

2 lectures.

426. Topology. Continuation of general topology. Topological manifolds, a weak embedding theorem, classification of 1-manifolds. Triangulation, simplicial complexes, simplicial homology. Classification and homology groups of closed (triangulated) 2-manifolds. The fundamental group covering spaces, homotopy groups, the Hurewicz isomorphism theorem.

2 lectures.


2 hours lectures.
428. Lattice Theory. Ordered sets, lattices, Galois connections. Special attention is given to geometric lattices (matroid theory).
Prerequisite: Mathematics 230.
2 hours lectures.

Prerequisite: Mathematics 230.
2 lectures, 1 term.

2 lectures.

2 hours lectures.

433. Metric Spaces and Integration. Theory of metric spaces, completeness and compactness, measure in Euclidean n-space, the Lebesgue integral, convergence theorems, the Fubini theorem, differentiability, absolute continuity. A study of Banach spaces.
2 lectures.

2 lectures. 1 hour problems.

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 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.

2 hours lectures, 1 term.
(b) Methods of graduating mortality tables.
2 hours lectures, 1 term.

438. Estimation and Hypothesis Testing. The mathematics and logic of estimation and hypothesis testing. Consistency, efficiency and sufficiency of estimates. Fiducial and confidence intervals, likelihood, Bayes’ theorem, tests of significance.
2 hours lectures.
439. **Theory of Experimental Design.** The logic of experimental design with reference to randomization, experimental and sampling errors. Construction and analysis of various kinds of designs.
2 hours lectures.

440. **Probability.** Classical probability and introduction to stochastic processes with applications such as branching processes, epidemics, etc.
2 hours lectures.

2 lectures.

442. **Theory of Relativity.** Covariant and contravariant tensors. Riemannian space. Gaussian curvature. The Lorentz transformation and Einstein's special theory. Introduction to the general theory of relativity.
2 lectures, Winter term.

443. **Electromagnetism.** Applications of the Maxwell equations. Reflection and refraction. Introduction to wave guides and antennae.
2 lectures, Fall term.

2 lectures, Winter term.

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, Fall term.

2 lectures.

449. **Experimental Design.** Similar to Mathematics 439 but with more accent on the logic and methods than on the mathematics. Primarily for students in the Sciences.
2 hours lectures.


454. **Game Theory.** Classification of games. Zero-sum matrix games. Infinite zero-sum games. n-person co-operative and non-co-operative games. 2 hours lectures.

455. **Mathematical Programming.** An introduction to the methods and applications of integer programming, non-linear programming and dynamic programming. 2 hours lectures.

457. **Applied Combinatorial Mathematics.** May include any subset of the following topics: applications of combinatorial mathematics to optimization, selected topics from the Beckenbach book, structural models, graphs and electrical networks, graph theory and statistical mechanics, the Ising problem, percolation processes, the dimer problem, random walk, applications to chemistry, automata. 2 hours lectures.

458. **Topological Graph Theory.** Selected topics within the general area of graphs and maps in the plane and on other surfaces, the four colour problem, connectivity and separation in graphs, thickness and genus of graphs, etc. 2 hours lectures.

459. **Algebraic Graph Theory.** Graphs and matroids. Applications of algebraic techniques (e.g. matroids, matrices, chain groups) to graph theory or related combinatorial topics. Applications of graph theory to algebra. 2 hours lectures.

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460. Combinatorics. Enumerative mathematics. Combinatorial properties of various mathematical structures (e.g. graphs, geometries, etc.).
2 hours lectures.

2 hours lectures, 1 term.

(b) Actuarial Laboratory. A tutorial course for the advanced actuarial student.
2 hours problems, 1 term.

462. (a) Fourier Series and Orthogonal Functions. Linear spaces, orthogonal functions, Fourier series, Legendre and Bessel functions, harmonic analysis.
2 hours lectures, Fall term.

(b) Measure and Integration. The theory of measure and the Lebesgue integral.
2 hours lectures, Winter term.

2 lectures, Fall term.

2 hours lectures.

2 hours lectures, Fall term.

Prerequisite: Switching Circuits.
2 hours lectures, Winter term.

*Prerequisite: Switching Circuits.*

2 hours lectures, Winter term.

480. **Functional Equations.** Cauchy's, Pexider's and similar equations. Equations for polynomials and for trigonometric functions. Reduction to differential equations. General methods and theorems. Iteration. Applications. Further topics, as Equations for functions of several variables, or Equations for analytic functions, or Equations on algebraic structures.

2 hours lectures.

499. **Reading in Mathematics.**
Faculty of Mathematics

Graduate and Research Programmes

While the faculty offers graduate work over a broad spectrum of the various branches of Mathematics, fields of special interest include: Abstract Algebra, Combinatorial Analysis, Computer Science, Differential Equations, Differential Geometry, Foundations, Functional Analysis, Functional Equations, Graph Theory, Harmonic Analysis, Mathematical Logic, Number Theory, Numerical Analysis, Optimization, Probability, Statistical Inference, Switching and Automata Theory.

The University of Waterloo has at present four computer systems, namely an IBM System/360 Model 75, an IBM System/360 Model 44, an IBM 1710, an IBM 1620 and peripheral equipment which includes an IBM 2250 Graphic Display and a CALCOMP plotter.

The IBM 1620 computer is available to undergraduate students at all times. The IBM 1710 is used by undergraduates, graduates, faculty and staff. The System/360 Model 75 is run on a closed shop basis but all members of the University can get programmes processed within a reasonably short period of time. The System 360 Model 44 is used in process control applications and provides the University with a centralized process control facility.

Extensive financial assistance is available through National Research Council Scholarships and Bursaries and Province of Ontario Graduate Fellowships. In addition, the Faculty of Mathematics offers a number of Teaching Fellowships and some Research Assistantships. For details, correspondence should be addressed to the Graduate Office of the Faculty or Department Chairmen.

Candidates for the degrees of M. Math., M. Phil. and Ph.D. are accepted under the general regulations set forth in the section of the calendar pertaining to the Graduate Studies. Students proceeding to the M. Math. degree are encouraged to present theses. Those proceeding by course work must submit a substantial essay in connection with at least one of the courses.


Research in compiler construction has produced the WATFOR fast FORTRAN IV compiler currently being used by over one hundred System/360 Computing Centres throughout the world. Over seventy installations are using a similar compiler developed in 1965 for 7040-7044 Series machines (Communications of the ACM, January, 1967).

The problems investigated in the areas of formal languages, automata and switching theory include: context-free languages, regular languages and finite automata, structure theory of sequential machines, asynchronous sequential circuits, and design of arithmetic units for residue number systems.

A graphic display unit will permit research in new techniques in graphic programming, design procedures and analogue simulation. A process control computer is currently used to perform and analyze complex experiments, some of which would not be undertaken if only conventional methods were available.

In numerical analysis, algorithms for two-point boundary problems, stiff systems of differential equations, unilateral matrix equations and optimization problems are under investigation at the present time.
In applied Analysis, among others, functional equations are studied, i.e. the theory of determining functions from elementary equations containing them. It is a field of mathematics with a two century history although the somewhat more general theory has developed only in the last two decades. Functional equations have applications in many modern disciplines including information theory, mathematical psychology and universal algebra.

At the University of Waterloo the research being done in functional equations includes general methods of solution, uniqueness theorems and applications in differential geometry, homological algebra, functional analysis, theories of continuous groups, quasigroups and nets, complex functions, nomographs and the theory of distributions.

Applied Mathematics: Research in this department is being carried out in a number of areas directly or indirectly applicable to problems in the Physical Sciences. The range of interests of the members of the department reflects the diversity of problems of a mathematical nature which arise in the real world.


Pure Mathematics: Current research in this area includes studies in sheaf theory and categories, differential geometry, topology of differentiable manifolds, Homotopy theory, function algebras, theory of generalized decomposition of groups, theory of integration and measure, topological vector spaces, Banach algebras, logic and foundations of set theory.

Statistics: Research in the Department of Statistics centres on the controversial problem of formulating exact statistical inferences in many diverse situations using generalizations of the approach introduced by the late Sir Ronald Fisher in his foundation of the theory of fiducial inference, the theory of the likelihood function and the theory of estimation in general. The extensive computing facilities available at the University of Waterloo have given rise to investigations into the uses of computers to obtain exact results on the basis of these theories in situations previously treated by asymptotic methods, and also research into exact tests in multivariate analysis.

Closely related to this research, there is active interest in problems of experimental design, with particular reference to incomplete designs, multivariate analysis, estimation theory, mathematical genetics and stochastic processes.

Members of the department are also interested in problems in combinatorial mathematics, such as the construction of balanced incomplete block designs, which arise in the design of experiments. Other combinatorial questions under consideration include edge-chromatic graphs and the Ramsey numbers.

Increasing contact with the departments of Chemistry, Physics and Psychology provides a variety of new problems and also gives advanced students a valuable opportunity to apply lecture material to useful practical situations. An arrangement with the Statistics Unit of the Department of Agriculture in Ottawa provides potential summer employment for advanced undergraduates and at the same time, a further opportunity for practical experience.
Graduate Courses

700. Mathematical Logic.
702. Transfinite Arithmetic.
703. Axiomatic Set Theory.
705. Recursive Function Theory.
707. Algebraic Theory of Numbers.
715. Seminar in Logic and Foundations.
716. Seminar in Number Theory.
718. Topics in Logic and Foundations.
719. Topics in Number Theory.
720. Universal Algebra.
724. Groupoids and Quasigroups.
727. Infinite Groups.
728. Representation Theory.
731. Homological Algebra.
736. Seminar in Group Theory.
738. Topics on General Algebraic Systems.
739. Topics in Group Theory.
740. Rings and Ideals.
742. Linear Algebra.
745. Galois Theory.
749. Topics on Rings and Fields.
766. Differentiable Manifolds.
768. Topological and Lie Groups.
778. Special Topics in Geometry.
779. Topics on Topological Structures.
780. Combinatorial Analysis.
782. Combinatorial Graph Theory.
783. Analytic Graph Theory.
784. Linear Graphs.
785. Planar Graphs.
786. Extrema in Graphs.
787. Directed Graphs.
796. Seminar in Graph Theory.
797. Topics in Graph Theory.
798. Seminar in Combinatorial Analysis.
799. Topics in Combinatorial Analysis.
810. Harmonic Analysis.
811. Orthogonal Series.
815. Special Functions.
817. Abstract Measure Theory.
819. Functional Analysis.
820. Linear Operators.
828. Topics in Classical Analysis.
829. Topics in Functional Analysis.
830. Potential Theory.
832. Ordinary Differential Equations.
834. Introduction to Partial Differential Equations.
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848. Topics in Potential Theory.
849. Topics in Differential Equations.
850. Functional Equations for Functions of One Variable.
852. Functional Equations for Analytic Functions.
855. Integral Equations.
858. Seminar on Functional Equations.
859. Topics on Functional Equations.
860. Calculus of Variations.
862. Vector and Tensor Analysis.
864. Integral Transforms.
867. Theory of Approximation.
869. Introduction to Numerical Analysis.
873. Problems in Numerical Integration.
876. Seminar in Numerical Analysis.
878. Topics in Applied Analysis.
879. Topics in Numerical Analysis.

894. Finite Automata.

895. Design of Sequential Machines.

896. Algebraic Structure of Sequential Machines.

897. Automata and Languages.

899. Statistical Information Theory.

900. Measurement of Information.

905. Seminar in Computer Science.

908. Topics in Computer Science.

909. Topics in Information Theory.

910. Introduction to Random Variables.


912. Stochastic Processes.

918. Seminar in Probability Theory.

919. Topics in Probability Theory.

925. Mathematical Genetics.

927. Topics in Probability and Biometry.

929. Topics in Biometrical Statistics.


932. Advanced Statistics.


938. Seminar in Statistics.

939. Topics in Statistics.

950. Complex Variable Techniques in Physical Problems.

969. Topics in Applied Mathematics.

970. Mathematical Optimization.

971. Applications of Directed Graphs.

972. Mathematical Programming.


976. Seminar in Mathematical Operations Research.

978. Seminar in Optimization.

979. Topics in Optimization.

990. Data Processing for Behavioral Scientists.


995. Seminar in Mathematics Education.

996. Topics in Mathematical Education.

999. Topics in the History of Mathematics.

M690. Literature and Research Studies.


M697. M. Phil. Thesis.

Department of Mechanical Engineering

T.A. Bruzustowski, B.A.Sc. (Toronto), A.M., Ph.D. (Princeton)  Professor
Chairman of the Department

S.A. Alpay, Dipl. Ing., Dr. Ing. (Berlin)  Professor

G.T. Csanady, Dipl. Ing. (Munich), Ph.D. (New South Wales)  Professor

H.L. Evans, M.Sc. (Wales), D.I.C., Ph.D. (London)  Professor

M.J. Hillier, B.Sc. (Eng.), B.Sc. (Gen.) (London), D.I.C., M.S. (Eng.) (London)  Professor

E.L. Holmes, B.Sc. (Bristol) M.A.Sc., Ph.D. (Toronto)  Associate Dean of the Faculty of Engineering

G.F. Pearce, B.A.Sc. (British Columbia), M.A.Sc. (Toronto)  Professor
Associate Chairman of the Department

E. Brundrett, B.S.A. (Ontario Agricultural College, Guelph), B.A.Sc., M.A.Sc., Ph.D. (Toronto)  Associate Professor

D.J. Burns, B.S., Ph.D. (Bristol)  Associate Professor

D.C. Ferguson, B.A.Sc. (Aevo Eng. Toronto)  Associate Professor

C.E. Hermance, B.E. (Yale), M.A., M.S.E., Ph.D. (Princeton)  Associate Professor

J.H.G. Howard, B.Sc. (Queen’s), M.Sc., Ph.D. (Birmingham)  Associate Professor

W.B. Nicoll, S.M. (Massachusetts Inst. of Tech.)  Associate Professor

Engineer (Stanford) Ph.D. (London)

K.R. Pickarski, Dipl. Ing. (London)  Associate Professor

A. Pluntree, B.Sc., Ph.D. (Nottingham)  Associate Professor

R.F. Scrutton, B.Sc., M.Sc. (Melbourne)  Associate Professor

D.M.R. Taplin, A.C.T. (Hons.), B.Sc. (Aston) D. Phil. (Oxford)  Associate Professor

G.M. Bragg, B.A.Sc. (Toronto), Ph.D. (Cambridge)  Assistant Professor

R.N. Dubey, B.Sc. (Hons.) (Patna), B.Sc. (Eng.) (Bihar) Ph.D. (Waterloo)  Assistant Professor

A.M. Hale, B.Sc., M.A. (New Brunswick), B.A.Sc. (Toronto), M.A.Sc. (Waterloo)  Assistant Professor

H.W. Kerr, B.A.Sc., Ph.D. (Toronto)  Assistant Professor

T.A. Ledwell, B.Eng., M.Eng. (Nova Scotia)  Assistant Professor

P. Niessen, B.Sc. (McMaster), M.A.Sc., Ph.D. (Toronto)  Assistant Professor

T.M.L. Wigley, B.Sc., B.Sc. (Hons. Math &Phys.) Ph.D. (Adelaide)  Assistant Professor

C.J. Beinessner, B.Sc., M.A.Sc., Ph.D. (Toronto)  Assistant Professor (half-time)

K.G. Adams, B.Sc. (Queen’s), M.A.Sc. (Waterloo)  Lecturer

T. Kowalski, B.Sc. (Glasgow), M.S. (Stevens Institute)  Lecturer

W.K. Luk, D.I.C. (Imperial College, London), (Dipl. of Hong Kong Tech College)  Lecturer

R.J. Pick, B.A. Sc. (British Columbia), M.S. (Imperial College London)  Lecturer

J.A. Newman, B.A.Sc., M.A.Sc. (Waterloo), M.S.E. (Princeton)  Lecturer

V.K. Rao, B.E. (Mysore), A.I.I.Sc., M.S. (Cornell)  Lecturer

A.B. Strong, B.A.Sc. (Waterloo), M.Sc. (Imperial College, London)  Lecturer

A.B. Thornton-Trump, B.A.Sc. (British Columbia), M.A.Sc. (Waterloo)  Lecturer

Undergraduate Programmes

Details of the undergraduate programme in Mechanical Engineering are to be found on page 72. All courses extend over one term only, and consist of 3 hours of lectures.
Department of Mechanical Engineering

per week unless otherwise specified. The hours of the core courses are listed on page 75.
The only prerequisites are the core courses, unless otherwise specified.

Undergraduate Course Descriptions


   Prerequisite: ME 13.
   2 lectures, 3 hours laboratory.

   Prerequisite ME 21.
   2 lectures, 2 hours laboratory.

23. Mechanical Design II. Principles of optimum design of machine elements; minimum cost, minimum weight, maximum power, etc. Statistical considerations in factors of safety and tolerances. Effect of manufacturing errors on product performance.
   Prerequisite: ME 22.


26. Mechanical Design III—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.


295

2 lectures.


2 lectures.

33. Materials Science Laboratories This course is designed to acquaint students with the experimental methods techniques in Materials Science. For the initial part, the students will be required to perform assigned experiments which demonstrate common physical phenomena in Materials Science. For the remainder of the course, each student will be allowed to work on a small experimental project of his own choice which has been approved by the instructor.

3 hours laboratory


45. Manufacturing Science VI. Manufacturing for design engineers. Classification of processes. Influence of choice of materials on processes and of choice of processes on

49. **Metrology.** Theory and practice of high precision mechanic 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. Tolerances and quality control.


54. **Thermodynamics II.** Emphasis on applications of thermodynamics to flow processes, real fluids, evaluation of state functions of real fluids.

55. **Thermodynamics II.** Chemical equilibrium, multiconstituent fluid phases, additional topics in statistical thermodynamics, introduction to thermodynamics of irreversible processes. 
*Prerequisite: ME 54*

56. **Heat Transfer II.** Forced and free laminar and turbulent convection heat transfer in internal and external flows. Special topics selected from current applications.

57. **Combustion I.** Phenomenological description of flames of various types, flash back, blow off, inflammability limits, premixed flames, diffusion flames, burner design, flame holding, laminar flame theory, quasi-steady droplet burning theory (should be taken with ME 55).

58. **Internal Combustion Engines.** Reciprocating SI and CI engines, gas turbines, jets, rockets.
*Orerequisite: ME 54*

59. **Energy Conversion.** Steam power plants (conventional and nuclear), batteries, fuel cells, solar cells, thermionic conversion, thermoelectric conversion, MHD generators. 
*Prerequisite: ME 54*

60. **Control Systems.** Fundamental equations governing mechanical, electrical and fluid control system units. The analogy between systems parameters. Block diagram algebra, standard block-diagram representation. Steady state operation: correlation between engine and control element characteristics. Introduction to system transfer function, stability, and fluidics.

61. **Fluid Control Systems I.** Analysis of fluid properties and fluid flow as they apply to the design and application of components comprising the fluid control system. Proportional, integral, derivative and hybrid type fluid control systems and examples. Energy transducers in fluid control systems: performance characteristics of various types of pump and fluid motor units and actuators.


64. Industrial Aerodynamics. Flow in ducts, furnaces, heat exchangers, reactors, etc. Air movements in and around buildings, wind loads. Cyclones and electrostatic dust precipitators, chimneys and chimney plumes. Atmospheric dispersion of pollutants.


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 coordinated 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.
Graduate and Research Programmes

To be admitted to graduate studies in the Department of Mechanical Engineering, an applicant must have an excellent academic record from a recognized university, and must possess maturity and self-motivation. Furthermore, since close technical contact with a faculty member is an essential part of graduate education in engineering, no applicant can be admitted unless a faculty supervisor who specializes in the applicant's desired area of research offers him a place in his research group. It is therefore important that the applicant indicate clearly in his application the area of research in which he wishes to be engaged. Active fields of research in which students may at present be accepted are listed and described in the calendar, and the departmental 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 department expands.

A. Master's Degree.

The core of the Master's degree is a thesis whose content shall indicate a high level of scholarly research by the student into a topic related to his faculty supervisor's area of research. Pursuit of the thesis will involve the student in an experimental or theoretical research programme or possibly a combination of both. Wherever possible the faculty member will attempt to arrange financial assistance for the student from his research grants, with such awards being made by the beginning of April. It is therefore essential that applications be complete by March 1 at the latest.

Candidates registered for an M.A.Sc. degree 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 requirements for the award of a Master's degree are: a) that the candidate obtains a pass in all prescribed subjects, comprising at least four one-semester courses of which two or more must be graduate courses, with an average of 66% or better; b) that his thesis be accepted. In certain special cases the thesis requirement may be satisfied by four additional one-semester courses and a research project of limited scope, but which contains a formal report.

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, according to a programme of studies approved by his supervising committee. Approximately at the end of his first year of residence as a Ph.D. candidate a comprehensive oral examination is administered by his supervising committee.

The mechanics of thesis topics selection is very much as described above. Students continuing for a Ph.D., after obtaining the M.A.Sc. at Waterloo, may often continue to work in the same area of specialization.

In order to be admitted to graduate study as a Ph.D. candidate an applicant 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.

The supervising committee consists of the supervisor and four other members appointed on the advice of the supervisor. One of these is appointed from outside the university, another one from outside the department (often from Mathematics or Physics.)

**Comprehensive Examination**

The comprehensive examination should be conducted about one year, but in any case not later than 18 months, after the student has been admitted to the Ph.D. programme. In preparation for this examination the candidate will submit a written research proposal of between 2000 and 4000 words describing his problem and outlining his proposed method of attack. This proposal must be circulated to the members of the supervising committee not less than two weeks before the examination. The supervising committee, on the advice of the candidate's supervisor, should examine: (a) The adequacy of the course of study being undertaken, (b) The performance of the student during his first year both in the coursework and in his research studies, (c) The proposal for a research programme as presented by the student and (d) His competence in being able to complete the work to the satisfaction of the committee. The main decision to be reached is whether the candidate should proceed with the work, but advice about taking additional graduate courses or about changing the emphasis in his research work may also be given.

*Experiment on impact and vibrations in Engineering Mechanics laboratory*
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: Regulations governing the submission and examination of the Ph.D. thesis are found in the section on “Graduate Studies” in the first part of the Calendar.

Graduate Course Descriptions

All courses listed consist of three lectures per week for one term, unless otherwise specified. Courses numbered in the 600’s are given regularly. Courses numbered in the 700’s are given only by special arrangement.


636. Materials Science Seminars. The student will be responsible for the formal presentation of two seminars and will be obliged to attend all the seminars given in this course. One seminar will be given weekly.

638. Physical Examination of Materials. This course is designed as an introduction to the fundamentals of Metallography, special optical techniques, X-Ray Microscopy and Microanalysis.


655. Combustion II. Structure and physics of monatomic and polyatomic molecules, spectroscopy-visible and infra-red, gas chromatography, statistical calculation of thermodynamic properties of molecules, bond energies and heats of formation, elements of kinetic theory of gases, elementary chemical kinetics, ionization and relaxation effects in gases, radiation from flames, atmospheric structure.

656. Combustion III. The theoretical description of common combustion processes such as laminar and turbulent premixed and diffusion flames, modelling of combustion processes, theory of ignition of solids and liquids, combustion instability, combustion in jet engines liquid propellant rockets, solid propellant rockets.

662. Laminar Flow. Use of tensor notation, Navier-Stokes and continuity equations, some exact solutions. Two dimensional boundary layer theory, laminar flow along flat walls and in "equilibrium" layers (Falkner-Skan equation) some approximate methods for non-equilibrium layers. Equations of motion with buoyancy term, energy equation, Reynolds analogy. The origin of turbulence, Orr-Sommerfeld equation, Tollmien-Schlichting waves.


667. **Boundary Layer Theory.** Review of elementary boundary layer theory in laminar and turbulent flow. The development of turbulent boundary layers in arbitrary pressure gradients, application to internal and external flows. Boundary layers on axisymmetric bodies, three-dimensional or "skewed" boundary layers. Heat and mass transfer through boundary layers, effect of material properties on boundary layer behaviour.


720. **Evaluation of Mechanical Systems and Design.** The testing and evaluation of mechanical systems. Product characteristics, reliability and long-life design. Hazards and safety consideration. Shock and vibration, environmental testing. Value engineering.


737. **Phase Transformations.** Phase diagrams, homogeneous and heterogeneous, nucleation, diffusion, phase changes in metals and alloys. Diffusional growth processes, diffusional and shear transformations.

739. **Dislocation Theory.** Description of simple and extended dislocations. Stress, strain and energy associated with single dislocations. Forces on and between dislocations. Dislocation-dislocation interactions cross slip and multiplication. Interactions with point defects. Applications in grain boundary theory.

740. **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.


Active Research Projects

The major subject areas of current research in the Department of Mechanical Engineering are:

Materials Science
Manufacturing Science
Solid Body Mechanics & Mechanical Design
Natural Fluid Dynamics
Combustion
Turbulent Flow in Boundary Layers and Ducts
Turbomachinery
Fluid Control Systems

Descriptions of the active projects in each area and a listing of publications resulting from them may be found in the brochure "Research in Engineering" published by the Faculty of Engineering.

761. Internal Aerodynamics of Turbomachines. Fundamental relationships for internal fluid flow with reference to stationary and rotating co-ordinate systems; vorticity and circulation; compressible inviscid flow with swirl within axisymmetric passages; some effects of viscosity and turbulence.

Applications: One-, two- and three-dimensional analysis methods for compressible flow in turbomachines; flow in diffusers; secondary flows in stationary and rotating passages; some characteristics of three-dimensional turbulent boundary layers.


791. Engineering Project I

801. Oral examination of the thesis for the Ph.D.

803. Comprehensive Examination

804. Language requirement for the Ph.D.

808. Research Thesis for the M.A.Sc.

809. Research Thesis for the Ph.D.
School of Optometry

E.J. Fisher, B.A., M.A. (Toronto). Professor and Director of the School
C.W. Bobier, B.A. (Toronto), M.Sc. (Ohio), O.D. (College of Optometry) Associate Professor
W.S. Long, B.A. (Toronto), O.D. (College of Optometry) Associate Professor
W.M. Lyle, M.Sc. (Indiana), Ph.D. (Indiana), O.D. (College of Optometry). Associate Professor
M.E. Woodruff, M.Sc. (Indiana), Ph.D. (Indiana), O.D. (College of Optometry) Associate Professor

Irving Baker, O.D. (College of Optometry) Adjunct Professor
D.H. Lamont, B.A. (Toronto) Q.C. Adjunct Professor
M. Langer, M.Sc. (Indiana) Adjunct Professor
Marvin Lunsky, M.Sc. (Indiana), O.D. (College of Optometry) Adjunct Professor
R.D. Pellowe, O.D. (College of Optometry) Adjunct Professor
B.B. Sparks, M.D. (Toronto) Adjunct Professor
S. Albright
W.R. Andrews, O.D. (College of Optometry) Clinical Associate
W.S. Bearance, O.D. (College of Optometry) Clinical Associate
R.R. Bock, O.D. (College of Optometry) Clinical Associate
E.L. Buchner, O.D. (College of Optometry) Clinical Associate
D.R. Gilhooley, B.Sc. (Saskatchewan), O.D. (College of Optometry) Clinical Associate

L. Gold
Ronald R. Hansford, O.D. (College of Optometry) Clinical Associate
Lorne S. Joyce, O.D. (College of Optometry) Clinical Associate
D.R. Larkworthy
M.S. Munn
Harvey Naftolin, O.D. (College of Optometry) Clinical Associate
John D. Price, O.D. (College of Optometry) Clinical Associate
Howard C. Thompson, B.A. (Toronto), O.D. (College of Optometry) Clinical Associate

N.C. Turnour
Ronald B. Watson, O.D. (College of Optometry) Clinical Associate
Alan J. Baldock, O.D. (College of Optometry) Laboratory Assistant
Garry Grant, O.D. (College of Optometry) Laboratory Assistant
J. Pollock, O.D. (College of Optometry) Laboratory Technician
Hartley Thompson
James White Laboratory Technician

Course Descriptions

200.* History and Orientation. This course will include a brief history of visual science, a brief history of the development of the professions generally and optometry specifically. Also included will be lectures indicating the nature and scope of optometrical practice.
1 lecture, winter term.
201.* Physiological Optics. The eye as an optical instrument. The refracting mechanism; accommodation, pupil action and lid action; the passage of light in the eye; stray light in the eye; analysis of the retinal stimulus pattern.
3 lectures, 2 hours laboratory, fall term.

202.* Introduction to Clinical Optometry. Lectures on the clinical techniques for the examination of the optical properties of the eye. Included will be:—measurement of the visual acuity, theory and practice of retinoscopy, ophthalmoscopy, keratometry, subjective sight testing, measurement of amplitude of accommodation, and calculation of reading addition. A laboratory course in which these techniques will be demonstrated and practised will run concurrently.
3 lectures, 3 hours laboratory, winter term.

3 lectures, 2 hours laboratory.

300.* Binocular Relations of the Non Strabismic Patient. Clinical techniques for the examination of the binocular relations, with particular emphasis on study of the relationship between accommodation and convergence. Techniques of phorometry, prism vergence tests, relative accommodation tests, dynamic retinoscopy, and monocular and binocular cross cylinder tests.
3 lectures, 3 hours laboratory, winter term.

301. Physiological Optics. Description and analysis of eye movements; the innervation systems of the intracocular and extraocular muscles; visual pigments; photoreception; electrical phenomena of the retina, visual pathways and cortex; light sensitivity; the psychic correlates of retinal stimulation.
3 lectures, 3 hours laboratory.

302. Optometrical Optics. History and manufacture of glass, manufacture of ophthalmic lenses, design of ophthalmic lenses, classification and performance of ophthalmic lenses, problems and solutions in fitting ophthalmic lenses to the eyes. The laboratory course deals with processing all types of ophthalmic material.
3 lectures, 2 hours laboratory.

305. General Pathology. A study of disease processes as they are found in the various organ-systems of the body, including inflammation, degeneration, neoplasia, hypersensitivity, physical agents other than microorganisms causing disease, principal diseases affecting each organ system, special study of headaches. The properties of pathogenic microorganisms and the specific disease with which they are associated are studied. Resistance immunity, antigen antibody reaction, problems presented by the contagious diseases are also considered.
3 lectures, 1 hour laboratory.

306.* Advanced Geometrical Optics. An extension of geometrical optics given in Physics 236 dealing with the optics of surfaces, prisms, thin and thick lens systems including the eye, aberrations of such systems and their correction; optic and ophthalmic instruments.
3 lectures, 3 hours laboratory, fall term.

306
400. Clinical Optometry. The sequence of testing in the clinical examination will be outlined. Stress will be on case history, tests of integrity of the visual system, tests of the refractive properties, and tests of binocular relations and the integration of these tests into a satisfactory clinical sequence. Interpretation of the data and a study of the various methods of clinical analysis and modes of treatment will constitute a large part of the course; the detection of strabismus and the techniques for testing the sensory and motor characteristics of the strabismic patient; the aim will be to allow the student to evaluate the likelihood of achieving a cure by non-surgical means; techniques of orthoptics and visual training by which a rehabilitation of vision can be attempted will be described and demonstrated.

3 lectures, 3 hours laboratory.

401. Physiological Optics. Binocular Vision and Visual Perception. The binocular sensory system; binocular integration and interaction; effects of disparate stimulation; perception of size, shape, direction, distance, motion, time, complex patterns and colour. Recent developments in physiological optics.

3 lectures, 3 hours laboratory.

402. Optometrical Optics. The lecture course will deal with the problems involved in preparing ophthalmic materials. The laboratory course will give the student experience in working with lenses and frames as he prepares ophthalmic materials for clinic patients.

1 lecture, 2 hours laboratory.
404. **Physiology of the Visual Systems.** Vascular supply; physiology of the cornea and lids; formation, supply and drainage of the ocular fluids; intraocular pressure; metabolism of cornea, lens, vitreous and retina; effects of drugs producing miosis, mydriasis, cycloplegia, spasm of accommodation and anaesthesia of the ocular surfaces; neurophysiology of the retina, sensory and motor pathways and the brain centres of the visual system.
   2 lectures, 2 hours laboratory.

405. **Ocular Pathology.** A detailed study of the diseases which involve the eye and its related structures with emphasis on early recognition. Evidence of systemic disease as manifest in the eye. Symptomatology and differentiation.
   2 lectures, 1 hour laboratory.

407.* **Optometrical Specialties.** A series of lectures and labs on special techniques of clinical examination and of handling the visual problems encountered in optometric practice. These include: contact lenses, subnormal vision aids, aniseikonia, pediatric optometry, biomicroscopy and gonioscopy.
   3 lectures, 3 hours laboratory, winter term.

408. **Optometry Clinic.** The student is assigned to the Visual Analysis Clinic and, under the direct supervision of optometrists of the clinic staff, carries out routine clinical investigations of patients who attend the public clinic.
   4 hours clinic.

409. **Summer Clinic.** Each student is required to complete 60 hours of clinical practice during the summer term. Times will be arranged by the student with the approval of the clinic staff.

432.* **Light and Illumination.** Light sources; transmitting and reflecting surfaces; principles of radiometry and photometry; colour specification; colorimetry and classification of colour defectives; illumination and other factors involved in the design of the visual environment.
   2 lectures, 2 hours laboratory, fall term.

500. **Advanced Clinical Optometry.** The lecture portion of this course will deal with special techniques of clinical optometry for examination of refractive properties and binocular relations; techniques of binocular refraction, prism adaptation, etc.; seminars and the presentation of clinical case reports by the student for defense and criticism will constitute a part of the course.
   3 lectures.

501. **Physiological Optics.** Consideration will be given to the individual student's special interests. Assignments will include preparing for seminars on topics of interest, reviews, library and laboratory researches by individuals or small groups.
   3 hours laboratory.

502. **Optometrical Optics.** A continuation of the fourth year course in optometrical optics. 
   2 hours laboratory.
School of Optometry

504.* Genetics. A brief review of Mendelian genetics, and the molecular basis of modern genetics. Inherited conditions of particular interest, e.g., color vision, albinism, aniridia, refractive error, retinoblastoma, etc. Genetic counselling, and the detection of carriers.
2 lectures, winter term.

506. Optometrical Jurisprudence and Praxis. Lectures on laws governing the practice of optometry in Canada and on laws relating to the rights and responsibilities of the optometrist in his relations with his patients; the establishment and management of optometric practice; economics, taxes, insurance, accounting, office design, mode of practice, professional organization and societies.
2 lectures.

507. Public Health Optometry. The role of optometry in providing vision care to society and the community. Optometric services to industry, in schools, the role of vision in the safe operation of highway vehicles and airplanes, as well as the role of optometry in private and government programs of vision care and health insurance.
2 lectures, 2 hours laboratory.

508. Optometry Clinic. This program is divided into a number of clinics in order to facilitate clinical instruction, to make the most effective use of time and clinic space, and to maintain a high quality of service to clinic patients. Each patient who attends the clinic is first seen in the visual analysis clinic. Patients will be referred to the other clinics as features of their cases dictate.
22 hours clinic.

509.* Pharmacology. Neurohumoral theory, responses to drugs, isotonicity, pH, stability; sterile techniques; preservatives; disinfectants; drugs used topically in the eye, as diagnostic aids, their uses, contra-indications, shelf life, sterility; drugs used in connection with contact lens practice; drugs used topically for therapeutic effect; drugs used systematically which have side effects on eyes and vision.
2 lectures, one term.
Department of Philosophy

L.L. Haworth, B.A. (Rollins), M.A., Ph.D. (Illinois) Professor
Chairman of the Department


R.J. Butler, B.A., M.A. (New Zealand) Professor

C.A. Hergott, M.A. (St. Louis), S.T.D. (Gregorian) Professor

J.S. Minas, B.A. (Wayne), Ph.D. (Illinois) Professor and Dean of the Faculty of Arts

P. Seligman, B.A., Ph.D. (London) Professor

L. Armour, B.A. (British Columbia), Ph.D. (London) Associate Professor

R.A. George, M.A., Ph.D. (Michigan State) Assistant Professor

J.F. Narveson, B.A. (Chicago), M.A., Ph.D. (Harvard) Associate Professor

D.D. Roberts, B.A. (Roosevelt), M.A., Ph.D. (Illinois) 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

E.B. Gamble (Miss) O.A. (Victoria), M.A. (Columbia), B.R.E. (Emanuel) Assistant Professor P

B.P. Hendley, B.A. (Marquette), M.A., Ph.D. (Yale) Assistant Professor

J.R. Horne, B.A., M.A. (Western Ontario), B.Th. (Huron), Ph.D. (Columbia) Assistant Professor

D.M. Lochhead, B.Sc., B.D., S.T.M., Ph.D. (McGill) Assistant Professor P

A.C. Narveson (Mrs.), B.A. (Radcliffe), M.A., Ph.D. (Harvard) Assistant Professor

J.W. Van Evra, B.A. (Valparaiso), M.A., Ph.D. (Michigan State) Assistant Professor

J. Wubnig (Miss), B.A. (Swarthmore), M.A., Ph.D. (Yale) Assistant Professor

G.T. Campbell, B.A. (Western Ontario), Ph.L. (Laval) Lecturer J

D.F. Irvine, B.A. (Western Ontario), B.Th. (Huron) M.A. (Waterloo) Lecturer R

E. Michael (Mrs.), B.A. (Sir George Williams) Lecturer

R.P. Sullivan, M.A. (Toronto) Lecturer

General 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 or 101 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. 40-44).

(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. Half courses (courses which meet for one term only) are designated by an asterisk (*) after the course number.

(5) Courses suffixed with 'J' are administered by St. Jerome's College; those suffixed with a 'P' are administered by St. Paul'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, 465 and one of 380*-389* or 480*-489*.

Undergraduate Courses

Note Concerning Introductory Courses: Normally all first year courses provide opportunity for weekly discussions in small groups.

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.

101. Introduction to Philosophy. As 100, but the course will be taught by a variety of instructors and a six-week detailed treatment of one philosophical problem will take place at the end of the second term. For this purpose the class will divide into a number of small sections, each in the charge of one of the original instructors. Each instructor will explore in depth a selected problem and students will be given some choice of sections. No prerequisite. 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.

No prerequisite.
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.

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 280/1, or consent of instructor.
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.

311.* Philosophy of Education. A philosophical analysis of the aims and methods of education. Selected readings from classical and contemporary sources.
Prerequisite: One full or two half Philosophy courses.
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 critical examination of the methods and substantive arguments found in selected major works of religious philosophy. The writings chosen for consideration will be announced in advance each year.
   *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.

341. *Decision and Value Theory.* A systematic study of the basic concepts in decision-making theories and their associated value theories. Special emphasis will be devoted to the definition and measurement of utility functions and to the various criteria employed in models of decision-making under uncertainty and under risk. Extensive use will be made of literature from Economics, Political Science, Psychology, and Mathematical Statistics.
   *Prerequisite: Consent of Instructor.*
   3 hours.

346. *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.

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.* A discussion of structural and substantive aspects of science in general, and of various specialized areas within science. General topics dealt with include the logical structure of scientific laws, theories and explanation. Specialized areas such as the philosophy of social sciences, and the philosophy of logic and mathematics will also be considered.
   *Prerequisite: One full of two half Philosophy courses, or consent of instructor.*
   3 hours.

362. *Philosophy of Social Science.* Problems about the fundamental methods and aims of the social sciences generally, and problems specific to psychology, sociology, political science, etc., and their relations to one another will be considered.
   *Prerequisites: Some previous work in a social science or in Philosophy.*
   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.

398 (a-b)* Directed Reading in Special Areas.

399. Tutorial for Honours students. Students wishing to enrol in 399 should consult the Department.

425.* Philosophy of the City. Analysis and evaluation of the philosophical points of view that underlie current criticism of urban life and prevalent schemes for its reconstruction.
Prerequisite: One half Philosophy course.
3 hours.

435*-436.* Studies in Philosophy of Religion. A study of a particular philosopher or problem. The topic will be announced in advance each year.
Prerequisite: Consent of instructor.
3 hours.
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.

455. Metaphysics. Theories of reality, historical and contemporary, with emphasis on metaphysical problems in the light of recent studies. 
Prerequisite: Two full courses (or equivalent) in Philosophy.  
3 hours.

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.

498 (a-b).* Directed Reading in Special Areas.

499. Tutorial and Honours Essay. Students wishing to enrol in 499 should consult the Department.

The following courses are administered by St. Jerome’s College

101J. Philosophy of Man. The nature of the psyche; organic life, sensory life and its philosophy; intellectual life and its philosophy; the nature of modern scientific psychology. 
3 hours. (at Resurrection College only) 

105J. Philosophy of Nature. A general introduction to the science of nature. A study of the principles of natural mobile being which is the subject of natural science, and a study of place and time which are measures extrinsic to mobile being, place and time. 
3 hours.

120J. Ethics. A study of the principles of ethics, of the norms of human behavior insofar as these pertain to the conduct of the individual. A subsequent study of some moral problems. 
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. (at Resurrection College only)
Department of Philosophy

205J. Philosophy of Science. A study of the nature and the meaning of the method of experimental science. An attempt to come to grips with its method, through a study of the works (philosophical) of past and present scientists. A comparison of this method with that of the philosophy of nature. A look at the great scientific revolutions and their effect on the method of experimental science.
Prerequisite: Philosophy 105J.
3 hours. (Not offered in 1968-69)

238J. History of Ancient and Medieval Philosophy. From the Presocratics to the decline of Scholasticism.
3 hours.

241J. Logic. The science and art of correct reasoning. A study of the principles of traditional logic and the three operations of the mind: simple comprehension, composition and division, and reasoning.
3 hours. (Not offered in 1968-69).

300J. Metaphysics. What is metaphysics? What is its subject? How does it proceed? The science which the ancients called "wisdom". A study of the principles of beings.
Prerequisite: Philosophy 105J.
3 hours.

301J. Philosophical Psychology. A study of the soul, the principle of life. What is life? Relation of body and soul and a study of the different powers of the soul.
Prerequisite: Philosophy 105J.
3 hours.

480J. History of Modern Philosophy. A study of the teachings and problems of the modern philosophers (from Descartes to existentialism).
3 hours. (Not offered in 1968-69).

The following courses are administered by St. Paul's College.

210*P Philosophies of Education. A study of theories, both religious and secular, of the nature and purpose of education. The thought of writers from antiquity to the present day will be considered.
3 hours.

336P Philosophical Sources of Contemporary Theology. The writings of selected contemporary theologians will be studied and their sources in the 19th century thought examined. Certain problems such as secularization and the 'death of God' will receive special attention.
3 hours.
Graduate Courses

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, Collingwood, Heidegger, McTaggart, Peirce, Price, Russell, Ryle, Sartre, Wittgenstein.

621*-622.* Seminar in Ethics.

625*-626.* Seminar in Political Philosophy.

630*-631.* Seminar in Aesthetics.

635*-636.* 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*-642.* Seminar in Logic.

650*-651.* Seminar in Epistemology.

655*-656.* Seminar in Metaphysics.

660*-662.* Seminar in Philosophy of the Sciences.

670*-679.* Specially Directed Studies.

680*-689.* Seminar in the History of Philosophy.

696.* (a) - (c). Directed Research for M.A. Candidates. Non-thesis M.A. students must take at least two of these three half-courses, which involve the writing of research papers, as part of their requirement for the degree.

698. (a)-(n). Qualification Area Tutorials for Ph.D. Candidates. Ph.D. candidates who have completed their regular course requirements select, with Departmental approval, four of these courses from the Department's list of areas. Satisfactory completion of the four fulfills the Comprehensive Examination requirement in Philosophy.

699. Thesis
a. Aesthetics
b. Epistemology
c. Ethics
d. Existential Philosophy and/or Phenomenology
e. History of Philosophy
f. Logic
g. Metaphysics
h. Philosophy of Religion
i. Philosophy of Science
j. Social and Political Philosophy
k. Studies in a Philosopher
l. Studies in a Philosophical Movement
m. Special Topics #1
n. Special Topics #2
Course Descriptions

100*. Introduction to Physical Education and Recreation. A study of the history of physical education and recreation and the role that biological, sociological and psychological principles play in these areas. Reference will also be made to different schools of philosophy and the effect they have on physical education and recreation.
3 lectures.

101*. Institutional Physical Education. This course is designed to acquaint the student with methods and practices in situations outside the normal setting. Discussion will centre around physical education for institutionalized persons such as those in penal institutions, mentally retarded centres, industrial shops, etc.
3 lectures.

110*. Administration of Physical Education and Recreation. A study of the policies and procedures involved in administering the school intramural and interscholastic programmes, and the recreational programmes of various social agencies with emphasis on such areas as staff, legal responsibilities, budgets, tournaments, awards and public relations.
3 lectures.

200*. Human Anatomy. A study of human anatomical systems, and their integration. Particular emphasis is placed on the skeletal, articular and muscular systems.
3 lectures, 2 hours lab.

3 lectures, 2 hours lab.
220*. Comparative Programmes in Physical Education and Recreation. A study of present physical education and recreation programmes of major countries of the world. Also included will be the basic principles involved in developing physical education and recreation programmes.
3 lectures.

230*. Administration of Facilities. A study of the problems involved in the planning and maintenance of the various athletic plants used by schools and recreational agencies and the selection and care of the equipment and supplies used within these facilities.
3 lectures.

240*. Basic Movement Education. A study of the basic movements of the human and their relationship to sports and dance. To include basic locomotor movements, factors related to movement and creativity in movement.
2 lectures, 2 hour lab.

250*. 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.
2 lectures, 1 hour lab.

300*. Anatomy and Physiology (Part I). An intensive study of the anatomy and physiology of the nervous system integrated with the physiology of muscle. Also includes a study of endocrine system.
3 lectures, 2 hours lab.

310*. Anatomy and Physiology (Part II). A study of the circulatory, respiratory, urinary, digestive and reproductive systems with an emphasis on those aspects related to physical activity.
3 lectures, 2 hours lab.

320*. Adapted Physical Education. The study of individual problems and their implications for the physical educator. Body mechanic problems, orthopaedic disabilities, neurological disabilities, psychologic disorders, heart disturbances and nutritional problems will be discussed in depth.
2 lectures, 2 hour lab.

2 lectures, 1 hour lab.

350*. Research Methods and Materials. An introduction to the methods and techniques basic to research in health, physical education and recreation. The student to be familiarized with various materials and equipment used in this research.
Prerequisite: P.E. 330.
3 lectures.
360*. Health Foundations (Part I). An introductory study of content material in the field of health education. Such areas as philosophy, health curriculums, community health services, elementary and secondary school health services and immunization are studied in detail.
3 lectures.

385. Basic Skills. Instruction and practice of the basic fundamentals including the mechanical analysis of the following skills: aquatics, gymnastics, track and field, physical conditioning, low organizational games, square and folk dancing, basketball, soccer, judo, football (M), hockey (M), badminton, field hockey, volleyball, dance (W), lacrosse (M), wrestling (M), and skiing.
Also included are the instruction and practice of the basic fundamentals of the following skills: archery, curling, fencing, golf, handball, paddleball, rugger, squash, tennis, skating and water polo.
4 hours, terms 1 to 5.
5 hours, terms 5 to 7.

Skill Week. (Part of the P.E. 385 course). Students will be given complete courses in canoeing, sailing, orienteering, and camping. Lectures in camp and waterfront administration will also be included.
50 hours. held before term two.

401*. Physiology of Exercise (Part I). A study of the effects of physical activity on the muscular, circulatory and respiratory systems and the mechanisms through which the body adapts to activity and environment.
Prerequisites: Biology 131, Introductory Chemistry, Biochemistry 37, P.E. 300 and P.E. 310.
3 lectures. 1 hour lab.

402*. Physiology of Exercise (Part II). A study of the metabolic and environmental aspects of exercise, fatigue, training, and physical fitness. Work capacity in relation to age and sex will be examined.
Prerequisite: P.E. 401.
3 lectures. 1 hour lab.

406*. Physical Growth and Development. The changing capacities and interests of man as he grows and develops are studied. The contribution of physical activity to growth and physical, psychological and sociological development is examined.
3 lectures.

430*. Health Foundations (Part II). An intensive study of present trends and concepts in such areas of health as drug addiction, tobacco and smoking, alcohol, mental health, family life education, and cancer. Also studied in depth are various health programmes currently in operation and a unit breakdown of resource materials.
Prerequisite: P.E. 360.
3 lectures, one term.

461*. Research Project. Each student will work under the direction of a member of the department on an approved research topic in health education, physical education
or recreation. The results of the investigation will be presented in thesis form.
*1 hour lecture, 1 hour lab. -two terms.*

412*. Coaching Foundations. A study of the basic principles and philosophies of coaching today. An examination of the qualifications and responsibilities of the coach, resource materials and problems pertinent to coaching.
3 lectures.

435*. Seminar in Health. A study of current issues pertaining to health and health education. Topics include pertinent research in the field of health which have significant value to the individual, family and community, as well as a complete study of the problem areas in health education.
3 lectures.

470*. Seminar in Physical Education and Recreation. An analysis of the current major issues found in the field of physical education and recreation. Included will be discussions of current trends in physical education and recreation.
3 hours.

485. Advanced Skills. Students will be required to study three skill activities in detail, including advanced techniques, mechanical analysis and coaching principles. Admission to courses will require above average ability in the basic course. Courses offered will include aquatics, track and field, gymnastics, basketball, football (M), hockey (M), wrestling (M), field hockey (W), dance (W).
5 hours, eighth term.
Department of Physics

J.W. Leach, B.Sc. Ph.D. (Queen Mary College), F. Inst. P. Professor
Chairman of the Department

R.A. Aziz, B.A., M.A., Ph.D. (Toronto) Professor
F.W. Boswell, B.A., M.A., Ph.D. (Toronto) Professor
Associate Dean of the Faculty of Science

D.E. Brodie, B.Sc., M.Sc., Ph.D. (McMaster) Professor
J.A. Cowan, B.Sc. (Manitoba), M.A., Ph.D. (Toronto) Professor
I.R. Dagg, B.Sc. (Manitoba), M.S. (Penn. State), Ph.D. (Toronto) Professor
D.J. Henderson, B.A. (U.B.C.), Ph.D. (Utah), F. Inst. P. Professor
H.E. Petch, B.Sc. (McMaster), M.Sc., Ph.D. (U.B.C.) Professor

Vice-President, Academic

G.E. Reesor, B.A., M.A. (McMaster), Ph.D. (Toronto) Professor
R.A. Snyder, B.Sc., Ph.D. (Western) Professor
S.F. Wang, B.E. (Port Arthur, China), D.Sc. (Nagoya) Professor
A. Anderson, M.A., D.Phil. (Oxford) Associate Professor
G.A. Bakos, B.A. (Trnava), M.A. (Bratislava), M.A., Ph.D. (Toronto) Associate Professor

S.H. Chen, B.Sc. (Taiwan), M.S. (Michigan), Ph.D. (McMaster) Associate Professor
S.G. Davison, B.Sc., M.Sc., Ph.D. (Manchester) 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.A.V. Fairbrother, B.Sc. (London), Ph.D. (Reading) Associate Professor
J. Grindlay, B.Sc. (Glasgow), Ph.D. (Oxon) Associate Professor
N.R. Isenor, B.Sc. (Acadia), M.Sc., Ph.D. (McMaster) Associate Professor
J.D. Leslie, B.A.Sc. (Toronto), M.S., Ph.D. (Illinois) Associate Professor
C.C. Lim, B.A. (DePauw), M.A. (Nebraska), Ph.D. (Toronto) Associate Professor
R.A. Moore, M.Sc. (McMaster), Ph.D. (Alberta) Associate Professor
J.L. Ord, B.A.Sc. (Toronto), M.S., Ph.D. (Illinois) Associate Professor
B.H. Torrie, B.A.Sc. (Toronto), Ph.D. (McMaster) Associate Professor
J.M. Corbett, B.A.Sc. (Toronto), M.Sc., Ph.D. (Waterloo) Assistant Professor
A.E. Dixon, B.Sc. (Mt. Allison), M.Sc. (Dalhousie), Ph.D. (McMaster) Assistant Professor

M.P. FitzGerald, B.Sc., M.Sc. (Toronto) Assistant Professor
D. Hemming, B.Sc., Ph.D. (Bristol) Assistant Professor
J. Kruuv, B.A.Sc., M.Sc. (Waterloo), Ph.D. (Western) Assistant Professor
H.M. Morrison, B.Sc., Ph.D. (Bristol) Assistant Professor
A.D. Singh, B.A., B.Sc., M.Sc. (Panjah), Ph.D. (Delhi) Assistant Professor
H.J.T. Smith, B.S., Ph.D. (London) Assistant Professor
K.A. Woolner, B.Sc. (London) Assistant Professor
M. Young, B.S., Ph.D. (Rochester) Lecturer
N. McKenna, B.Sc. (Wales) Instructor
D. McVicar, B.Sc. (Waterloo) Instructor
L. Young, B.Sc. (Waterloo) Instructor
Undergraduate Course Descriptions

Details of the undergraduate programmes offered by the Faculty of Science are to be found on page 108.

All full-year courses taken by students in the co-operative programme are divided into two terms designated A and B. Each term is considered to be a separate half course.

11. Mechanics and Wave Motion. 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. 3 lectures. 3 hours laboratory.

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.


3 lectures per week for first term only.

No prerequisites.

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 on alternate weeks for students not taking Physics 233.)

233. Laboratory. Selected experiments in electricity and magnetism, optics, electronics, structure of solids and astronomy.

6 hours laboratory.


3 lectures, second term.

235. Optics. Reflection and refraction 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 alternate weeks.

236*. Optics. Reflection and refraction 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.

3 lectures, first term. (3 hours laboratory alternate weeks for students not taking Physics 233).

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.


2 lectures, 3 hours laboratory and 2 hours problems on alternate weeks.


3 lectures, 3 hours laboratory alternate weeks, one term.

326
245*. Structure of Solids I. 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, second term. (3 hours laboratory alternate weeks for students not taking Physics 233).

316*. Cellular Biophysics. Application of the analytical methods of the physical sciences to biology. Emphasis will be placed on describing the nature, function and control of the physical systems which are found in living cells.
Prerequisites: Physics 232 and Mathematics 236 or equivalent.
3 lectures per week, first term.

317*. Biophysics of Organ Systems. Special senses, biological transducers, information handling in the central nervous system, theories of muscle contraction; physics of homeostasis, interactions with the environment, circulation of blood, temperature regulation, respiration, and transport problems.
Prerequisites: Physics 232 and Mathematics 236 or equivalent.
3 lectures per week, second term.

3 lectures.

332. Electronics. An integrated survey of tube and transistor circuitry. Basic A.C. circuit theory, power supplies, amplifiers, equivalent circuits, oscillators, feedback, and a variety of special purpose circuits. Emphasis on the point of view of the user rather than the designer.
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.

2 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; eigen-functions.
2 lectures.

337. Astronomy II. Selected topics in astrophysics, cosmogony, and radio-astronomy.
2 lectures.

338. Geophysics I. (Same as Earth Sciences 338). Selected introductory topics on the
physics of the Earth. Seismology and the Earth's interior. Thermal history of the
Meteorology. Oceanography.
2 lectures.

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, mole-
cular and solid state physics.
3 lectures.

341*. Electronics. A one-term course designed for students in the co-operative pro-
gramme. The topics listed under Physics 332 will be discussed in slightly less detail.
3 lectures and 3 laboratory hours per week for one term.

416*. Molecular Biophysics. Shapes, sizes and internal structure of macromolecules as
revealed by physical methods; functions of large molecules in protoplasm, viscosity,
transport, energetics, information coding on DNA and RNA molecules.
Prerequisites: Physics 232 and Mathematics 236 or equivalent.
3 lectures per week, one term.

417*. Radiation Biophysics. The effect of radiation of various kinds of cells and tis-
sues; exposure calculations, mechanism of damage, repair theories, genetic effects,
target theory; isotopic tracers in biophysical research.
Prerequisites: Physics 232 and Mathematics 236 or equivalent.
3 lectures per week, one term.

431. Classical Mechanics II. Review of Lagrangian formulation of mechanics. rotate-
tion of a rigid body; the inertia tensor; Hamilton's principle; Hamilton's equations.
Classical theory of small vibrations. Dynamics of deformable matter; elasticity; hy-
drodynamics.
2 lectures.

electrons in semiconductors, transport properties, minority carrier injection, theory of
p-n junctions, transistors, tunnel diodes, field effect devices. Applications.
3 lectures, second term.

433*. Advanced Laboratory. Selected experiments in atomic and nuclear physics, solid
state physics, thermodynamics. Electrical and electronic measurements, vacuum
techniques.
6 hours laboratory, first term.

328
2 lectures.

3 lectures, 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.

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.

3 lectures, first term.

443*. Hydrodynamics. Stress tensor, kinematics of strain, Navier-Stokes equations, hydrostatics, streamline flow, vorticity, waves, viscous flow.  
3 lectures, second term.

3 lectures, second term.

445*. Modern Optics. Coherence, interference and optical resonators; quantum optics, amplification and lasers.  
3 lectures per week, second term only.
447. Astronomy III. Spherical astronomy and celestial mechanics. 
   2 lectures.

   6 hours laboratory, second term.

Graduate Studies and Research Programmes

See page 140 for general information.

There are at present several major areas of study in the Department in which graduate students may specialize. These include:

Astrophysics: Stellar evolution in galactic clusters, radial velocities and spectral analysis, galactic structure.

Biophysics: Radiation biophysics of synchronized cell cultures. Thermodynamics of intra-cellular movement.


Low Temperature Physics: Experimental studies of condensed inert gases, liquid helium, superconductivity, energy gap and Fermi surface determinations.

Microwave Research: Dielectric constant measurements. Field induced absorptions, microwave spectrometry.

Magnetic Resonance and Neutron Diffraction: Physical properties of solids, particularly ferroelectrics, are studied by these methods.

Spectroscopy: Raman and Brillouin scattering, far infra-red absorption.

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.

Theoretical Physics: Theory of liquids, the elastic dielectric, electronic states in crystals and molecules, colour centers, phonon dispersion curves, polymers, superconductivity, liquid helium.

Graduate Course Descriptions

All graduate courses are three lectures per week for one term. Those indicated (†) are available every year, others are given when required.

330


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.

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. 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.

627. Atomic Spectra. The fine and hyperfine structure of one-electron and many-electron atoms, the Zeeman and Stark effects.

628. Molecular Spectra. Vibrational and rotational spectra of simple molecules; symmetry considerations and selection rules; spectra of condensed phases; brief survey of instruments and techniques of microwave, infrared and Raman spectroscopy.


†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. First term.

†636. Electromagnetic Theory II. Relativistic electrodynamics, electron theory, Hamiltonian formulation of the electromagnetic field, selected topics. Prerequisite Physics 635. 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.

†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.

646. Advanced Statistical Mechanics. Applications of the principles of statistical mechanics to classical and quantum many-body systems.


†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.

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.


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.

656. Magnetism. Introduction to the theory of magnetic phenomena in metals and non-metals. Relevant experimental work will also be discussed.

658. Crystal Physics. The phenomenological theory of the elastic, dielectric and thermal properties of crystals. Classical field theory—linear and non-linear; field equa-
tions and boundary conditions; equations of state; material symmetry. Thermodynamics; thermodynamic identities; phase transitions. Applications to the ferroelectric crystals.


660. Selected Topics in Physics.


664. Magnetic Resonance. Magnetic resonance theory; magnetic nuclear dipolar broadening of rigid lattices; nuclear spin-lattice relaxation and motional narrowing of resonance lines; magnetic interaction of nuclei with electrons; electron paramagnetic resonance; double resonance; nuclear quadrupole resonance.

665. Cellular Biophysics. The physics of cellular structure and function; membrane theories, diffusion and active transport, bioelectric phenomena; intracellular motion, thermodynamics; selected topics of current interest and seminar.

666. Biophysics of Organ Systems. Specialized cells and organs; the nerve impulse and its propagation, muscle contraction, sensory transducers, the central nervous system; haemodynamics, the red blood corpuscle, homeostasis; selected topics of current interest and seminar.

668. Molecular Biophysics. Physical methods of determining macromolecular structure; energetics, intramolecular and intermolecular forces, information storage, DNA and RNA, recognition and rejection of foreign molecules.

669. Radiation Biophysics: Physical properties and biological effects of different kinds of radiation; action of radiation on various cellular constituents; target theory, genetic effects, repair of radiation damage, physics of radiology and radiotherapy, isotopic tracers.


681. **Celestial Mechanics I.** The two body problem.

682. **Celestial Mechanics II.** The three body problem and perturbations.

683. **Astrophysics.** Stellar atmospheres and interiors.

684. **Stellar Spectroscopy.** Description and classification of stellar spectra.

685. **Selected Topics in Astronomy and Astrophysics.**

699. **Thesis.**
Department of Political Science

A.D. Nelson, A.B., A.M., Ph.D. (Chicago) Associate Professor
Chairman of the Department

T.H. Qualter, B.A. (New Zealand), Ph.D. (London) Professor

J.E. Kersell, B.A., M.A. (Queen's), Ph.D. (London) Visiting Associate Professor

S. Andracki, LL.M. (Poznan), M.Sc. (London), Ph.D. (McGill) Associate Professor

D.R. Gordon, B.A. (Queen's), M.A. (Toronto) Associate Professor

J.E. Anderson, B.A. (Manitoba), M.A. (Princeton) Assistant Professor

L.G.E. Edmondson, B. Soc.Sc. (Birmingham), M.A. (Queen's) Assistant Professor (On leave of absence 1968-69)

D.E. Epstein, B.A. (Hamilton College), M.A. (Princeton) Assistant Professor

R.W. Hansen, B.A. (Rockford College), M.A. (Princeton) Assistant Professor

K.E. Rawling (Miss), A.B. (Catawba College) Assistant Professor

J.M. Wilson, B.A., M.A. (Toronto) Assistant Professor

Undergraduate Programmes

The Department of Political Science offers a series of undergraduate programmes designed to meet the needs of students with varying interests.

1) General Programme. Students choosing a three-year General programme in Political Science (See the University's requirements for the General Course on p. 19) must complete, before graduation, Political Science 250 and 280.

2) Honours Programme. Students choosing an Honours Programme in Political Science (See p. 44) may elect to pursue a series of connected courses as a minor programme in a related discipline such as Economics, History, Philosophy, Psychology or Sociology in consultation with the departments involved.

3) Joint Honours Programmes. A number of joint Honours Programmes have been arranged for students who wish to obtain a broad training in related disciplines. These are:
   (a) Honours Economics and Political Science (p.21)
   (b) Honours French and Political Science (p.30)
   (c) Honours History and Political Science (p.38)

4) Minor Programme. The Department will be glad to recommend a connected series of courses in Political Science beyond the first year for students majoring in related disciplines.

Graduate Programme

The Department of Political Science offers a programme leading to the degree of Master of Arts. The departmental graduate brochure provides details of the requirements for this degree.
Undergraduate Courses

Note
Students in upper years in Faculties other than Arts are encouraged to consult with the Department in arranging first courses in Political Science, which need not necessarily be at the 100 level.

(2) 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.

103*. Introduction to Political Ideas. A study of some of the leading political ideas of the contemporary world.
3 lectures. Fall term.
(This course is designed specifically for students in co-operative programmes.)

104*. Introduction to Political Practices. A comparative treatment of the institutions and practices of modern government, with particular reference to Canada.
3 lectures. Winter term.
(This course is designed specifically for students in co-operative programmes.)

110. Democratic Government. An examination of the theory and practice of constitutional democracy in modern industrial “mass” society. Emphasis will be placed on the relationship between basic political objectives and general features of organization, procedure, and practice.
3 lectures.

112. Introduction to Politics. A study of political values, ideas, and ideologies, democratic and other, together with a study of modern political systems.
3 lectures.

3 lectures.

248*. The Legal Process. An analysis of the manner in which the Common Law functions together with an examination of the courts as a social institution.
3 lectures.
Fall term (not offered 1968-69)

249*. Administrative Law. Discusses the issues raised by delegation of legislative and executive authority and the proliferation of administrative boards.
3 lectures. Winter term.
(Not offered 1968-69)

250. The History of Political Theory. A history of the development of western political theory from the time of Socrates to the present day.
262* International Politics. Sovereignty and Internationalism. The adjustment of conflict in the contemporary political environment.
3 lectures. Fall term.

3 lectures. Winter term.

280. Canadian Government and Politics. A critical examination of the institutions and practices of the Canadian political system.
3 lectures.

284*. American Government and Politics. The theory and practice of the American political system as revealed by the institutions and operations of American national government.
3 lectures. Winter term.

286*. Soviet Government and Politics. A survey of the development of Soviet political structures with an analysis of the relative influence of ideological goals on the one hand and social forces on the other.
3 lectures. Fall term.

287*. Problems in Soviet Politics. A study of the sources and formulation of selected policies in the Stalin and post-Stalin periods, including analysis of Soviet foreign policy.
Prerequisite: Political Science 286*.
3 lectures. Winter term.

288*. Comparative Politics. An introduction to comparative method in, and alternative approaches to, the study of politics.
3 lectures. Fall term.

Prerequisite: Political Science 288*.
3 lectures. Winter term.

Admission by consent of instructor.
3 lectures. Fall Term.

365*. The International Political System. Analysis of international politics with special emphasis on components of national power and methods of pursuing national and collective interests.
Admission by consent of instructor.
3 lectures. Fall term.
370. 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 process.
Admission by consent of instructor.
3 lectures.

Admission by consent of instructor.
3 lectures.

384*. Comparative Models of Political Development. An examination of various theories of political development and their application to traditional and modern political systems. Examples will be drawn from divergent political ideologies and will include the Soviet model, with emphasis on the Central Asian Republics, the democratic model of Japan and an example of a country that has not enjoyed notable success in political modernization.
Prerequisite: Political Science 288* or consent of instructor.
3 lectures. Fall term.

385. Comparative Communist Political Systems. An examination of selected aspects of various Communist political systems. e.g.: political socialization, national minority questions, and problems of political legitimacy. Some attention will also be given to Marxist and Marxist-Leninist ideology, the international Communist movement, and non-Communist political systems in which a large or significant Communist Party exists.
Admission by consent of instructor.
3 lectures.

386. Authoritarian Politics. A study of the organization, tactics and mass appeals of non-democratic and radical movements in competition for political power in developing and modern societies, together with a comparative analysis of the functioning of selected Communist, Fascist and Nationalist political systems.
Admission by consent of instructor.
3 lectures.

394*. Political Parties. An analytical and comparative study of the development, organization, activity and function of political parties, and the nature of contemporary party systems.
Admission by consent of instructor.
3 lectures. Fall term.

395*. 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.
Admission by consent of instructor.
3 lectures. Winter term.
**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 may be offered in each year.

*Admission by consent of instructor.*

3 lectures.

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**461*. Defence Policy and National Security.** A study of Canadian and American national defense policy as affected by the constitutional and political setting, as well as its relation to foreign policy. Emphasis will be placed on the role of interest groups like the scientific community in the formulation of defence policy. Some attention will be given to strategic doctrine.

*Admission by consent of instructor.*

3 lectures. **Fall term.**

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**462*. Comparative Civil-Military Politics.** An examination of the relationships between the military establishment and the civilian authority in selected countries. Attention will be given to the role of the military in modernizing or modern society, the nature of the military socialization of society, and the influence of the military on the formation of public policy.

*Prerequisite: Political Science 461* or consent of instructor.

3 lectures. **Winter term.**

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**465*. Theories of International Politics.** A critical examination of alternative approaches to the study of international politics.

*Admission by consent of instructor.*

3 lectures. **Winter term.**

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**480. The Politics of the Developing Areas.** An analysis of political systems and processes in the transitional societies of Africa, Asia and Latin America.

*Admission by consent of instructor.*

3 lectures.

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**481*. The Politics of French Canada.** A study of the principles, practices and personalities of French Canadian politics.

*Admission by consent of instructor.*

3 lectures. **Fall term (not offered 1968-69).**

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**482-485*. Comparative Government Seminars.** A series of half courses in the government and politics of selected countries, regions or systems.

*Admission by consent of instructor.*

3 lectures.

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*Admission by consent of instructor.*

3 lectures. **Winter term.**

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**498. Senior Research Seminar.**

*Admission by consent of instructor.*

3 lectures.
Senior Undergraduate and Graduate Courses

Note: Courses at the 500 level are open to senior undergraduates and to students in qualifying programmes as well as to those in graduate programmes. Admission in all cases is by consent of the instructor.

500*-510*. Special Subjects. In any year one or more subjects may be offered as special seminars. Course descriptions will be announced at the time of registration.

550*. Contemporary Democratic Theory. An examination of recent and contemporary theories of democratic government.
3 lectures. Fall term.

560*. Canadian Foreign Policy. A critical examination of the sources, challenges and methods of Canadian foreign policy together with case studies of major contemporary issues.
3 lectures. Winter term.

581*. Power and Society. A critical inquiry into the nature, distribution and exercise of power, with particular reference to American and Canadian society. Consideration will be given to analysis and evaluation of various interpretative theories of power, e.g. "elitism," and "pluralism," and the relationship of power to political institutions, both public and private.
3 lectures. Fall term.

582*. Comparative Politics in the "Old" Commonwealth. An analytical comparison of institutions and processes as they have developed in various systems of the "old" Commonwealth such as Britain, Canada and Australia.
3 lectures. Fall term.

583*. Comparative Politics in the "New" Commonwealth. An analytical comparison of politics in some of the "new" systems of the Commonwealth such as India, Pakistan and Nigeria.
3 lectures. Winter term.

3 lectures. Fall term.

592*. 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.

593. Political Behaviour. An examination of the objectives, characteristics, and problems of contemporary research on political behaviour, with emphasis on democratic electoral behaviour.
3 lectures.

594*. The Communications Media. A study of the impact of the mass communications media on the political process.
3 lectures. Fall term.
Graduate Courses

652. Political Theory. Selected themes in political theory.

660. International Politics. Contemporary theoretical and empirical problems in international politics.

680. Canadian Politics. Selected problems of the Canadian political system.

681. Comparative Politics. Theories and concepts of comparative politics.


698. Graduate Research Seminar

Department of Psychology

G.T. Barrett-Lennard, B.Sc., B.A. (Western Australia), Ph.D. (Chicago)  Professor
Acting Chairman of the Department

M.P. Bryden, S.B. (Massachusetts Institute of Technology), M.Sc., Ph.D. (McGill)  Professor

M.A., Ph.D. (Ohio State)

A. Castaneda, A.B. (San Francisco College), M.A., Ph.D. (Ohio State)

M.P. Bryden, S.B. (Massachusetts Institute of Technology), Professor
M.Sc., Ph.D. (McGill)  Deputy Chairman

A. de Vos, M.Sc., Ph.D. (Wisconsin)  Professor
(Philosophy and Psychology) (on leave of absence 1967-69)

H.D. Kirk, B.S. (City College), New York, M.A., Ph.D. (Cornell)  Professor
(Sociology and Psychology)

J.S. Minas, B.A., M.A. (Wayne State), Ph.D. (Illinois)  Professor
(Philosophy and Psychology)

R.K. Penney, B.Sci. (Wayne State), Ph.D. (Iowa)  Professor

D.A. Sprott, B.A., M.A., Ph.D. (Toronto), F.S.S.  Professor
(Statistics and Psychology)

R.K. Banks, B.A., M.A., Ph.D. (Toronto)  Associate Professor

K.S. Bowers, A.B., Ph.D. (Illinois)  Executive Secretary

T.E. Cadell, B.A. (British Columbia), M.A. (Massachusetts), Ph.D. (Wisconsin)  Associate Professor

J.M. Cornell, B.A., M.S., Ph.D. (Washington)  Associate Professor

W.D. Feuz, B.A. (Southern Missionary), M.A., Ph.D. (St. Andrew's), M.Sc. (Hawaii), Ph.D. (Massachusetts)  Associate Professor

M.A., B.D. (St. Andrew's), M.Sc. (Hawaii), Ph.D. (Massachusetts)

G.V. Goddard, B.A., M.A. (Saskatchewan), Ph.D. (McGill)  Associate Professor

H.M. Lefcourt, B.A. (Antioch), M.A., Ph.D. (Ohio State)  Associate Professor

G.E. MacKinnon, B.A. (Queen's), Ph.D. (Johns Hopkins)  Associate Professor

P.M. Rowe, B.A. (Toronto), M.A. (Dalhousie), Ph.D. (McGill)  Associate Professor

R.R. Ross, B.A., M.A., Ph.D. (Toronto)  Associate Professor (part-time)

S.D. Saleh, B.A. (Cairo), Dip. Ed. and Psych. (Ein-Sharms), M.A., Ph.D. (Western Reserve)  Associate Professor

R.A. Steffy, B.A. (Albright), M.A., Ph.D. (Illinois)  Associate Professor

R.V. Thysell, B.A. (Montana), M.A., Ph.D. (Iowa)  Associate Professor

M.D. Vogel-Sprott, B.A. (McMaster), M.A., Ph.D. (Toronto)  Associate Professor

D.M. Amoroso, B.A., M.A. (Toronto), Ph.D. (Waterloo)  Assistant Professor

P.E. Bowers, B.A. (Rosemont), M.A., Ph.D., (Illinois)  Assistant Professor (part-time)

M. Breidenbaugh, B.A. (Wittenburgh), Ph.D. (Vienna)  Assistant Professor

M. Brown, B.A., M.S. (McGill), Ph.D. (Michigan)  Assistant Professor

G.R. Engel, B.A., M.A., Ph.D. (Queen's)  Assistant Professor

G.A. Griffin, B.A. (Colgate), M.A., Ph.D. (Wisconsin)  Assistant Professor

W.C. Horne, B.A., M.A., Ph.D. (Iowa)  Assistant Professor

P.C. Jennings, B.A. (Utah), M.A., Ph.D. (Texas)  Assistant Professor

R.D. Lambert, B.A., M.A. (McMaster), Ph.D. (Michigan)  Assistant Professor (Sociology and Psychology)

J.D. Kalbfleisch, B.Sc. (Toronto), M.Sc., Ph.D. (Waterloo)  Assistant Professor (Statistics and Psychology)
Undergraduate Offerings

An introductory course (Psychology 110, 111-112, 150) is a prerequisite for all subsequent courses in Psychology.

A first year student intending to take either an Honours or a General Degree programme in Psychology must select either Psychology 110 or Psychology 150, and is advised to elect Philosophy 100 or two of Philosophy 125, 135, 140, 150. Students without high school Biology are advised to include Biology 101 or 131 in their programmes. Students with fewer than two Mathematics papers in Grade XIII are, in addition, advised to take Mathematics 85.

In year II to IV Honours students are required to take Psychology 280, 290, 360, 430, and 499 as part of their programme.

In year II the General student majoring in Psychology must take Psychology 201-202, and at least one other full-year or two half-year Psychology courses. Psychology 281-282 is strongly recommended in the second year. The general student with a background in Mathematics or who plans to do graduate study in Psychology should substitute Psychology 280 for Psychology 281-282. 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 281-282 if it has not been taken previously.

Students who expect to proceed to graduate study in Psychology will find it helpful to include the following courses in their programme: Biology 231, Mathematics 140, Mathematics 243, Philosophy 220.

Note on numbering: 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.
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 equivalent preparation may select either a research-oriented course leading to the Ph.D. degree or a professionally-oriented course leading to the Ph.D. degree or a professionally-oriented course leading to a Master of Applied Science (M.A.Sc.) degree.

Ph.D. candidates must pass a general examination and examinations in major and minor fields of specialization. Permissible major areas of specialization are: perception and cognition, learning and motivation, biopsychology, child behaviour and development, social, clinical, and counselling. Permissible minor areas of specialization are: any one of the permissible major areas (except biopsychology), quantitative methods, physiological and comparative, educational, and industrial. Candidates electing to major in clinical or counselling psychology will be required to complete internship training under conditions approved in advance by the Department.

Students primarily interested in professional work in applied settings, for which they are seeking to qualify at the master's level, are advised to take the M.A.Sc. programme. This programme is organized on a co-operative plan and includes four full terms of on-campus study and two terms of employed practical work and training in field settings. Students enter the programme in mid-September and will go out for their first fieldwork (internship) term in the following January or May. The degree thus requires two calendar years beyond the honours bachelor degree in psychology or equivalent preparation.

Undergraduate Course

Note

The number of hours of lectures shown after the course description is an attempt to indicate the "normal"; each instructor determines how often his particular class will meet.

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 Students only).
3 lectures.
112*. Introductory Psychology II. (For Co-operative Students only).
3 lectures.

150. Research Methods in Psychology. An introduction to research methods in psychology. Emphasis will be placed on methods of testing, observation, and experimentation. (For students in Honours Psychology or in joint Honours programmes with Psychology. Other students by permission of department only.)
2 lectures. 2 hours laboratory.

201*. General Experimental Psychology: Learning. An introduction to the data and theories of learning, with emphasis on experimental methodology. Required of all General Psychology students.
2 lectures, 2 hours laboratory. Fall term.

202*. General Experimental Psychology: Perception. An introduction to the data and theories of perception, with emphasis on experimental methodology. Required of all General Psychology students.
2 lectures, 2 hours laboratory. Winter term.

211*. Developmental Psychology. An examination of the process and factors of human development from birth to adolescence emphasizing methods of child study.
3 lectures. Fall term.

212*. Socialization Processes in the Child. Consideration will be given to a number of topics relating to the development of social behavior in children.
3 lectures. Winter term.

253*. (Sociology 210). Introductory Social Psychology. The relation between psychological processes and social interaction. Topics to be considered include (1) how we evaluate others' personalities, (2) determinants of friendship, (3) formation and change of attitudes, (4) conformity and independence, (5) the self-concept.
3 lectures. Fall term.

254*. (Sociology 212) Interpersonal Relations. The contribution of social organization to interpersonal processes. Consideration of some "theories" of social interaction. The social system approach to the problem of personal and interpersonal control.
Prerequisite: Psychology 253*.
3 lectures. Winter term.

256*. Small Groups. Study of the structure and functioning of small groups and the effects of group membership on the individual. Data from the laboratory are studied in relation to selected theories.
Prerequisite: Psychology 253*.
3 lectures. Winter term.

260. Physiological Psychology. The structure and function of the nervous system and their relation to behaviour.
3 lectures, 2 hours laboratory.
280. **Statistical Methods in Psychology.** An introduction to the logical and theoretical base for 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 and understanding of experiments. Required of all Honours Psychology students, except Mathematics students who have taken Mathematics 233.
3 lectures, 1 hour problems.

281*. **Elementary Statistics.** An introduction to descriptive and inferential statistics.
3 lectures. Fall term.

282*. **Tests and Measurements.** An introduction to the theory and use of psychological tests. Special emphasis is placed on the assessment of personality, intelligence, aptitudes and interests.
Prerequisite: Psychology 281*.
3 lectures. Winter term.

290. **Learning.** This course is designed to introduce the student to Learning theory and to provide an understanding of experimental techniques in this area. The course allows the student to carry out independent research in the area. Required of all Honours Psychology students.
2 lectures, 2 hours laboratory.

331*. **Individual Differences.** An analysis of individual and group differences in behaviour, with an emphasis on studies of intelligence.
3 lectures. Fall term.

332*. **Applied Psychology.** An introduction to the methods and problems of such applied areas as educational, industrial and counselling psychology.
3 lectures. Winter term.

340. **Cognitive Processes.** An examination and evaluation of selected topics dealing with human learning, thinking, concept formation, memory and language.
Prerequisite: Psychology 201*-202* or Psychology 290.
3 lectures.

351*. **Personality Theory.** An examination and evaluation of some of the outstanding theories of personality and methods of assessment deriving from these theories.
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: Psychology 351*.
3 lectures. Winter term.

353*. **Research Methods in Social Psychology.** Standard research techniques and recent methodological developments will be discussed. Problems involved in the design and evaluation of social psychological research will receive considerable attention.
Prerequisite: Psychology 253*, 280.
3 lectures. Fall term.
354*. Special topics in social psychology. One or more topics in social psychology will be covered in depth. 
Prerequisite: Psychology 253* and consent of instructor. 
3 lectures. Winter term.

360. Sensation and Perception. A consideration of data and theory concerning sensory and perceptual processes. Topics will include psychophysical methodology, sensory mechanisms, the neuropsychological basis of perception, basic behavioural data and theory relating to such topics as the perception of form and space, perceptual learning, and a consideration of the effect of personality variables in perception. Opportunity for independent research will be provided. (Required of all Honours Psychology students.) 
2 lectures, 3 hours laboratory alternate weeks.

370. Animal Behaviour. An in depth study of the behaviour of animals emphasizing both observational and experimental research. 
2 hours lecture, 2 hours laboratory.

380. Advanced Physiological Psychology. Advanced study of the physiological basis of behaviour, with particular reference to function of the central nervous system. Emphasis will be on laboratory work and on practical considerations involved in relating brain function to behaviour. 
Prerequisite: Psychology 260. 
2 hours lecture, 2 hours laboratory.

390. Human Motivation. An examination of the determinants of the direction, strength and persistence of behaviour. Several theoretical approaches which stress the role of expectancies, values and individual differences are considered. 
2 hours lectures, 1 hour discussion/lab.

410. History and Systems. An examination of current theoretical approaches to psychological problems presented in a historical context. 
3 hours lectures.

430. Contemporary Issues in Psychology. This course is conducted as a proseminar in which nearly all the faculty give talks on the contemporary issues underlying their current research and thinking. Topics are clustered into three major areas: (1) Study of individual differences, (2) The change of behaviour, (3) Reconsideration of assumptions underlying theories of learning and perception. Required of all Honours Psychology students. 
2 lectures.

440. Psychophysiology. The course deals with the study of interrelationships between the physiological and psychological aspects of behavior in human subjects. It covers research by psychologists, physiologists and psychiatrists on physiological responses to stimuli which are designed to influence mental, emotional or motor behavior. The laboratory deals with the physiological and physical principles and methods involved in the measurement of autonomic responses. 
2 lectures, 2 hours laboratory.
2 lectures.

480. **Directed Studies in Selected Topics.** For the student who desires to pursue a particular topic in depth through independent experimental research and/or extensive reading. A faculty member must approve a student's project prior to registration for this course. Open to exceptional students with permission of the instructor and the Department.  
3 hours supervised research.

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. Required of all Honours Students in Psychology.  
5 hours supervised research. Seminar.

**Graduate Course**

**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*. **Basic Issues in Clinical Psychology.** A critical evaluation of issues that have particular relevance for clinical psychology. Epistemological and methodological issues will be raised as well as problems in person perception, clinical judgment, and behaviour change. The course will also include historical developments, ethical problems and role definition of clinical psychology. A practicum portion of the course involves topical questions in clinical research, and subsequently covers intellectual assessment with lectures pertaining to the development and reliability of, and the validation research on, each of the tests utilized.

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.

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. Traditional views and recent experimental approaches to psychopathological states are analyzed and contrasted. Course work is concerned with the definition and research of certain central concepts: mental illness, anxiety, defense mechanisms, unconscious processes, neurotic and schizophrenic reactions.

625*. Psychotherapy. A detailed coverage of psychotherapeutic system; their respective views of health-illness, their techniques of intervention, and related research are considered.

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.

629A*. 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.

629B*. Behaviour Modification. Learning theory is extended in the realm of human behavior with particular emphasis on the use of operant and classical conditioning in the elimination of maladaptive behavior and the production of adaptive behavior.

629C*. Child Psychotherapy. A number of theoretical approaches to child therapy, ranging from analytical through family to milieu therapies, are examined, particularly in the light of current research.

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.

631*. Advanced Statistics. An advanced introduction to descriptive statistics and statistical inference. 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.

637*, 638*. Experimental Personality Research. Two half-year courses emphasizing experimental approaches to personality psychology. 637 will be given in the Fall term, 638 in the Winter term, but 637 is not a prerequisite for 638. Prerequisite: Psychology 711.

640*-649*. Selected Topics in Psychology.

698. Internship.
Thesis.

Sensory and Perceptual Processes I. A seminar series surveying some of the major contemporary problems in the area. Both human and animal research will be discussed. Required of all students who major or minor in Perception.

Learning I, II, III. A series of seminars devoted to critical reviews of basic theoretical issues and recent advances in selected topics in learning.

Physiological and Comparative Psychology. A seminar series dealing with the physiological aspects of human behavior and with relevant animal physiological and behavioral studies. Open only to students obtaining minor credit in comparative and physiological psychology.

Social Psychology, I, II, III. A series of seminars dealing with theoretical issues and research findings in the area of social psychology.

Child Psychology I. A detailed study of theoretical issues and research in the areas of child development and behavior.

Biological Basis of Behaviour. A seminar on aspects of cytology, histology, anatomy, embryology, phylogeny and genetics in relation to the behavior of organisms.

Biopsychology I, II, III. Seminars dealing with topics in the comparative, physiological and neurological study of behaviour.

Comparative and Human Neuroanatomy. Comparative study of the vertebrate nervous system; detailed study of the central nervous system of mammals including man.

Physiological Mechanisms in Behaviour. An examination of aspects of physiology and physiological chemistry that are related to the behaviour of organisms.

Advanced Psychometrics. An advanced course covering theory of test construction, factor analysis, and scaling methods.

Seminar in Personality. Systematic review of personality theories and related research.

Social Development. Theory and data relating to the social development of humans and subhuman species.

Sensory and Perceptual Processes II, III. A series of seminars focusing on a number of specific selected topics. In addition, research going on within the department will be discussed.

Child Psychology II. The first half of this course will deal with concrete descriptions and evaluations of the most widely used research techniques applied to the study of developmental and child behavior. The second half will be concerned with an application of the research methods to the student's own research.
740. Comparative Psychology. An advanced course dealing with selected problems in animal behavior.


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 student's 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 primate behaviour, including learning, concept formation, and social behaviour, accompanied by training in observational and testing techniques appropriate to the area of study.

Courses Principally for M.A.Sc. Candidates

801. Psychometric Theory. An examination of methods and issues in the construction, selection and evaluation of psychological tests. Prerequisite: Psychology 631 or consent of instructor.

811. Personality Theory. A consideration of several major theories of personality and relevant areas of research. Applications will be made to case materials.

812. Assessment of Abilities. Theories of human abilities and nature of tests derived from these theories, including intelligence tests. Criteria for the selection of tests. Review of relevant research. Practice in test administration and evaluation of results.

813. Assessment of Personality I. The development and use of objective personality and interest tests with reference to the theoretical foundations and research literature.

814. Assessment of Personality II. An introduction to projective techniques, including their rationale, administration and scoring, fundamentals of interpretations, and discussion of relevant research.

815. Tests in Education. An examination of the major testing materials available for assessment of achievement, interests, aptitudes, and learning disabilities of the child in a school setting. Special attention is given to diagnostic tests through practicum experience.

820. Assessment Practicum. Intensive assessment of individual persons, with emphasis on integrating results from a variety of tests.

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.
830. **Personality: Effectiveness and Disability.** An examination of concepts of optimal, healthy or mature personality, and of factors that influence the formation and content of such concepts. Problems in the study of personality variation. Patterns and typologies in normal and deviant functioning. Dimensional and level differentiation. Conditions associated with improving and deteriorating functioning.

831. **Theories of Psychopathology.** A review of leading theoretical interpretations of deviant behaviour, e.g., psychonanalytic, Rogerian, and social-learning theories.

833. **Interviewing.** Applications and analyses of interviewing in the contexts of gathering and giving information, forming judgments and providing psychological assistance. An examination of influencing and communciation processes in interviewing. Effects of interviewer and interviewee characteristics. Interview demonstrations, and introductory practice, reporting and self observation in interviewing.

834. **Principles and Practices in Counselling.** Counselling as a helping process, examined in the context of differing situations, practical orientations and theoretical interpretations. Communication and relationship features of the client-counsellor interaction. Explanations and research bearing on the process and effects of personal counselling and therapy. Comparison of individual and group counselling. The course will include a practicum of demonstrations and discussion of recorded and live interviews and, according to the opportunities available, experience as a participant counsellor in individual or group situations.

*Prerequisite: Psychology 833.*

836. **Practicum in Psychological Counselling.** Supervised practice in individual and/or group counselling in settings selected with the student's individual interests and objectives in mind. Students will meet with their instructor or supervisor individually and/or in small groups for intensive examination and discussion of their own counselling sessions and related issues.

*Prerequisite: Psychology 834 or consent of instructor.*

838. **Small-group processes.** The course will be concerned primarily with applications and interpretations of small-group procedures with normal persons, where the intention is to facilitate increasing sensitivity and skill in human relations, to foster self-related learning, or to facilitate communication and reduce tensions in an on-going group or set of interacting individuals. Research investigations of small-group processes and their effects will be considered. A series of practicum sessions will provide a personal experience of a basic encounter or human relations training group process.

*Prerequisite: Psychology 833.*

840. **Selected Topics in Applied Psychology.**

841. **Professional Issues.** Ethical concepts, practices and problems. Issues of responsibility, personal and professional values. Implications of a professional influencing function in relation to human conduct and personality. The counsellor in his contemporary and prospective institutional settings and interprofessional relations.

842. **Applied Research.** A seminar on methods and issues in applied research.
Department of Psychology

843. Research 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 aspects of applied psychology: or

(c) present a series of related case studies within a theoretical framework.


847. Organizational Psychology: Personnel. An examination of the psychological basis of the personnel function with special reference to personnel selection, performance review, training, and labour-management relations.

848. Organizational Psychology: Analysis of Organizational Behavior. A consideration of current theories of organizational behavior and the use of the system approach in its analysis. Special emphasis is placed on interpersonal interaction and organizational change.

849. Organizational Psychology: Motivation and Leadership. This course deals with the psychological basis of organizational effectiveness with special emphasis on leadership and motivation.

850. Exceptional Children. The classification and definition of the exceptional child within the school system. Characteristics of learning difficulties will be emphasized. Mental retardation, emotional problems, and receptive and expressive handicaps will be considered in detail.


852. Assessment and Treatment of Exceptionality. A study of diagnostic techniques including available tests used to identify the exceptional child. Treatment procedures will be considered, stressing available resources within the school system.
Religious Studies

J.R. Horne, M.A. (Western), B.Th. (Huron), Ph.D. (Columbia)  Assistant Professor
Acting Chairman

J.W. Fretz, A.B. (Bluffton), B.D. (Chicago Theol. Seminary), M.A., 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), Th.D. (Emmanuel)  Associate Professor P

E.B. Gamble (Miss), B.A. (Victoria), M.A. (Columbia), B.R.E. (Emmanuel)  Associate Professor P

D.M. Lochhead, B.Sc., B.D., S.T.M., Ph.D. (McGill)  Assistant Professor P

L.J. Siess, Ph.D., S.T. L. (Gregorian, Rome)  Assistant Professor P

N.L. Medley, B.A. (St. Mary's)  Assistant Professor J

P.F. Pigott, B.A. (Western), S.T.L. (Laval)  Lecturer J

Note:
It is tentatively planned to introduce into the General programme a major in Religious Studies. Students interested in such a major are advised to consult with the chairman.

Undergraduate Courses

15* Eastern Religious Thought  An introductory study of the history and thought of Hinduism and Buddhism, with particular attention to Zen Buddhism and its effect upon the culture of North America. For students in co-operative programmes.
3 lectures (Not offered in 1968-69).

16* Western Religious Thought  An introductory study of the history and thought of Judaism and Christianity, with special emphasis upon recent “secularizing” movements in Christianity.
3 lectures (Not offered in 1968-69).

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. (at Resurrection College only)

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 Studies

3 lectures, Fall Term

102J* Introduction to the New Testament. This course will be conducted on the same lines as RS 101J*.
3 lectures, Winter Term

3 hours. Not offered in 1968-69.

110P*-111P* Introduction to Theology A survey of the basic elements of Christian Faith, the relationship between revelation and reason, the authority of Scripture, the doctrine of God, of man, of the Church, of God's activity in history.
3 lectures (Fall & 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 reforms and evaluation of their place in modern Christianity.
3 lectures.

201J. Christian Doctrine. A consideration of selected theological problems arising out of Biblical teaching: the nature of theology; faith and reason; one God; the Incarnation and Redemption; Original Sin and the Fall; Trinity, Mariology.
3 lectures

210G*. History of the Ancient Church (A.D. 33-450). A study of the history of the ancient church, special emphasis being placed on the new Testament period and on subsequent developments in form and doctrine and their relation to the culture and thought of the time.
3 lectures.

210P*. Philosophies of Education. A study of religious and secular theories of the nature and purpose of education. The thought of classical Greek and Biblical writers, Reformation and Renaissance thinkers, and selected educators of the present day.
3 hours, one term.

212P*. Psychology of Religion. A study of theories of the psychological nature of religious experience and the sources of religious belief. Special attention to such questions as faith and doubt, conversion, revivalism, conscience, and religious prejudice.
3 hours, one term.
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.

236. The History of Christian Thought to 1800. A consideration of basic Christian statements of belief, and the arguments advanced for them, from the patristic period to the eighteenth century. 3 lectures.

300J. Contemporary Social Doctrine of the Church. The Church and society; the pronouncements of the Church on civil, domestic, professional and international societies. 3 lectures.

336P. Contemporary Theology. The sources of contemporary theology in 19th century thought with particular reference to Schleiermacher, Kierkegaard and Nietzsche. The thought of selected contemporary theologians, including Barth, Tillich and Bonhoeffer. Special attention to certain problems such as secularization and the ‘death of God’. 3 hours.

400. The Religion of Ancient Egypt. This course will concentrate on those aspects of Egyptian Religion which are of universal significance as well as of philosophical interest. Beginning with the religious origin of Egyptian civilization, it will survey the great theological systems and the varying degrees of spiritualization to which they attained. An account will be given of the principal myths of chaos and creation, and of the divine kingship. Other topics to be discussed include the Egyptian conceptions of the human soul and the beliefs concerning the dead. The ethical aspect will also come under consideration. 3 lectures (Not offered in 1968-69).
Department of Sociology and Anthropology

H.J. Fallding, B.A., B.Sc., M.A. (Sydney)  Professor
Ph.D. (Australian National University)  Chairman of the Department
Helen Abel (Miss) M.S. (Cornell), Ph.D. (Cornell)  Professor
J.W. Fretz, A.B. (Bluffton), B.D. (Chicago Theol. Seminary), M.A., Ph.D. (Chicago)  Professor
H.N. 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
F.A. Fasick, B.A. (Pennsylvania State), M.A., Ph.D. (Columbia)  Associate Professor
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)  Associate Professor
T.S. Aber, B.A. (Northwestern), M.S. (Wisconsin-Milwaukee)  Assistant Professor
R.D. Lambert, B.A., M.A. (McMaster), Ph.D. (Michigan)  Assistant Professor
K.A. Peter, B.A., M.A. (Alberta)  Assistant Professor
Wm. B. Roosa, B.A. (Texas Christian), M.A. (New Mexico)  Assistant Professor
Sally M. Weaver (Mrs.), B.A., M.A., Ph.D. (Toronto)  Assistant Professor
Audrey Wipper (Miss), B.A., M.A., (McGill)  Assistant Professor
N.L. Choate, C.R., B.A. (St. Mary's, Kentucky), M.A. (St. Louis)  Lecturer J (on leave)

Undergraduate Courses

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 and 102, but Anthropology 101 and 102 cannot be substituted for Sociology 100 towards further work in Sociology.

(2) General students who major in Sociology must elect the following courses: Sociology 100, Anthropology 102, Sociology 212, 320, 325, and one other full or two half courses in Sociology. Courses listed under Anthropology are accepted as credit in Sociology.

(3) General students who major in Anthropology must elect the following courses: Anthropology 101 and 102, 222 or 223, 225 or 226, Anthropology 350, and at least one other full course in Anthropology at the 300 level. Under certain conditions the following Sociology courses will be accepted for credit in Anthropology: Sociology 230, 251, 260, 270, 300, 301, 320, 331, and 355. Anthropology major must have their full programme approved for the second and third years by an anthropologist in the department.

(4) 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.
(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.

(6) All courses are not necessarily offered in 1968-69.

**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 or permission of the instructor.
3 lectures.

223. Old World Archaeology. A survey of Old World archaeology from the beginning of culture up to the advent of history.
Prerequisites: 101 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: 102, or permission of the instructor.
3 lectures, alternate years. Offered in 1968-69.

226. Non-Literate Peoples of the World. A survey of non-literate cultures from the Americas, Africa, Asia, and Oceania. A culture area approach will be used.
Prerequisites: 102, or permission of the instructor.
3 lectures. Not offered in 1968-69.

227*. Peoples of Africa. A survey of the cultures and societies of sub-Saharan Africa. An emphasis will be placed upon the ethnographic present, but the effects of modernization will also be considered.
Prerequisites: 102 or permission of the instructor.
3 lectures, alternate years.

228*. Peoples of the Pacific. A survey of the indigenous cultures and societies of the Pacific region, including Australia. Prehistory and post-contact history of the area is considered, but the greater part of the course concerns the cultural systems of the
area in the ethnographic present.
Prerequisites: IO2 or permission of the instructor.
3 lectures, alternate years.

230*. (Art 230*) Primitive Art. A study of Paleolithic, Mesolithic and Neolithic world art, aspects of Bronze Age Europe, Asia, and the Near East, the art of the African continent, the North and South American Indians in pre-Columbian and colonial times, and Australia-Oceania, together with related fields such as folk art, naive art and child art.

350. Culture Theory. A survey of the historical development of the concepts of culture, cultural evolution, and acculturation.
Prerequisites: 101 and 102.
3 lectures. Not offered in 1968-69.

353*. Primitive Social Organization. A study of primitive social structure with primary emphasis on kinship systems.
Prerequisites: IO2, or permission of the instructor.
3 lectures. Offered in 1968-69, if sufficient demand.

356*. Primitive Economics. A study of economic systems of bands, tribes, and chiefdoms as contrasted with those of primitive states.
Prerequisites: IO2, or permission of the instructor.
3 lectures, alternate years. Not offered in 1968-69.

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. Offered in 1968-69, if sufficient demand.

359*. Political Anthropology. The study of political behaviour in both state and non-state society. A comparative approach will be used with a thorough examination of the political systems of selected societies.
Prerequisites: IO2 or permission of the instructor.
3 lectures, alternate years. Offered in 1968-69.

370*. Ethnographic Field Methods. Traditional and recently developed approaches to ethnographic field work are explored. The problems the worker faces in the field, and possible solutions to them, are discussed. Some effort will be made to develop field technique in simulated and/or real field situations.
Prerequisites: IO2 or permission of the instructor.
3 lectures, alternate years. Offered 1968-69.

390 or 391* Reading in Anthropology. Guided reading in a selected portion of the anthropological literature.
Prerequisites: Anthropology major and permission of the instructor.
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 examination of cultural forces that create social problems and failures in personal and institutional adjustments. Specific attention is paid to the problems of emotional disturbance, addictions, delinquency and crime.
3 lectures.

210*. (Psychology 253*) Introductory Social Psychology. The relation between psychological processes and social interaction. Topics to be considered include (1) how we evaluate others' personalities, (2) determinants of friendship, (3) formation and change of attitudes, (4) conformity and independence, (5) the self-concept.
Prerequisite: Introductory Psychology.
3 lectures. Fall term.

212*. (Psychology 254*) Interpersonal Relations. The contribution of social organization to interpersonal processes. Consideration of some "theories" of social interaction. The social system approach to the problem of personal and interpersonal control.
Prerequisite: Second year standing.
3 lectures. Winter term.

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 contem-
porary research. A sound knowledge of sociological concepts is advisable.
3 lectures, alternate years. Offered 1967-68.

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, alternate years. Offered 1968-69.

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 (non-literate, folk and rural). 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 rural societies; major theories concerning communities of these types.
Prerequisite: Sociology 100 and Anthropology 102.
3 lectures, alternate years.

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, alternate years.

311*. Social Structure and Character. The relation between social organization and personality is here explored in the context of communal societies, modern bureaucratic organization, a comparison of Latin-American and Anglo-American slavery, and the concentration camp.
Prerequisite: Sociology 210.
3 lectures.

312*. Art and Society. Art is studied as collective representation, as a mode of work with particular career patterns, as evolving leisure and play focus. The affinity of some forms and styles for certain types of social organization; the professionalization and bureaucratization of art in education, publishing, the museum, theatre, and other mass media.
3 lectures.
315*. Social Stratification. Analysis of social classes in society including their basis for development, composition, and consequences for society.  
3 lectures, alternate years.

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. Limited to third year students majoring in sociology-anthropology, honours sociology-psychology; others admitted by permission of instructor.  
3 lectures.

330*. Comparative Social Structure. General theoretical and methodological issues facing comparative sociology; comparative methods at work in the treatment of Western and non-Western societies.  
3 lectures.

331*. Social Change. A systematic review and analysis of major theories of social change including some of the classical and modern theories. Analysis will focus upon the sources, patterns, processes and consequences of change. Special topics to be included are: Marxism, social change in developing countries, the role of ideas, and the breakdown and reorganization of social structure.  
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, alternate years.

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*. Sociology of Occupations. The sociological study of occupations as an aid to understanding the social structure; social and demographic aspects of the labour
Department of Sociology and Anthropology

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, alternate years.

355*. 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*. Political Sociology. The sociological analysis of the institutionalization of power, political movements, parties, conflict and its accommodation.
3 lectures.

365*. 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*. 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*. 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.
Senior Honours Essay. Required of all honours students in Sociology or Psychology-Sociology in their fourth year.

Graduate Courses

M.A. and Ph.D. degrees in Sociology are offered by the Department. These make a preparation for research and teaching in the discipline of Sociology and would be particularly useful for careers in the universities and colleges. They do not substitute for professional degrees in fields like social work, administration, planning and education.

The interest of the Graduate Faculty of the Department is centred on a General Sociology. This approach ties theory to measurement. It uses studies by anthropologists, political scientists, and historians as readily as those by sociologists. It recognizes some of the work of the social psychologists and social philosophers as being strictly sociology. It analyses social systems in a comparative and developmental way, giving attention to social change and to deviance and conformity during change. Social systems studied include family and kinship, religion, science, art, industry and community. Area specialties include North America and Africa.

A candidate for the M.A. is required to take a course in sociological theory, a course in method, a third course in the field of specialization, and to write a thesis. A candidate for the Ph.D. is required to enrol for one year in seminars selected in consultation with the Faculty. He is then required to pass a set of qualifying examinations and to subsequently present a doctoral dissertation. The entrance requirement for either degree is normally the Honours B.A. in Sociology. An applicant who does not already have this may, with approval, do qualifying work. The doctoral programme requires at least two years' enrolment beyond the M.A., or three years beyond the Honours B.A.

Sociological Theory. A stock-taking of the present fund of conceptual equipment for handling distinctively social phenomena, with proposals for its refinement for purposes of measurement.

Sociological Method. Design of theoretically oriented research; gathering, processing, and analyzing qualitative and quantitative data, including field methods, use of documents, laboratory observation, and punched-card techniques. Problems of statistical inference, causality, and measurement.

Theories of Social Change. 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, economic institutions, social stratification, urban structures, etc.

Social Stratification. This course will deal with class, status, and power groups in an industrial society as they strive to maximize their share of wealth, prestige, and power. In order to do so, cross-cultural materials treated as historical examples will be used to develop general principles.
Department of Sociology and Anthropology

620. Comparative Social Structure. The course is devoted to the comparative study of Western vs. non-Western societies with their institutions, structure and change in them. Modern sociological theories which have been developed on the basis of studies of Western societies are to be applied and modified for analysis of non-Western societies.

625. Socialization and Social Structure. Comparison of childhood socialization in family settings with socialization in formally organized settings, such as Kibbutzim. Analysis of socialization in adolescent and young adulthood focuses on the interplay of the family, educational, and political institutions in occupational placement. North America is compared with England, Russia and Japan.

630. Sociology of Knowledge. An analysis of the social and cultural determinants of thought and its various forms of expression including ideology, science, and religion. The relationship between thought and social change.

635. Deviance. A theoretical approach to the problem of deviance/conformity in society. A theoretical discussion of the following concepts will be undertaken: social organization/disorganization, institutionalized norms, anomie, social system, social roles, etc. Some systematic theories of delinquency will be studied.

640. Work and Leisure. Selected topics in the sociological analysis of industrialization. Emphasis on the structural and processual aspects of industrialization as a change in the whole way of life. Comparison between stages of industrialization in Western and "underdeveloped" societies and the social problems associated with each.

642. Formal Organizations. A review of the latest research findings dealing with formal organizations, including a consideration of problems of methods and the relevance of both to organization theory.

645. Community Power Structures. An analysis of the theoretical and selected empirical, sociological studies of community power structures and their practical implications. The sociological material will be supplemented with relevant contributions from the fields of anthropology and political science.

650. Sociology of Religion. Religion is considered as an activity generated by the social process itself. The significance of its recoil and attempted recovery in secular society is considered, as well as the encounter in the forum of secular society of the different faiths.

655. Family and Kinship. Family and kinship are viewed as the rudimentary structures of society from which other structures differentiate. They are shown to persist in modern society as a reinforcement structure beneath the specialized institutions.

660. The Bases of Community. Community is considered as an affinity bond rather than place (Durkheim's "mechanical solidarity"; Toennies' "Gemeinschaft"). The competitive strengths of the following in generating community are considered: kinship, territory, race, class and faith.
670. Social Psychology. A seminar dealing with theoretical issues and research findings in the area of social psychology.

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.

This four-fold diversity is significant because of the four faculties existing at the time this Mace was presented to the University and as well, of the four church-related
Residence Information

Residence and Fees

Conrad Grebel College
Conrad Grebel College, a Mennonite residential college and student centre, became affiliated with the University in 1961. The College provides accommodation on campus for sixty-six men and forty women. All rooms are double rooms.

The residence facilities include a small library and archives, recreation rooms, dining facilities, classrooms, a large common room and a chapel with capacity for one hundred and fifty.

Preference will be given to students who give evidence of wanting to develop an intelligent understanding and practice of the Christian faith as an integral part of their University life and studies.

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<tr>
<th>Fees:</th>
<th>Per Academic Year</th>
<th>Per Academic Term</th>
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<tr>
<td>Double</td>
<td>$835</td>
<td>$417.50</td>
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Renison College
Sponsored by the Anglican Church of Canada for students of all denominations and affiliated with the University of Waterloo, Renison College offers credit courses in arts and the social sciences for the University of Waterloo degree.

Applicants for admission to the University's Faculty of Arts through Renison College must be prepared to enrol in the College's academic programme (for details see the Renison calendar). Courses not offered by the College are available in the University. As Renison students are registered for degree purposes with the University, academic applications must be submitted through the University Registrar.

Applicants for admission to the University's Faculties of Engineering, Mathematics, Science and to the School of Architecture, Physical and Health Education and Optometry, may apply to Renison College for residence privileges. They must be prepared to participate in the extra-curricular programmes of the College. Accommodation is available for men and women. Single rooms are reserved for senior students.

Fees:

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<tr>
<td>Single</td>
<td>$975</td>
<td>$487.50</td>
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<tr>
<td>Double</td>
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St. Jerome's College
St. Jerome's College is a Roman Catholic Liberal Arts College federated with the University of Waterloo. Its residence is on campus and is open to men enrolled in its own General Arts course, or registered in any faculty of the University. Both single and double accommodation is available.

(Single accommodation is not available to first year residents.)

Fees:

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<tr>
<td>Single</td>
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<td>Double</td>
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Notre Dame College
Notre Dame College is the women's residence of St. Jerome's College. It is open to women registered in St. Jerome's or in any Faculty of the University of Waterloo. Seventeen single and eighteen double rooms, each provided with running water, built-in desks, book shelves, and wardrobes, accommodates fifty-four students. The residence has its own chapel along with kitchenettes and laundrettes for the convenience of its residents. The College is designed to provide a satisfying atmosphere for study and social life while still preserving the informality and comforts of home.

Fees:

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St. Paul's College
St. Paul's (United Church) is a residential and teaching college affiliated with the University of Waterloo, and located on the campus.
Residence Information

The residence provides accommodation in seventy-five semi-private rooms for one hundred men and fifty women.

Library, chapel, refectory, common rooms, recreation rooms and laundry facilities are contained in the College buildings. A deliberate attempt is made to include students from other religious traditions and from abroad, as well as students who are seriously questioning their religious heritage.

The purpose of the College is to provide an atmosphere in which a student may pursue his academic studies and may engage in dialogue with students of other backgrounds, traditions and vocational goals.

Elective courses in Religious Knowledge recognized for credit towards degree work in the University are offered by the College.

Fees:

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<tr>
<td>Double</td>
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University of Waterloo Residence

The University of Waterloo Residences (non-denominational) known as the "Student Village" are adjacent to the teaching facilities of the campus.

The residence portion of the "Village" consists of twenty-six houses with a total of 873 single, 370 inter-connecting rooms and eight double rooms.

A House comprises three floors. In addition to the usual facilities, each floor has a lounge and kitchenette and houses sixteen students in twelve single and two interconnecting rooms well-equipped for study purposes. Each House is under the supervision of a Don.

The "Student Village" accommodates 1,287 students, and the "Village Square" includes a town hall, four dining halls, chapel, two coffee houses, drugstore, tuck shop, barber shop and pick-up service area as well as outdoor recreational facilities.

Fees:

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<tr>
<td>Single</td>
<td>$960</td>
<td>$480</td>
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<td>Semi-private</td>
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<td>$470</td>
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<tr>
<td>Double</td>
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Minota Hagey Residence

The Minota Hagey residence will accommodate 75 women graduate students. The building is the first in a four house residence complex and will be situated at the southwest part of the campus. Each floor of the three story building will accommodate 25 students and each will have its own washrooms and service core.

Each room, of approximately 130 sq. ft., will be equipped with built-in fixtures such as closet, dresser, desk and vanity, in addition to a sink and counter space, enabling the occupant to carry out light cooking. The building is expected to be ready for occupancy in September 1968.

Fees:

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<th>One Term</th>
<th>Two Terms</th>
<th>Three Terms</th>
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<tr>
<td>Single</td>
<td>$285</td>
<td>$570</td>
<td>$855</td>
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Off Campus Housing Office

The Off Campus 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.

Book Store

University of Waterloo students may purchase text books, stationery and engineering supplies at the University's modern Book Store located on the main floor of the New Food Services and Book Store 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 text books, reference material, paper supplies, crested gift and souvenir items and drawing materials, the University of Waterloo Book Store also features the largest display of quality paperbacks in Kitchener and Waterloo.

Department of University Extension

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 provided by a University, are our first concern.

To help undertake this rapidly expanding task many community leaders provide advice, counsel and guidance. In addition, many dedicated citizens, fully supporting the concept of continuing education for adults, give freely of their time to help in the development of courses and programmes. The many and varied proposals 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 in residence on campus. Because of the scheduling of the undergraduate programmes, conferences and seminars co-sponsored with off-campus organizations and associations are normally arranged 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, the "updating" and refresher" approach recognizes and complements adult professional experience. Present programmes designed with this in mind reflect this view in the imaginative development of several new courses to meet the needs of business, industry, labour and government.

Administrative services and programme design are available to present special opportunities to secondary school teachers and adult students, professional associations or other groups and the general public through lectures, seminars, workshops, intensive short courses and University orientation programmes.

The Department does not offer correspondence course. Courses not fully developed at the time of the publication of the Calendar are advertised in sufficient time to advise the public.

Details of courses, programmes and other offerings are set forth in the University Extension Calendar. Further information is available from the Director, Department of University Extension, University of Waterloo, Waterloo, Ontario.
Centre for Continuing Studies in Marketing

Centre For Continuing Studies In Marketing

All courses and seminars in the Centre for Continuing Studies in Marketing programme are strictly in the field of continuing education. The “Centre” does not offer degree courses and no courses involve degree credits. An “Acknowledgement” suitable for framing is granted to participants in extended courses involving a minimum of thirty lecture hours. No such “Acknowledgement” is granted for short-term seminars.

In the five years in which marketing courses have been offered over five hundred national marketers from coast to coast have enrolled one or more of their upper or middle management people at all levels of line and staff responsibility. Over two thousand marketing people have participated in the various courses and seminars which have comprised the “Centre’s” total program.

The program has grown from the original Advanced Course in Marketing and Sales Management in 1962 to twenty courses in 1967-68. The “Centre” will continue to explore new opportunities for service.

The staff of the “Centre” will be happy to assist management and individuals in selecting career development courses most appropriate to the individual’s needs.

Courses and Seminars in 1967-68 Program

Courses
Field Sales Management (2)
Advertising Agency Management
Marketing Management
Marketing Research
Sales Management
Sales and Marketing Management
for Industrial Marketers
Sales and Marketing Management
in the Smaller Business
Sales Promotion Management

Seminars
Development and Training of the Sales Force
The Management of Marketing Research
Marketing Planning
New product Development
Physical Distribution Management
Product Management (Consumer Goods)
Sales Office Management (2)

Conference - Seminars
The Management of Advertising
New Dimensions in Marketing Management
New Dimensions in Sales Management

For information re scheduled dates of above courses write or phone - Centre for Continuing Studies in Marketing, University of Waterloo, Waterloo, Ont., Area Code 519, 744-6111 (Ext. 2577)
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.

Medical Health Services

Medical 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 Health Service Building to be completed during the summer of 1968 will house the Health Service staff which serves the university community. A fully qualified medical staff including a medical doctor and registered nurses is available for regular service from Monday to Friday from 8 a.m. to 8 p.m. Emergency Service is available at all times on a 24 hour basis.

Health and Accident Insurance—Undergraduate students are covered from the date of registration by a University Health and Accident Insurance Plan. The premium, which is included in their tuition, is for single coverage only. Students requiring dependent coverage must inquire at the Business Office.

Arts and Science students are insured from the 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 for single or dependent coverage. N.B. Students who do not wish to be covered by the Health & Accident Insurance Policy which is provided, may opt out of the plan within three weeks after Registration, and have the premium payment refunded by providing proof of adequate alternate insurance coverage.

Further information about the University's Health Insurance Plan may be obtained from the insurance clerk. Claims are to be submitted to her also.

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, sexual 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 students who have within themselves the resources to solve their problems with some assistance. The primary goal in coming to the Centre is to gain increased information and understanding of oneself through counselling and the use of psychological 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.

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 Charter of the Federation of Students which guarantees certain rights and privileges to students was approved by the Board of Governors of the University and then by the Provincial Secretary on April 27, 1967. It supercedes the Constitution of the Federation which was approved in a campus-wide referendum in 1964.
Objects. The principal “Objects” of the Federation are:

To promote the welfare and interests of the students of the University of Waterloo in all matters respecting their common interests.

To act as the representative of the students.

To promote and maintain responsible student government.

To promote and co-ordinate student participation in athletics, cultural and social activities.

To promote and maintain communication between the student body and the duly elected and appointed authorities of the University of Waterloo.

To promote and assist in maintaining good conduct and proper discipline.

The Students’ Council. Twenty-five elected members plus 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, the governing body of the Federation, include upholding the objects 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 and cultural 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 and the University Drama Group; in music: Chamber Orchestra, Concert Band, Dance Band, Warrior’s 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 of Students, and handles its activities, programmes and organizations in all areas that are outer-directed in relation to the campus, activities which connect
and relate the student to the local, national, and international communities. Board functions are roughly divided into three commissions: Domestic Affairs, International Affairs and Information and Services, and a Hosting Committee which welcomes official student groups from other Canadian campuses and other countries. In the past, the Board through its Commissions has provided, or worked for; a high school tutorial service, overseas travel service, C.U.S. Life Insurance, seminars on the Canadian Indian, speakers of foreign countries, a court of revision on campus for provincial elections, a Waterloo drop-in centre, a study of Red China, and many other activities within its broad area of concern. Through the International Affairs Commission, the Board also provides support for the Student United Nations Association of Canada (S.U.N.A.C.), Canadian University Services Overseas (C.U.S.O.), Conference on Inter-American Student Projects (C.I.A.S.P.), and others. The Board also maintains the Federation of Students association with the Canadian Union of Students (C.U.S.), the Ontario Union of Students (O.U.S.), the Indian-Eskimo Association (I.E.A.), and, from time to time, such groups as the Student Union for Peace Action (S.U.P.A.), and Friends of the Student Non-Violent Co-Ordination Committee (Friends of S.N.C.C.).

The Board of Publications. The Board of Publications major publications include: The Chevron which is the weekly student newspaper; the Compendium, the University yearbook; the Student Directory, the tri-annual campus telephone directory; the Handbook Series involving a set of informative guidebooks; Liontayles, a bi-annual literary magazine. In addition the Board provides financial assistance to the Faculty Societies for the production of faculty anti-calendars.

The Boards of Student Activities. The Board of Student Activities co-ordinates and supervises all campus-wide programs, including, Freshman Orientation, Homecoming, Winter Weekend, Grad Ball and Summer Weekend. The Board also maintains a classical record collection for the use of all students, supports the House of Debates and assists the operation of over thirty clubs whose membership is open to all members of the Federation.

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.

Career Planning and Placement

The Career Planning and Placement section of the Department of Co-ordination and Placement provides assistance for graduates from all Faculties who seek permanent employment and all undergraduates (excluding students in co-operative programmes) who seek summer employment. It is customary for employers to interview students
graduating from all Faculty of Arts during a three week period in November, and students graduating from all Faculties during a second three week period in January. Undergraduates from all faculties are urged to discuss career opportunities with the placement and career planning officials and to familiarize themselves with company brochures that are on display in the Placement Office. The Career Planning and Placement offices are located on the sixth floor of the Arts Library Building.

Regular Officers’ Training Plan (ROTP)

Under this plan successful applicants are enrolled as Officer Cadets. They are paid $187.00 per month. Tuition is paid on their behalf and they also receive a book and instrument grant in the amount $125.00 annually. Successful applicants must agree to serve four years in Canadian Armed Forces after graduation.

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:

ROTP Selection Board
National Defence Board
Ottawa, Ontario

If application is delayed until after admission to university, it should be sent to:

Canadian Forces Recruiting Centre
Suite 202
251 King Street W.
Kitchener, Ontario
Telephone 743-6661

Homecoming 1968
X

Fees
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.

Students who have received notice of assistance under the Province of Ontario Student Award Programme and are relying upon this source of funds for the payment of their fees, may make arrangements on the day of registration to direct payment to the University, up to the value of the award.

If, for reasons acceptable to the Treasurer, payment in full cannot be made on the day of registration, fees may be paid into two instalments but an extra charge of $10.00 for regular students and $5.00 for co-operative students 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 fees plus all incidental fees. The balance must be paid as follows:

Regular students: On or before the first day of the second term.

Co-operative students: On or before the first day of the eighth week of the term.

Failure to comply with terms of payment as set out above, will result in an additional service charge of 5% of the outstanding balance plus interest calculated at the current bank rate from the due date.

Failure to pay all outstanding fees, accounts or other assessments, such as library or parking fines, before conclusion of lectures may bar a student from writing examinations and will result in withholding of 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 1967-68 year and at the time of printing is still subject to review and possible change for the 1968-69 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.
Schedule of Fees—Undergraduate Programmes

Tuition and Incidental Costs

<table>
<thead>
<tr>
<th>Faculty or School</th>
<th>Year</th>
<th>Tuition</th>
<th>Incidental*</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arts</td>
<td>All years</td>
<td>$510.50</td>
<td>$70.00</td>
<td>$580.50</td>
</tr>
<tr>
<td>Engineering</td>
<td>Year One</td>
<td>292.50</td>
<td>36.75</td>
<td>329.25</td>
</tr>
<tr>
<td></td>
<td>Other Years</td>
<td>342.50</td>
<td>36.75</td>
<td>379.25</td>
</tr>
<tr>
<td>Environmental</td>
<td>All Years</td>
<td>342.50</td>
<td>36.75</td>
<td>379.25</td>
</tr>
<tr>
<td>Studies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>All Years</td>
<td>510.50</td>
<td>70.00</td>
<td>580.50</td>
</tr>
<tr>
<td></td>
<td>Year One</td>
<td>292.50</td>
<td>36.75</td>
<td>329.25</td>
</tr>
<tr>
<td></td>
<td>Other Years</td>
<td>317.50</td>
<td>36.75</td>
<td>354.25</td>
</tr>
<tr>
<td>Science</td>
<td>All Years</td>
<td>510.50</td>
<td>70.00</td>
<td>580.50</td>
</tr>
<tr>
<td></td>
<td>Year One</td>
<td>292.50</td>
<td>36.75</td>
<td>329.25</td>
</tr>
<tr>
<td></td>
<td>Other Years</td>
<td>317.50</td>
<td>36.75</td>
<td>354.25</td>
</tr>
<tr>
<td>Optometry</td>
<td>All Years</td>
<td>510.50</td>
<td>70.00</td>
<td>580.50</td>
</tr>
<tr>
<td>Physical and</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>Year One</td>
<td>292.50</td>
<td>36.75</td>
<td>329.25</td>
</tr>
<tr>
<td></td>
<td>Other Years</td>
<td>335.25</td>
<td>36.75</td>
<td>372.00</td>
</tr>
<tr>
<td>Part time</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td>Per Course</td>
<td>100.00</td>
<td>NIL</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Incidental fees included in the above schedule are shown in detail below. The additional fees for photograph, or degree and graduation, will be assessed at the registration as indicated below.

Co-operative

<table>
<thead>
<tr>
<th>Incident*—Compulsory Assessment</th>
<th>Session</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federation of Students (activities)</td>
<td>$22.00</td>
<td>$11.00</td>
</tr>
<tr>
<td>Athletic</td>
<td>22.00</td>
<td>11.00</td>
</tr>
<tr>
<td>Tenth Anniversary Fund (See Note I)</td>
<td>10.00</td>
<td>5.00</td>
</tr>
<tr>
<td>Campus Health Services</td>
<td>6.00</td>
<td>3.00</td>
</tr>
<tr>
<td>Health Insurance (See Note II)</td>
<td>10.00</td>
<td>6.75</td>
</tr>
<tr>
<td></td>
<td>$70.00</td>
<td>$36.75</td>
</tr>
<tr>
<td>Photograph (At First Registration)</td>
<td>$1.00</td>
<td>$1.00</td>
</tr>
<tr>
<td>Degree and Graduation (At Final Registration Only)</td>
<td>$10.00</td>
<td>$10.00</td>
</tr>
</tbody>
</table>

Note 1—Tenth Anniversary Fund

In January, 1968 the Student’s Council of the Federation of Students petitioned the Board of Governors to assess each student $5.00 per term as a donation to the Tenth Anniversary Fund.
It is anticipated that this assessment will continue until a total donation of $500,000 has been accumulated. The objective of the Tenth Anniversary Fund is $500,000, an amount needed by the University as its contribution to the University Building Programme.

Payment of the assessment is required at registration but a student who does not wish to participate may obtain a refund by applying to the Federation of Students' office in the Campus Centre Building within three (3) weeks after registration date.

**Note 2 — Health Insurance**

The premium of $10.00 affords coverage for a 12 month period from date of registration. The "co-operative" premium of $6.75 affords coverage for an 8 month period from the date of registration. First year co-operative students registering in January for second term are assessed $3.25 to ensure coverage until the date of next registration. Final year co-operative students, returning from work terms and registering in January, are assessed $3.25 to complete coverage for the final term.

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

Students who do not wish to take this insurance and who can show proof of adequate coverage elsewhere will be entitled to a refund of the premium if request for premium refund is made within three weeks after registration date, provided no claim for benefits has been presented in this period. Proof of coverage should be presented to the Student Health Services Centre where authorization for a refund will be issued. Payment of fees is required at registration as per assessment.

**Miscellaneous Fees**

<table>
<thead>
<tr>
<th>Service</th>
<th>Fee</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>$7.00</td>
</tr>
<tr>
<td>Late Registration — First day</td>
<td>$10.00</td>
</tr>
<tr>
<td>— Each additional day</td>
<td>$5.00</td>
</tr>
<tr>
<td>— Maximum</td>
<td>$25.00</td>
</tr>
<tr>
<td>Transcript of record</td>
<td>$1.00</td>
</tr>
</tbody>
</table>

**Schedule of Fees—Graduate Studies**

**Definitions**

The following definitions are applicable to prospective applicants and to students currently enrolled in graduate studies at the University of Waterloo. Graduate students from other universities who spend a resident period at the University of Waterloo but are not candidates for a Waterloo degree will pay fees as per regular graduate students.

Classification of graduate students is made by the Graduate Admissions Committee for each respective Faculty.

**Regular Full-Time Graduate Students:**

Students possessing an Honours Bachelor's Degree or equivalent with such standing that they have been accepted by a Faculty Graduate Committee to study for a higher degree.

A full-time graduate student is taken to mean a graduate students enrolled for more than the equivalent of a one term course in any given term.
Qualifying (Full Time) Students:
Students possessing a university degree, who, in the opinion of the Faculty Graduate Committee concerned, may not yet be prepared to undertake graduate study. All, or part, of their programme will consist of undergraduate studies. These students are not candidates for a degree. Completion of the work of the qualifying year does not automatically entitle a student to proceed toward a higher degree. In exceptional cases a student may remain in this class for two (2) years. If it is apparent at the end of the first or second year, that the student is not qualified to proceed to a degree, he may be refused enrolment in Graduate Studies, but will be granted a Certificate of Attendance for the time he has spent at the University of Waterloo.

Regular Part-Time Graduate Students:
Students admitted as regular graduate students, but who, with the permission of the Faculty Graduate Committee concerned, are studying for a graduate degree on a part-time basis. A part-time graduate student is taken to mean a graduate student enrolled for not more than the equivalent of a one-term course in any given term.

Special Part-Time Graduate Students:
Students possessing a university degree who are taking one or more graduate courses but are not intending to proceed to a degree or a diploma. (Students who obtain credits in this category and subsequently decide to proceed to a degree will pay fees according to their category at that time.)

Tuition and Incidental
The standard full time twelve month tuition fee is $396.00 and the minimum tuition fees are as follows:

- One year programme $396.00
- Two year programme $792.00
- Three year programme $1,188.00

In faculties where term registrations are applicable, the full time tuition fee assessment is $132.00 per term.

Regular part time students will be assessed a tuition fee at the rate of $77.00 per term. A continuing fee of $60.00 per calendar year or $30.00 per term will apply to a full time or a part time student when the accumulated fee paid exceed the minimum for his programme.
### Schedule of Fees—Graduate Studies

#### Tuition and Incidental

<table>
<thead>
<tr>
<th></th>
<th>Tuition</th>
<th>Incidental*</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Regular Full Time Students:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per calendar year of required resident study</td>
<td>$396.00</td>
<td>$70.00</td>
<td>$466.00</td>
</tr>
</tbody>
</table>

Resident requirements are as follows:

(a) **For a Doctor's Degree**
- Three years of study beyond a Bachelor's degree
- Two years of study beyond a Master's degree

(b) **For a Master's Degree**
- One year for a "One Year" programme
- Two years for a "Two Year" programme

(c) **For a Master of Philosophy Degree**
- One year beyond a Master's Degree

Additional resident study
- Per Year (three terms) 60.00 70.00 130.00
- Per Term 30.00 33.35 63.35

Additional non-resident study
- Per Year (three terms) 60.00 NIL 60.00
- Per Term 30.00 NIL 30.00

**Qualifying (Full Time) Students:**
- per academic year (two terms) of resident study

  - Faculty of Arts 510.50 70.00 580.50
  - Faculty of Engineering 545.00 70.00 615.00
  - Faculty of Mathematics 510.50 70.00 580.50
  - Faculty of Science 510.50 70.00 580.50

**Regular Part Time Students:**
- per term 77.00 NIL 77.00
- beyond the minimum fee for the programme
  - Per Year 60.00 NIL 60.00
  - Per Term 30.00 NIL 30.00

**Special Part Time Students:**
- per full course 100.00 NIL 100.00
- per half course or course for one term 50.00 NIL 50.00
Incidental*—Compulsory Assessment | Per Year | Per Term
---|---|---
Federation of Students (activities) | $22.00 | $11.00
Athletic | 22.00 | 11.00
Tenth Anniversary Fund (See Note I) | 10.00 | 5.00
Campus Health Services | 6.00 | 3.00
Health Insurance (See Note II) | 10.00 | 3.35
| $70.00 | $33.35
Photography (At First Registration Only) | $1.00 | $1.00
Degree and Graduation (At Final Registration Only) | $20.00 | $20.00

Note 1—Tenth Anniversary Fund
In January, 1968 the Students' Council of the Federation of Students petitioned the Board of Governors to assess each student $5.00 per term as a donation to the Tenth Anniversary Fund.

It is anticipated that this assessment will continue until a total donation of $500,000 has been accumulated. The objective of the Tenth Anniversary Fund is $5,500,000, an amount needed by the University as its contribution to the University Building Programme.

Payment of the assessment is required at registration but a student who does not wish to participate may obtain a refund by applying to the Federation of Students' office in the Campus Centre Building within three (3) weeks after registration date.

Note 2—Health Insurance
The premium of $10.00 affords coverage for a twelve month period from date of registration. The "term" premium of $3.35 affords coverage for a four-month period from date of registration.

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

Students who do not wish to take this insurance and who can show proof of adequate coverage elsewhere will be entitled to a refund of the premium if request for premium refund is made within three weeks after registration date, provided no claim for benefits has been presented in this period. Proof of coverage should be presented to the Student Health Services Centre where authorization for a refund will be issued. Payment of fees is required at registration as per assessment.

Coverage for dependents is also available at additional premium. For information write to Student Health Insurance c/o University of Waterloo, or enquire at registration.

Miscellaneous Fees
Late Registration | $10.00
Transcript of record | $1.00
### Residence Fees 1968-69

*Per Academic Year (Two Terms)*

<table>
<thead>
<tr>
<th>Residence</th>
<th>Single Room</th>
<th>Interconnecting Room</th>
<th>Double Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Waterloo</td>
<td>$960.00</td>
<td>$940.00</td>
<td>$920.00</td>
</tr>
<tr>
<td>— Student Village</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>— Minota Hagey</td>
<td>$570.00*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>St. Paul's College</td>
<td>—</td>
<td>—</td>
<td>875.00</td>
</tr>
<tr>
<td>Conrad Grebel College</td>
<td>—</td>
<td>—</td>
<td>835.00</td>
</tr>
<tr>
<td>Renison College</td>
<td>975.00</td>
<td>—</td>
<td>900.00</td>
</tr>
<tr>
<td>St. Jerome's College</td>
<td>915.00</td>
<td>—</td>
<td>835.00</td>
</tr>
<tr>
<td>Notre Dame College</td>
<td>915.00</td>
<td>—</td>
<td>835.00</td>
</tr>
</tbody>
</table>

* Excludes meals.

Co-operative students are assessed per term at 50% of above rates. 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 a term and the beginning of the next term.

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

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

Information concerning the Residences can be found on page 369.
The University Libraries
The University Libraries

University Librarian
Doris E. Lewis, (Mrs.) B.A., B.L.S., (Toronto)

Assistant to the Librarian
Helen McKinnon, (Miss) B.A. (Saskatchewan), B.L.S. (Toronto), M.L.S. (McGill)

Acquisitions Department

Head
Enid Waterman, (Mrs.) B.A. (McMaster), B.L.S. (Toronto)

Acquisitions Librarian
Paul Dyment, B.A. (Manitoba), B.L.S. (McGill)

Serials Section

Head
Carolyn Pawley, (Mrs.) B.A. (McMaster), B.L.S. (Toronto)

Serials Librarian
Susan Nichols, (Miss) B.A. (Waterloo), B.L.S. (British Columbia)

Bibliographic Searching Department

Head
Patricia Noonan, (Mrs.) B.A. (Western), B.L.S. (Toronto)

Cataloguing Department

Head
Robert G. Bean, B.A. (Western), B.L.S. (Toronto)

Assistant Head
Patricia Fitz Gerald (Mrs.) B.A., B.L.S. (Toronto), M.S. in L.S. (Western Reserve)

Cataloguers
Douglas Armstrong, B.A. (Western), B.L.S. (Toronto)
Catherine Blackshaw, (Miss) B.A. (Carleton), B.L.S. (Toronto)
Sandra Brenner, (Miss) B.A. (Waterloo), M.A. (Emory), B.L.S. (Toronto)
Daniel Bruce, B.Sc., M.Sc. (Dalhousie), B.L.S. (Toronto)
Joan Scanlon, (Miss) B.A., M.A., B.L.S. (Toronto)
Wasyl Sirskyj, B.A., (Toronto), M.A. (Waterloo) B.L.S. (Toronto)

Circulation Department, Arts Library

Head
Elaine Reaman, (Miss) B.A. (McMaster), B.L.S. (Toronto)
The modern university library is a major resource for research and study, and as such shares in the development of academic excellence within the university. It supports teaching and research by acquiring, cataloguing, and making available for use books, periodicals, documents, manuscripts, maps, pamphlets, micromaterials, slides and phonorecords, and by providing reference, interlibrary loan and circulation services for students, faculty, researchers and staff.

There are two centres for library service and study on the campus. The new $2,525,000 Arts Library Building was officially opened in October, 1965 and presently provides accommodation on the second (main) floor and third floor for 175,000 volumes in the Humanities and Social Sciences, as well for seating space for 400 readers and quarters for the library administration and all technical services. Some parts of the first floor are being used for library receiving, binding preparation, serials acquisitions, and storage. University administrative offices are housed temporarily on other floors of the building. Future expansion will provide ten floors with a total area of approximately 167,000 square feet, to accommodate 2,000 readers and 800,000 volumes.

The Engineering, Mathematics and Science Library occupies temporary quarters of 11,000 square feet on the ground floor of the west wing of the Engineering Building. This space houses 80,000 volumes of books and bound periodicals in Science, Mathematics and Technology, 1700 current journals and a fine collection of indexes, abstracts and other reference materials. There are 160 seats at study tables and carrels. It is anticipated that this divisional library will move to the fourth floor of the Mathematics and Computer Science Building in August, 1968. Some 34,000 square feet of space will be available, with accommodation for about 550 readers.

The total library holdings of the University include approximately 250,000 volumes of books and bound journals, 3,600 current periodical subscriptions and many kinds of special materials. The collection is increasing at the rate of 60,000 volumes per year, and more than half a million dollars per year is now being spent to build a collection that will have the richness and depth necessary for the scholarly research required by our undergraduate, post-degree and research programmes.
A staff of professional librarians and supporting personnel, now numbering more than 100, will be happy to assist users of both libraries to make the best possible use of the library collections and facilities. A Student Library Handbook explains the arrangement of library materials, the classification system, circulation procedures, and general rules and regulations. It also outlines library hours and provides useful floor plans. A similar handbook for members of the faculty will soon be issued.

The library has successfully completed its first venture into automation with a computer-produced Serials List, now in its second edition. The annual volume is kept up-to-date with weekly supplements which are available at all service points in the libraries. The annual cumulation is distributed to academic departments and to other academic libraries; and provides quick reference to our serials holdings. The next step in automation, now in the programming stage, will be the mechanization of our circulation system, with acquisition and cataloguing procedures to follow. Computerization will allow the library to provide services not possible with manual procedures, and the computer will perform many routine tasks with speed and accuracy.
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 work 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 experience related to their fields of service. 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.

Associate Directors
G. L. White, B.A.Sc. (Toronto), P.Eng.

Engineering, Applied Physics and Applied Chemistry

Assistant Director

Co-ordinators
D. G. S. Anderson, B.A.Sc. (Toronto), P.Eng.
H. D. Ball, B.A. (Western), P.Eng.
R. E. Findlay, B.Sc. (McGill), 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.
R. D. Mumford, B.Sc. (Queen's), P.Eng.
W. A. Runge, 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

Co-ordinators
T. H. Fitzgerald, B.A. (St. Lawrence).
B. A. McCallum, B.A. (Western).
S. R. Stankus, B.Sc. (R.M.C.)
R. J. Wieser, B.Eng. (Saskatchewan), P.Eng.
Co-operative Applied Psychology

Co-ordinator
R.J. Walsh, B.A. (Queen's)

Co-operative Physical and Health Education

Co-ordinators
J.D. Paton, B.A. (U.N.B.), Rec. Cert. (Western)
J.D. Pearse, B.A. (Toronto)

Environmental Studies—Architecture

Co-ordinator
J.W. Hoag, B.Arch. (Toronto).

Career Planning and Placement

C.F. Burk, M.A.Sc. (Toronto), P.Eng.
Miss E. McTavish, B.A. (Toronto), M.A. (Colorado State)
J.D. Stewart, B.A.Sc. (Toronto)

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
In the standard co-operative programmes all year 1 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. As far as possible students' choices of A or B streams will be honoured, but in the case of imbalance of the streams, students may be placed arbitrarily in either stream. Precise dates for the beginning and end of various terms are shown in the Academic Calendar. The eight terms of study and six terms of employment provided in the standard co-operative programmes are arranged as shown in the diagram below:

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<td>Fall</td>
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<tr>
<td>&quot;A&quot;</td>
<td>First Term</td>
<td>Second Term</td>
<td>Work Period</td>
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<tr>
<td>&quot;B&quot;</td>
<td>First Term</td>
<td>Work Period</td>
<td>Second Term</td>
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<tr>
<th>Stream</th>
<th>1971</th>
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<td>Winter</td>
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<td>&quot;A&quot;</td>
<td>Fifth Term</td>
<td>Work Period</td>
<td>Sixth Term</td>
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<td>&quot;B&quot;</td>
<td>Work Period</td>
<td>Fifth Term</td>
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Co-operative Physical and Health Education operates on "A" steam only, and variations of the standard programme are used for Environmental Studies—Architecture and Co-operative Applied Psychology, and the new Co-operative Mathematics teaching option.

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 commits students to the acceptance of 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.
By registering in a co-operative course, students give permission for the release of their marks to employers. Academic marks and work term evaluations are included in the student records which are sent to prospective employers in the course of the interview progress. Copies of examination reports received by students while on work assignments are provided for the information of co-operating employers.

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 employers may consult with the Co-ordination Department. Wages can be expected to increase when merited as the student progresses through the course and assumes more responsibility. However, the student should not expect the income from his work periods to make him completely self-supporting.

Although the Co-ordination Department does not guarantee placement of students, 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 applying for interview appointments. An interview schedule is prepared and the employers' representatives interview the students on campus. In signing for an interview, a student undertakes to accept the employment offered if he should be chosen. Under certain conditions and with the permission of the Co-ordination Department a student may be allowed to withdraw from a specific job situation. The experience obtained in these interviews 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 employers will not obtain the students they have selected. Consequently, the Department will make every effort to place these students and satisfy the employers 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.

Students in co-operative courses are required to return for a second work term when acceptable to employers. Valid reasons for exceptions to this rule will be considered by the Co-ordination Department. Additional work terms with co-operative organizations are a matter of mutual agreement between employers and students.

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. The failure of a student in two work terms will result in a thorough investigation of his performance. Unless there are extenuating circumstances, he may be suspended or required to withdraw from the course. The Co-ordination Department maintains a close liaison with the faculties, with employers and with the students, so that a valid assessment of a student's progress can be made by members of the Department.

The student is required to prepare a "work report" on some phase of his current employment during each work assignment. A report must be submitted each time a student returns to the University for an academic term. The report must be approved by the employer and submitted to the Co-ordination Department at the times set forth in work report instructions.

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 field as he progresses through the course.

It is emphasized that during the student's work periods 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 an employer 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 business 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 practical phases of his education.
Industrial Advisory Council for
Co-operative Engineering and Applied Sciences

The Industrial Advisory Council is composed of delegates from organizations interested in education in engineering and the applied sciences. The Council acts in an advisory capacity to the University on the programming of the co-operative courses in engineering, applied chemistry and applied physics as it affects the relations of the University and its students with industry. A list of members follows:

Fiberglas Canada Limited
C. C. Parker and Associates
Shell Canada Limited
Air Canada
Aluminum Company of Canada Limited
Ball Brothers Limited
Coulter Copper & Brass Co. Ltd.
Du Pont of Canada Limited
City of Hamilton
Hawker Siddeley Canada Limited
Kaufman Footwear Limited
Kimberly-Clark Pulp & Paper Co. Ltd.
Northern Electric Company Limited
Ontario Department of Highways
Pigott Construction Company Limited
Proctor & Redfern
Public Service Commission
The Steel Company of Canada Limited
Woods, Gordon and Company

Mr. A. J. Fisher
Chairman
Mr. C. C. Parker
Vice-Chairman
Mr. H. L. Hinchcliffe
Secretary
Mr. A.E. Ades
Mr. H. J. Baker
Mr. L. J. Eskritt
Mr. W. R. Coulter
Dr. H. R. L. Streight
Mr. W. A. Wheten
Mr. W. D. Walker
Mr. W. H. Bechtel
Mr. C. C. Wright
Dr. F. S. Eadie
Mr. H. W. Adcock
Mr. D. H. Stevens
Mr. A. Staig
Dr. D.H. Laughland
Mr. C. P. Layard
Mr. H. P. Connor

Companies Employing Co-operative Honours Mathematics Students

A. G. T. Management Systems Consultants
H. G. Acres & Company Limited
Air Canada
Allied Towers Merchants Limited
Aluminum Company of Canada, Limited
A. E. Ames & Company
Atlas Steels Company
Atomic Energy of Canada Limited
Automatic Electric (Canada) Limited

Bata International Centre
The Bell Telephone Company of Canada
The British American Oil Company Limited
Budd Automotive Company of Canada Ltd.
Burroughs Business Machines Ltd.

The Canada Life Assurance Company
Canadair Limited
Canadian Aviation Electronics Ltd.
Canadian Canners Limited
Canadian General Electric Company Limited
Canadian Imperial Bank of Commerce
Canadian Industries Limited
Canadian Ingersoll-Rand Company Limited
Canadian International Paper Co.
Canadian Kodak Co., Limited
Canadian Marconi Company
Canadian National Railways
Canadian National Telecommunications
Canadian Pacific Railway Company
Canadian Tire Corporation Limited
Cockshutt Farm Equipment of Canada Ltd.
Computel Systems Ltd.
Confederation Life Association
The Consumers' Gas Company
Continental Can Co. of Canada Limited
Co-operators Insurance Association
Crown Life Insurance Co.

DCF Systems Limited
The De Havilland Aircraft of Canada Ltd.
Deloitte, Plender, Haskins & Sells
Dominion Dairies Limited
Dominion Foundries and Steel Limited
Dominion Life Assurance Company
Dominion Stores Limited
Dominion Textile Company Limited
Domtar Limited
Domtar Packaging Limited
Dunlop Canada Limited
Dupont of Canada Limited

The T. Eaton Co. Limited
City of Edmonton
Electric Reduction Company of Canada Ltd.
The Empire Life Insurance Company
The Excelsior Life Insurance Company

Falconbridge Nickel Mines Limited
Firestone Tire & Rubber Company of Canada, Ltd.
Ford Motor Company of Canada, Limited

Galt Metal Industries Limited
General Foods Limited
Department of Co-ordination and Placement

General Motors of Canada, Limited
General Spring Products Limited
Global Life Insurance Company
B. F. Goodrich Canada Limited
Goodyear Tire & Rubber Co. of Canada Limited
Government of Canada
Central Data Processing
Dept. of Agriculture
Dept. of Energy, Mines & Resources
Dept. of Finance
Dept. of Mines & Technical Surveys
Dept. of National Defence
Dept. of National Health & Welfare
Dept. of National Revenue
Dept. of Northern Affairs
Dept. of Transport
Dominion Bureau of Statistics
National Energy Board
Post Office Department
W. R. Grace & Co. of Canada Limited
Great-West Life Assurance Company

Honeywell Controls Limited
The Hydro-Electric Power Commission of Ontario
Hydro-Quebec

The Imperial Life Assurance Company of Canada Limited
Imperial Oil Limited
Imperial Tobacco Company of Canada Limited
Industrial Acceptance Corporation Limited
International Business Machines Company Limited
International Harvester Company of Canada, Limited
The International Nickel Company of Canada Ltd.

Kingsway Transports Ltd.

John Labatt Limited
Liquor Control Board of Ontario
London Life Insurance Company

Manitoba Hydro
The Manufacturers Life Insurance Company
McKinnon Industries Limited
Mead Johnson of Canada Ltd.
Metropolitan Life Insurance Company
Minnesota Mining & Manufacturing of Canada Limited
Bank of Montreal
Montreal Life Insurance Company
Montreal Trust Company
The Mutual Life Assurance Company of Canada
Mutual of Omaha
The National Life Assurance Company of Canada
North American Life Assurance Company
Northern Electric Company Limited
Northern Employers Group
Northern Telephone Limited
Board of Education for the Borough of North York
The Bank of Nova Scotia
Province of Nova Scotia,
Dept. of Provincial Secretary

Ontario Institute For Studies in Education
Province of Ontario
Department of Education
Department of Highways
Treasury Board
Oshawa Wholesale Limited
Outboard Marine Corporation of Canada, Ltd.

Pan American Petroleum Corporation
Phoenix of London Group
Polymer Corporation Limited
The Procter & Gamble Company of Canada Limited
The Prudential Assurance Company Limited
Department of Co-ordination and Placement

Queen's University

Recording & Statistical Corporation Limited
Robin Hood Flour Mills Limited
Rothmans of Pall Mall Canada Limited
The Royal Bank of Canada
Ryerson Polytechnical Institute

Township of Scarborough
J. M. Schneider Limited
House of Seagram
I. P. Sharp Associates Limited
Shell Canada Limited
Simpsons-Sears Limited
The Sovereign Life Assurance Company of Canada
The Steel Company of Canada Limited
Sun Life Assurance Company of Canada
Sunshine Uniform Supply Co. Limited

Texaco Canada Limited
City of Toronto, Finance Dept.
The Toronto Stock Exchange
Toronto Traffic Control
Toronto Transit Commission
The Toronto-Dominion Bank
Traders Group Limited

Union Gas Co. of Canada Limited
United Aircraft of Canada Limited
United Co-operatives of Ontario
United Investment Services Limited
United Shoe Machinery Company of Canada Limited
Univac-Canada, Division of Sperry-Rand Limited

Wabush Mines
University of Waterloo
*Dept. of Civil Engineering*
Computer Centre
*Management & Systems Engineering*
University of Western Ontario
Workmen's Compensation Board

Organizations Employing Co-operative Physical and Health Education Students

Arnprior District High School
Breithaupt Recreation Centre, Kitchener
Burlington Recreation & Parks Department
Organizations Employing Co-operative Applied Psychology Graduate Students

Alcoholism & Drug Addiction Research Foundation, Toronto Clinical Services
Brantford, The Board of Education for the City of
Department of Co-ordination and Placement

Centre for Vocational Services, Hamilton
Government of Canada,
Public Service Commission
Department of Veterans Affairs
Hamilton Mental Health Clinic for Children & Adolescents
Jewish Vocational Service, Toronto
The Kitchener Separate School Board
Kitchener-Waterloo Hospital, Department of Psychiatric Services
Ontario, Province of
Department of Civil Service, Training & Personnel Research Branch
Department of Health, Lakeshore Psychiatric Hospital
Department of Reform Institutions, Guelph Reformatory
Oshawa, The Board of Education of the City of
Ottawa, Public School Board, City of
Rehabilitation Foundation for the Disabled, Toronto
St. Michael's Hospital, Dept. of Psychological Services, Toronto
Sutherland Educational Clinic, Toronto
Toronto Metropolitan Separate School Board
Windsor Board of Education
The Workmen's Compensation Board, Hospital & Rehabilitation Centre
Y. M. C. A. Counselling Services, Toronto

Companies Employing Co-operative Engineering, Applied Physics and Applied Chemistry Students

Abex Industries of Canada Limited
Abitibi Power and Paper Company Limited
H. G. Acres & Company Limited
Aerovox Canada Limited
Ainley & Associates
Air Reduction Canada Limited
Ajax Engineers Limited
The Algoma Steel Corporation, Limited
Allen-Bradley Canada Limited
Allied Chemical (Canada) Limited, Brunner Mond Division
Aluminum Company of Canada, Limited
Aluminum Goods Limited
Aluminum Laboratories Limited
American-Standard Products (Canada) Ltd.
Ampex of Canada Ltd.
Andrew Antenna Company Limited
Angelstone Limited
H. H. Angus & Associates Ltd.
Anthes Eastern Limited
C. G. Russell Armstrong
Armstrong Construction Company
S. A. Armstrong Ltd.
Atkins Hatch & Associates Limited
Atlas Steels Company
Atomic Energy of Canada Limited
Aunor Gold Mines Limited
Automatic Electric (Canada) Limited
Automotive Hardware Limited
Aviation Electric Limited

Babcock-Wilcox Canada Limited
Bailey Meter Company Limited
Ball Brothers Limited
A. H. Banani & Associates Limited
Barber-Colman of Canada Ltd.
Barringer Research Limited
Barton Tubes Limited
Bata Shoe Company of Canada Limited
Baxter Laboratories of Canada Ltd.
Beatty Bros. Limited
Beaver Construction (Ontario) Limited
The Beaver Wood Fibre Company, Limited
Beer Precast Concrete Limited
Bell-Camp Corporation Limited
The Bell Telephone Company of Canada
Beller Steel Company
Bendix-Eclipse of Canada Limited
Bennett & Wright Contractors Limited
Bick's of Canada Limited
Biltmore Hats Limited
Black-Clawson-Kennedy Ltd.
Black and Decker Manufacturing Company Ltd.
Black & McDonald Limited
Blackstone Industrial Products Limited
Black, Shoemaker & Robinson
Blacktop Paving Company Limited
G. S. Blakeslee Equipment Limited
Blenkborn and Sawle Limited
W. H. Bonus & Associates Ltd.
The Borden Chemical Company (Canada) Ltd.
Borg-Warner (Canada) Limited
Bot Construction Company Limited
Brampton, Town of
Brandoflex Limited
Brant, County of
Brantford Concrete Pipe Company Limited
Brantford, The Corporation of the City of
The Brantford Cordage Company, A Division of Tancord Industries Ltd.
Brantford, Public Utilities Commission
Brantford Trailer & Body Limited
B. P. Refinery Canada Limited
Department of Co-ordination and Placement

The British American Oil Company Limited
British-American Research & Development Company
Brockville Chemical Industries Ltd.
Brown Forest Industries Limited
Brown & Root Limited
Brunswick of Canada Ltd.
Building Products of Canada Limited
Burlington, Corporation of the Town of
Burlington, Public Utilities Commission of
Burroughs Business Machines Ltd.
Butts, Ross & Associates, Ltd.

Calvert Distillers Limited
Canbar Wood Tank Company - Division of Canada Barrels & Kegs Ltd.
Canada & 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 Acme Screw & Gear Limited
Canadian Admiral Corporation, Ltd.
Canadian Allis-Chalmers Limited
The Canadian Blower & Forge Company Limited
Canadian Broadcasting Corporation
Canadian Carborundum Company Limited
Canadian Coleman Company, Limited
Canadian Copper Refiners Limited
Canadian Electrolytic Zinc Company Limited
Canadian General Electric Company Limited
Canadian General-Tower Limited
Canadian Gypsum Company 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 Kodak Co., Limited
Canadian Marconi Company
Canadian Mitchell Associates Ltd.
Canadian National Railways
Canadian National Telecommunications
Canadian Pacific Railway Company
Canadian Pacific Telecommunications
Canadian Pittsburgh Industries Ltd.
Canadian Refractories Limited
The Canadian Salt Company Limited
Canadian SKF Company Limited
Canadian Timken, Division of the Timken Roller Bearing Co.
Canadian Vegetable Oil Processing Ltd.
Canadian Vickers Limited
Canadian Westinghouse Company Limited
Canadian Wilbur B. Driver Limited
Can-Eng Consultants Ltd.
Wm H. Carr, O.L.S.
Carter Bros. (Waterloo) Ltd.
Catalytic Construction of Canada Limited
Cello Products (Preston) Div.
Chatham, City of
Chemcell Limited
Chicago Rawhide Products Canada Limited
Chinook Chemicals Corporation Limited
Chrysler Canada Ltd.
CLM Industries, Division of McGraw-Edison (Canada) Limited
C. P. Clare Canada Ltd.
Clevite Limited
Cobalt Refinery Limited
Columbian Carbon (Canada) Ltd.
Columbus McKinnon Limited
Cominco Ltd.
Computing Devices of Canada Limited
Consolidated Paper Corporation Limited
Consolidated Sand & Gravel Limited
The Consumers' Gas Company
Consumers Glass Co. Ltd.
Continental Can Company of Canada Limited
Cooper-Bessemer of Canada Ltd.
Coulter Copper & Brass Co. Limited
R. L. Crain Limited
Crane Canada Limited
Crane Packing Company, Limited
Crouse-Hinds Company of Canada Limited
Croven Limited
Crowe Foundry Limited
CSA Testing Laboratories
Cunningham-Limp Limited
Cyanamid of Canada Limited

Dahmer Steel Limited
Damas & Smith Limited
Dashwood Planing Mills Ltd.
Davenport-Campbell Ltd.
Daystrom, Limited
Dearborn Chemical Company Ltd.
Department of Co-ordination and Placement

Decca Radar (Canada) Limited
John Deere Welland Works
The DeHavilland Aircraft of Canada Limited
De Laval Company Limited
De Leuw, Cather & Company of Canada, Limited
Delmar Chemicals Limited
Deloro Stellite, Division of Deloro Smelting & Refining Co. Ltd.
M. M. Dillon & Company Limited
Dilworth Secord Meagher & Associates Limited
D & J Machine Shop
P. D. Dirksen Limited
Dodge Construction Company Limited
Dominion Bridge Company Limited
Dominion Chain Limited
Dominion Die Casting Limited
Dominion Foundries and Steel. Limited
Dominion M. I. Limited
Dominion Road Machinery Co. Limited
Domtar Chemicals Limited
Domtar Construction Materials Ltd.
Domtar Limited
Domtar Newsprint Limited
Domtar Pulp & Paper Limited
Donald Inspection Limited
Dorr Oliver-Long Ltd.
Dosco Industries Ltd.
Douglas Engineering Company Ltd., Vibro-Acoustic Division
Dow Chemical of Canada, Limited
Walter Dow & Company Ltd.
Dowdell & Associates
Dravo Corporation
Dryden Chemicals Limited
Dryden Paper Company Limited
Dufresne Engineering Company Limited
Dunker Construction Limited
Dunlop Research Centre
Du Pont of Canada Limited

Eagle Star Group
Eastern Steel Products Company - Div. of Turnbull Elevator Ltd.
Eaton Automotive Canada Limited
T. Eaton Company Limited
Ecstall Mining Company Ltd.
The E. B. Eddy Company
Edo (Canada) Limited
Eldorado Mining and Refining Limited
Electric Reduction Company Canada Limited
Electrical Bureau of Canada
Electrohome Limited
W. R. Elliott Limited
Ellis-Don Limited
Emco Limited
Erie Iron Works Co. Ltd.
Erie Technological Products of Canada, Ltd.
The Exolon Co.
Extrusion Machine Co. Ltd.

Factory Mutual Engineering Division
Fairchild Semiconductor
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
Fitzmaurice & Boyer, O. L. S.
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
W. J. Gage Limited
Galt, City of
Gamma Engineering Ltd.
Garrett Manufacturing Limited
Gaspe Copper Mines Limited
Gates Rubber of Canada Ltd.
Genaire (1961) Ltd.
General Concrete Ltd.
General Foods Limited
General Motors of Canada, Limited
General Spring Products Limited
General Wire & Cable Co. Ltd.
Gerencser & Russell
Giffels Associates Limited
Gilvesy Construction Limited
Globe Stamping Co. Ltd.
B. F. Goodrich Canada Limited
The Goodyear Tire & Rubber Company of Canada, Limited
Gore & Storrie Limited
Gould-National Batteries of Canada Limited
Government of Canada:
Analytical Chemistry Research Service
Department of Energy, Mines & Resources
Department of Fisheries
Department of National Defence
Department of National Health & Welfare
Department of Public Works
Department of Transport
Post Office Department
W. R. Grace & Co. of Canada Ltd.
The Great Lakes Paper Company, Limited
A. P. Green Refractories (Canada) Ltd.
Grey, County of
The Griffith Laboratories Ltd.
Guelph, City of

Hahn Brass Limited
Hamilton, The Corporation of the City of
Hamilton Gear and Machinery Company - Division of Turnbull
Hamilton Hydro-Electric System
J. Harris & Sons Limited
E. A. Hastings Ltd.
Hawker Siddeley Canada Limited
Hawley Engineering Ltd.
Hayes-Dana Limited
Hayes Steel Products Limited
H. J. Heinz Company of Canada Ltd.
R. R. Higgins & Associates Limited
Hollinger Consolidated Gold Mines
Holman Bros., (Canada) Limited
Holstead & Orendorff
Honeywell Controls Limited
The Hoover Company Limited
Horton Steel Works Limited
C. D. Howe Company Limited
Huntec Limited
Hussman Refrigerator Company Limited
The Hydro-Electric Power Commission of Ontario
Hyon, Canada Limited

Imperial Oil Enterprises Ltd.
Inspiration Limited
Interchem Canada Limited - Ault & Wiborg Division
International Business Machines Company Limited
International Harvester Company of Canada Limited
International Nickel Company of Canada, Limited
International Systcoms Limited
Interprovincial Corrosion Control Co. Ltd.
Iron Ore Company of Canada
I-T-E Circuit Breaker (Canada) Limited
Jeffrey Manufacturing Company Limited
Jerrold Electronics (Canada) Limited
S. C. Johnson & Son Limited
Jones & Laughlin Steel Corporation - Adams Mine
Joy Manufacturing Company (Canada) Limited

Kaufman Footwear Limited
Keates Organ Company Limited
Kellogg Company of Canada, Limited
The Kendall Company (Canada) Limited
Harold Kerr Construction Ltd.
Kerr-Addison Mines Limited
Kieswetter's Limited
Kimberly-Clark of Canada Limited
Kimberly-Clark Pulp & Paper Company Limited
Kitchener, City of
Kitchener Electronic Industries Limited
Kitchener Water Commission
Kitchener-Waterloo Hospital
Konvey Construction Company Limited
Kruger Pulp and Paper Limited
Kruschen & Dailey
Kuntz Electroplating Limited
The KVP Company Limited

John Labatt Limited
Lake Ontario Steel Company
Legatt Aircraft Limited
Leigh Instruments Limited
Lennox Industries (Canada) Limited
Lever Brothers Limited
Link-Belt Limited
Link-Belt Speeder (Canada) Limited
Liquid Carbonic Canadian Corporation Limited
Litton Systems (Canada) Limited
Logan Contracting Limited
London, City of
W. P. London & Partners
Looby Construction Ltd.
Lundy Steel Products

Robert McAlpine Limited
McCavour Developments Limited
W. A. McDougall Ltd.
McGrath Engineering Limited
McGrath Associates Limited
McIntyre Porcupine Mines, Limited
A. M. MacKay & Associates Limited
Arthur G. McKee & Company of Canada Ltd.
McKinnon Industries Limited
Department of Co-ordination and Placement

James F. MacLaren Limited
MacLeod Cockshutt Gold Mines Limited
McNamara Marine Limited
M & T Products of Canada Ltd.
Madsen Red Lake Gold Mines Ltd.
Malcolm Construction Company
Mallory Battery Company of Canada Limited
Mansfield-Denman General Limited
Marshall Macklin Monaghan Limited
Marsland Engineering Limited
E. F. Marston Construction Ltd.
Ian Martin Associates Limited
V. K. Mason Construction Co. Ltd.
Massey-Ferguson Brantford Limited
Mathews Conveyor Company Limited
Mattagami Lake Mines Limited
Metcana Products Ltd.
Milltronics Limited
Minnesota Mining & Manufacturing of Canada Limited
Mobil Paint Company
O. G. Moffat Limited
Moffats Limited
Mollenhauer Contracting Co. Ltd.
Molson's Brewery (Ontario) Limited
Montreal Engineering Company Limited
Morval Products Limited
Murray Printing & Gravure Limited

National Research Council
National Semiconductor Limited
National Sewer Pipe Limited
National Steel Car Corporation Limited
Niagara Falls, City of
R. H. Nichols Co. Limited
Nisbet, Letham Ltd.
Norak Steel Construction Ltd.
Noranda Mines Limited
North Bay, City of
Northern Electric Company Limited
Northern Telephone Limited
Norton Company
Nuclear Products Ltd., Division of Rio Algom Mines Limited

Oakville, Town of
Oakville, Public Utilities Commission of
O. H. M. Distributors & Manufacturers Ltd.
Oliver, Lloyd and Associates Limited
W. H. Olsen Manufacturing Company Limited
The Ontario Paper Company Limited
Ontario, Province of

Department of Health
Department of Highways
Department of Mines
Ontario Water Resources Commission
Orphan Mines Limited
Ortho Pharmaceutical (Canada) Ltd.
The Public Utilities Commission of the City of Oshawa
Otaco Limited
Otis Elevator Co. Ltd.

Parke, Davis & Company, Limited
C. C. Parker and Associates Limited
John B. Parkin Associates
Ralph M. Parsons Construction Co. of Canada, Ltd.
County of Peel, Assessment Dept.
Peterborough, City of
E. M. Peto & Associates Limited
W. R. Petri, P. Eng.
Pigott Construction Company Limited
Pioneer Electric Eastern Limited
Pioneer Saws Limited
Jos. F. M. Poelman & 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
Process-Instrument Systems Ltd.
Procor Limited
The Procter & Gamble Company of Canada, Limited
Proctor & Redfern
Pro-Eco Limited
Provincial Gas Company Limited
Purolator Products (Canada) Limited

The Quaker Oats Company of Canada Limited
Quebec North Shore Paper Company
Quemont Mining Corporation, Limited
Quist & Associates

Ralston-Purina of Canada Ltd.
Raytheon Canada Limited
RCA Victor Company, Ltd.
Redfern Construction Company Limited
Reid Crowther & Partners Limited

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Department of Co-ordination and Placement

Reuter-Stokes Canada Limited
Peter E. Rhodes & Associates
Rio Algom Mines Limited
Wm. Roberts Electric Limited
P. L. Robertson Manufacturing Co. Limited
Robertson-Yates Corporation Limited
E. S. & A. Robinson (Canada) Limited
Roelofson Elevator Company - Div. of Montgomery Elevator Co. Ltd.
B. M. Ross and Associates Limited
Royal Military College of Canada
Rubbermaid (Canada) Limited
Ryba, Smith & Ginsler Ltd.
Ryco Cape Company

St. Lawrence Cement Co.
The St. Lawrence Seaway Authority
St. Mary's Cement Co., Limited
St. Thomas, City of
St. Williams Preservers Limited
Salter & Allison
Sandwell and Company Limited
Sarco Canada Limited
Sarnia Inspection Company Limited
Sarnia Scaffolds Limited
Scarborough General Hospital
F. Schaeffer & Associates Limited
Schell Industries Ltd.
J. M. Schneider Limited
Schwenger Construction Limited
L. H. Schwindt & Co. Limited
Joseph E. Seagram & Sons Limited
Sefer Limited
Sehl Engineering Limited
Shawinigan Chemicals Limited
Sheldons Engineering Limited
Shell Canada Limited
The Sherwin-Williams Co. of Canada
M. V. Shore & Associates
Shore & Moffat and Partners
Sick Children's Hospital
A. Simard Inc.
A. C. Simmonds & Sons Ltd.
Sinclair Radio Laboratories Ltd.
Sinterings Limited
S. N. C. Filer, Limited
C. R. Snelgrove Co. Ltd.
Aden B. Snyder Electric Limited
Southam Murray Printing & Gravure Limited
Sperry Gyroscope Co. of Canada, Ltd.
Spruce Falls Power & Paper Co. Limited
Standard Paving & Materials Ltd.
Standard Tube & T. I. Limited
Stanley Steel Co. Ltd.
The Steel Company of Canada, Limited
Steep Rock Iron Mines Limited
Stephens-Adamson Mfg. Co. of Canada, Limited
Stone & Webster Canada Limited
Stratford, City of
Sudbury, City of
Sun Oil Company Limited
Sunshine Office Equipment Limited
Surveyer, Nenniger & Chenevert
Swansea Construction Company Limited

Tele-Radio Systems Limited
Texaco Canada Limited
Texas Instruments Inc.
Thompson Products Limited
Timberland-Ellicott Limited
Timber Structures, Div. of Foldaway Furniture Ltd.
T M C (Canada) Limited
Toronto, City of
Board of Education
Department of Public Works
Toronto, The Corporation of the Township of
Toronto East General & Orthopaedic
Toronto Foundry Limited
Toronto, Municipality of Metropolitan
Department of Works
Toronto Star Limited
Toronto Transit Commission
Totten, Sims, Hubicki & Associates Ltd.
Trans-Canada Pipe Lines Limited
W. A. Trow & Associates Limited

Union Carbide Canada Limited
Union Drawn Steel Company, Limited
Union Gas Company of Canada, Limited
UniRoyal (1966) Limited
United Aircraft of Canada Limited
Unitel Limited
Universal Plumbing & Heating Company (1961) Limited
Univex Canada Limited
Ure & Smith

Versafood Services Limited
Vickers-Sperry of Canada Ltd.

Wabush Mines
Walter, Eull & Elliott Ltd.
Walter, Fedy & Associates Ltd.
Ward Leonard of Canada Limited
The Warner & Swasey Company
Warnock-Hersey Company Ltd.
Waterloo, City of
Waterloo, County of
Waterloo Public Utilities Commission

University of Waterloo

Audio Visual Centre
Dept. of Chemical Engineering
Dept. of Civil Engineering
Dept. of Design
Dept. of Electrical Engineering
Dept. of Mechanical Engineering
Dept. of Physics
Engineering Computing Centre
Management and Systems Engineering
Water Resources Institute

Jervis B. Webb Company of Canada, Ltd.
Welland, County of
John Wheelwright Limited
Willroy Mines Limited
George Wimpey & Company Limited
Winchester-Western (Canada) Ltd.
John Wood Company Limited
The W. C. Wood Company Limited
XIII

Scholarships, Bursaries, Prizes and Financial Aid
Undergraduate Scholarships

King George VI and Queen Elizabeth Scholarship
The Province of Ontario will award this Scholarship to the student graduating from Grade 13 with the highest aggregate marks in the number of papers required for an Ontario Scholarship and who enrols in a degree course, other than Divinity, at an Ontario University in the month of September following the award. The Scholarship has a value of $500 a year, for a maximum of four years, provided at least second class honour standing is maintained. No application is required.

Ontario Scholarship Programme
The Province of Ontario awards an Ontario Scholarship to all students who achieve an average of 80 per cent or better in papers worth seven credits, as required for the Ontario Secondary School Honour Graduation Diploma, and written in June of the year of completion of Grade 13. These students will be designated "Ontario Scholars" and will receive an award of $150.

National and University Scholars
The following students have been named University National and University Scholars for the 1967-68 academic year.

University National Scholars
Uldis Alfred Celmins
Gordon Rowe Chapman
Jane Deborah Conway
William Bruce Cowan
Ronald Earl Davey
Sheila Margaret Dennett
Richard Lawrence Ferch
Mary Joanne Garvey
Rodney Stuart Hallsworth
John Joseph Koval
Jack Lubeck
Carol Ann Mains
Stephen Rolf Pettin
Carla Mary Small
Douglas Allan Squire
Glenn Brian Strathdee
Robert James Vodarek

Weston, Ontario
Oakville, Ontario
Ottawa, Ontario
Waterloo, Ontario
Brampton, Ontario
King, Ontario
Fort William, Ontario
Barrie, Ontario
Marathon, Ontario
Sarnia, Ontario
Toronto, Ontario
Ottawa, Ontario
Rexdale, Ontario
Guelph, Ontario
Granton, Ontario
St. Pauls, Ontario
Leamington, Ontario

Mathematics I
Mathematics I
Mathematics I
Science I
Mathematics I
Science I
Science IV
Science I
Science I
Mathematics I
Mathematics I
Mathematics I
Mathematics I
Engineering I
Science I
Engineering I

University Scholars.
Nora Janet Abbson
Nancy Margaret Adamovits
Rosalie Evelyn Adams
Barry Grant Adams
Dennis Lee Adams
Gary Ross Adams
Alan Aage Adamson
Margaret Elizabeth Aitchison

Brantford, Ontario
Bramalea, Ontario
Scarborough, Ontario
Paris, Ontario
Toronto, Ontario
Port Coborne, Ontario
Manotick, Ontario
Windsor, Ontario

Mathematics II
Science II
Mathematics I
Mathematics II
Engineering II
Engineering IV
Mathematics II
Mathematics I
Scholarships, Bursaries, Prizes and Financial Aid

Gary George Albach  
Catherine Mary Albers  
Carl Wayne Alexander  
Russell Ivan Alexander  
Francis Ronald Allaire  
Richard Brian Allen  
Virginia A. Andreoli  
Viesio W. Aniol  
Iiris Marja-Lizsa Arvola  
Michael James Ash  

Gary George Albach  
Catherine Mary Albers  
Carl Wayne Alexander  
Russell Ivan Alexander  
Francis Ronald Allaire  
Richard Brian Allen  
Virginia A. Andreoli  
Viesio W. Aniol  
Iiris Marja-Lizsa Arvola  
Michael James Ash

Ridgeway, Ontario  
Toronto, Ontario  
Welland, Ontario  
Ottawa, Ontario  
Timmins, Ontario  
Kingsville, Ontario  
Toronto, Ontario  
Sudbury, Ontario  
Toronto, Ontario  
London, Ontario

Science II  
Mathematics I  
Engineering III  
Engineering II  
Mathematics I  
Engineering III  
Mathematics I  
Engineering II  
Mathematics I  
Engineering II

Sharon D. Baechler  
David Albert Baechler  
John David Bailie  
Donald John Baird  
Thomas Charles Baker  
Wayne Carman Baker  
Gordon Richard Ball  
Robert Ewart Banyard  
James Robert Barney  
Bonnie Ann Barton  
John Trelawyn Batchelor  
Wayne Beverley Baynham  
Richard John Beach  
Neil Vernon Beamer  
Nocham Nenny Beckerman  
Bruce Dennis Bellaire  
Edward Belobaba  
Ronald Cecil Bender  
David George Bennett  
Joanne Therese Catherine Berges  
Thomas George Berry  
Bevin Earl Bilton  
John William Boland  
Bernard Werner Bos  
Maria-Anne Ernst Boterman  
John Michael Boyarchuk  
Bryan P. Brady  
Paul Joseph Brennan  
Kenneth Jerome Brenner  
Mara Lee Britney  
Kenneth Stephen Brown  
Robert Leigh Brown  
Russell William Brown  
William Franklin Brown  
Linda Louise Brox  
Christian Bruckschaiger  
John Robert Bucher  
Kenneth Allan Buckingham  
Richard Bjarki Bugatsch  

Zurich, Ontario  
Waterloo, Ontario  
Leamington, Ontario  
Baden, Ontario  
North Bay, Ontario  
Brussels, Ontario  
Ottawa, Ontario  
Hamilton, Ontario  
Fort William, Ontario  
Scarborough, Ontario  
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Exeter, Ontario  
Cobourg, Ontario  
Welland, Ontario  
Don Mills, Ontario  
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Waterloo, Ontario  
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Weston, Ontario  
Preston, Ontario  
St. Thomas, Ontario  
Mount Forest, Ontario  
Smith Falls, Ontario  
Sault Ste. Marie, Ontario  
Kitchener, Ontario  
Frankford, Ontario  
Seaford, Ontario  
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Tavistock, Ontario  
Ingleside, Ontario  
Orillia, Ontario  
Lindsay, Ontario  
Downsview, Ontario  
Mindemoya, Ontario  
Waterloo, Ontario  
London, Ontario  
Guelph, Ontario  
Levack, Ontario  
Waterloo, Ontario

Arts I  
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<td>Karen Ena Crozier</td>
<td>Stoney Creek</td>
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### Scholarships, Bursaries, Prizes and Financial Aid

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<thead>
<tr>
<th>Name</th>
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<th>Subject</th>
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<tr>
<td>Ian MacDonald Cunningham</td>
<td>Scarborough, Ontario</td>
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<td>Picton, Ontario</td>
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Scholarships, Bursaries, Prizes and Financial Aid

Bruce Douglas Henry
Pamela Joan Heron
James Donald Hewitt
Timothy Richard Hicks
Dorothy Jean Hildebrand
Paul George Hill
Robin Bernard Hill
Douglas Bruce Hodgins
Clive Hodson
Sally Jane Holton
J. George Hopkins
Manfred Henry Hubert
Peter Melvin Huck
Paul William Humphries
Elizabeth Sutherland Hunt
George Emerson Hunt
Margaret Ann Hunter
Dianne Mary Hussey

Lawrence James Jackson
Catharine Jean Johnson
Lorne James Johnson
Dilys Estelle Jones
Boywe Jonkman
Robert Sidney Jones
Marian Juzkiw

Sandra Anne C. Karges
Barbara Esther Kellerman
Judith-Anne Williams Kelly
Dennis Wayne Kerr
Terence Henry Keys
James Arthur King
Philip David King
William Richard Kinread
Robert Bernard Klein
Paul Philip Koenderman
Andrew Koziar
Jouni Paavo Kraft
Andrew Melvin Kramer
Christopher Nicholas Kroloszynski
Ole Falk Kristensen
Filen Marie Kukurin

Roger J. LaFleur
Kayll William Lake
Gerald Elie Lalonde
Dolf Landheer
Willie Edward Laurila
Jens Laursen

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Richmond Hill, Ontario
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<td>Mary Rose Schill</td>
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<tr>
<td>Terry Carl Schmidt</td>
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Scholarships, Bursaries, Prizes and Financial Aid

Ruth Ann Schnarr
Johannes Ave Schriel
Stephen Richard Schroeter
Richard John Schur
Gary Raymond Scott
William Edward Scott
Edward Herbert Sear
Derek Brian Seeley
William Arthur Serack
David Bruce Shuh
James Laverne Shute
Carl Albert Silke
Michael William Simpson
Richard Thomas Simpson
John Barry Sims
Edward Lawrence Skiba
David John Smith
Earl Thomas Smith
James John Smith
Vaughan Charles Smith
Douglas Jack Smyth
William James Snodgrass
Marjorie Elaine Snyder
Linda Lorraine Solomon
Shirley Marie Sonley
Eric David Soulis
Dora Elaine Speers
Kenneth Allan Spence
Maitland Jack Spencer
Lothar Steigerwald
Hans Jergen Stelzer
Michael Edwin Stephens
Joseph Perry Stephenson
Robert Amos Stoll
Douglas Carl Strahan
Rae William Struthers
Sydney John Stuart
Brian James Sullivan
Daniel Thomas Sullivan
Crispin Guy Sumner
Paul James Sutherland
Robert Leonard Swift
Robert Edward Taylor
William Joseph Taylor
Melvin Sutherland Ternan
Joseph Leo Tevaarwerk
Rejean Joseph Thibeault
James Frederick Thomson
Linda Kay Thorndyke

Waterloo, Ontario
Cooksville, Ontario
Waterloo, Ontario
Thorold, Ontario
Waterloo, Ontario
Brantford, Ontario
Hespeler, Ontario
Trenton, Ontario
Kitchener, Ontario
Bognor, Ontario
Pembroke, Ontario
Don Mills, Ontario
St. Catharines, Ontario
Scarborough, Ontario
Deep River, Ontario
North Bay, Ontario
Sarnia, Ontario
Belleville, Ontario
North Bay, Ontario
Weston, Ontario
Ottawa, Ontario
Kitchener, Ontario
Meaford, Ontario
Blackwater, Ontario
Kitchener, Ontario
Mono Road, Ontario
Galt, Ontario
Brantford, Ontario
Richmond Hill, Ontario
Westhill, Ontario
Islington, Ontario
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Goderich, Ontario
St. Marys, Ontario
Blair, Ontario
Barrie, Ontario
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Bobcaygeon, Ontario
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Galt, Ontario
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Sarnia, Ontario
UXbridge, Ontario
Cardinal, Ontario
London, Ontario
Montrook, Ontario
Oakville, Ontario
Port Hope, Ontario
Science I
Mathematics IV
Science III
Science II
Mathematics II
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Science IV
Science II
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Science I
Mathematics IV
Engineering III
Science I
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Engineering III
Science II
Mathematics I
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Engineering III
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<tr>
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Scholarships, Bursaries, Prizes and Financial Aid

Anthony Stephen Wyatt
Douglas Alexander Yonson
David Michael Young
John Macgregor Young
William Dennis Young
Patrick H. Zettel
Maya Zielanski
Fenwick, Ontario
Oshawa, Ontario
Don Mills, Ontario
Montreal, Quebec
Collins Bay, Ontario
Preston, Ontario
Downsview, Ontario
Mathematics I
Mathematics I
Science III
Engineering II
Engineering I
Arts II
Mathematics I

The American Optical Co. of Canada Ltd. Scholarship (value $525.00). The American Optical Co. of Canada Ltd. presents an annual scholarship to any Canadian student entering Year II in the School of Optometry.
Application for this Scholarship should be submitted to the Scholarship Committee before July 31st, 1968.

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.

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.

Centennial Optical Scholarship (value $500.00). The Centennial Optical Company provides a scholarship to a deserving Ontario student entering the first year in the School of Optometry.
Application for this Scholarship should be submitted to the Scholarship Committee before July 31st, 1968.

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 College of Optometrists of Ontario’s Scholarship (value $1,200.00). The award of the College of Optometrists of Ontario is made to an Optometry graduate who is recommended by the faculty and is proceeding toward a graduate degree at the University of Waterloo. The award is payable in installments subject to satisfactory achievement.
Application for this Scholarship should be submitted to the Scholarship Committee before July 31st, 1968.
Cominco Scholarships
To assist in ensuring a continuing supply of qualified graduates in fields vital to industry in Canada, Cominco Ltd. has established a programme of twenty-four scholarships at specified Universities in Canada. One of these scholarships will be awarded annually in the form of a two-year award of $800 per year, at the University of Waterloo. It is open to students who, in the fall, will enter the penultimate undergraduate year of a course leading to a degree in Chemical Engineering, Honours Geology, Geological Engineering, Mining, Mineral Engineering, Metallurgy, Metallurgical Engineering, Mechanical Engineering, Honours Chemistry, Soil Science, Agronomy. Students must apply to the University of Waterloo by November 1st, on forms obtainable from the Awards Officer, University of Waterloo, Ontario. Renewals for the second year will be subject to attainment of academic standards satisfactory to the Scholarship Committee of the University.

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.

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.

Friedrich Lehner Scholarship
This scholarship will be awarded to a third or fourth year undergraduate student of German Literature and Language.

The value of this award is $100 and is provided annually by Mr. Friedrich Lehner of Lehner Travel Service, Toronto, Ontario, Canada.

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.

The Institute of Chartered Accountants’ of Ontario Scholarship at the University of Waterloo
The Institute of Chartered Accountants of Ontario offers a scholarship to a third year student in the Faculty of Arts who expresses a definite interest in the field of Accountancy as a future career. Application should be made to the Office of the Registrar, University of Waterloo not later than September 30.

J. P. Bickell Foundation Scholarships
The Trustees of the J. P. Bickell Foundation provide a number of J. P. Bickell Foundation scholarships of $1,500, 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.

Kitchener-Waterloo Council of Friendship Scholarship Fund
The Kitchener-Waterloo Council of Friendship offers scholarships totalling $2,000. 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.

The Percy Hermant Centennial Bursary Scholarships are the gift of Sydney Hermant. Bursary Scholarships are awarded on the basis of academic achievement in first year General Science at any Canadian University and financial need to a student who is proceeding into Year II, School of Optometry. Six Scholarships are available, each of a total possible value of $1,200.00, being $300.00 per year over the four professional years (years II, III, IV and V) provided satisfactory standing is maintained. One scholarship is awarded to a student who resided in the Maritimes immediately prior to his first University year; two scholarships are awarded to students who resided in Ontario; three scholarships are awarded to students who resided in Western Canada. The various Provincial Optometrical Associations are consulted in awarding these Bursary Scholarships.

Application for this Scholarship should be submitted to the Scholarship Committee before July 31st, 1968.

Rotary District 709 Overseas Student Scholarship
Rotary District 709 offers a scholarship to a graduate or undergraduate student from a foreign country. The value of this scholarship is $1,300.

Applicants should have high scholastic ability, proficiency in English and ability to speak in public.

Application should be made before April 30, 1968, to the Awards Officer, Office of the Registrar, University of Waterloo.

Rotary Scholarship for Study Abroad
The Rotary Clubs of Kitchener & Waterloo offer a scholarship to an undergraduate or graduate student from the University of Waterloo to study abroad for one year. The value of this scholarship may be up to $1,500.

Applicants should have high scholastic ability, and be able to read, write and speak the language of the country in which he/she is to study.

Application should be made before April 30, to the Awards Officer, Office of the Registrar, University of Waterloo.

The Saskatchewan Optometric Association Scholarship (Value $400.00).
The Saskatchewan Optometric Association presents an annual scholarship of $400.00 to a Saskatchewan student enrolling in the School of Optometry.

Application for this Scholarship should be submitted to the Scholarship Committee before July 31st, 1968.

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.
University of Waterloo Physics Dept. Scholarship

The Physics Department has initiated a scholarship programme to recognize academic excellence in students proceeding to a degree in physics. Successful candidates are known as Physics Scholars and are eligible to receive a University of Waterloo Physics Department Scholarship valued at $600. Payment is $150 per annum, renewable each year provided a satisfactory standing is maintained.

Several designations and awards will be made each year by the Physics Scholarship Committee (five were given last year). Any student declaring an interest in PHYSICS at registration will automatically be considered for these awards.

Grade XIII students are informed that the results of the high school Canadian Association of Physicists examination written in the Spring may be used as a criterion in awarding the scholarships to freshmen.

Undergraduate Bursaries

Note:
Second Class standing is normally required of applicants for bursary assistance. Applications must be submitted by end of first month of first term unless otherwise indicated.

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.

Atkinson Charitable Foundation “In Course” Bursaries
The Atkinson Charitable Foundation has established an “In Course” bursary programme which 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.

Fireco Sales Limited Admission Bursary
Covering first year tuition costs, this bursary is available to a student showing good academic standing as well as financial need, who has worked in a grocery store during the last year of High School.

Applications are available at 1,500 grocery stores throughout Canada. Completed forms should be forwarded to the Registrar’s Office not later than September 15th.

Huron County Bursaries
Huron County Council has established a bursary fund at the University of Waterloo for students who attended High School in Huron County and whose home is in that
Scholarships, Bursaries, Prizes and Financial Aid

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 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.

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 program 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.

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.

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.

K-W University Women’s Club Bursary Fund
The University Women’s Club of Kitchener-Waterloo has established a bursary fund at the University of Waterloo to assist one or more girls in second, third or fourth year, who have attained Second Class Standing and are in need of financial assistance. Preference will be given to girls not holding tuition scholarships.

Application should be made on the forms provided by the Office of the Registrar.
Lambton County Bursary
Lambton County Council offers a bursary valued at $100. to a student from that County but excluding residents of the city of Sarnia.

Application should be made through 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.

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.

Middlesex County Bursaries
Middlesex County Council offers two bursaries, each valued at $150, to students from Middlesex County who are of approved academic standing and in need of financial aid.

Application should be made through the Office of the Registrar.

Selection will be made by the Senate Committee on Scholarships and Student Aid.

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.

Oxford County Bursaries
Oxford County Council has granted the University of Waterloo an amount of $800. to be distributed to Oxford County Students excluding those from the municipalities of Woodstock and Ingersoll. Students must be of good academic standing and in need of financial assistance.

Application should be made through the Office of the Registrar.

Perth County Bursary
Perth County Council offers two bursaries of $100 to deserving students beyond the freshman year. Candidates must have resided in Perth County for one year previous to admittance to the University of Waterloo.

Application should be made through the Office of the Registrar.
Scholarships, Bursaries, Prizes and Financial Aid

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.

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 Minnesota Mining 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.

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 a Resident of Kitchener or Waterloo.

Application should be made through the Office of the Registrar by October 15.

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.

Systems And Procedures Association Bursary In Computer Science
The Systems and Procedures Association offers a bursary of $250, to a student in Cooperative Honours Mathematics (Computer Science Option) who is entering the fourth year of studies.

The basis on which the awards are made includes:
(a) academic excellence
(b) an indication that the student intends to enter the business world in the area of Computer Science and Data Processing.
(c) performance in industry during co-operative work periods.

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The award is made by the Senate Committee on Scholarships and Student Aid in cooperation with the Applied Analysis and Computer Science Department. No application is necessary.

Uniroyal (1966) Ltd. Student Aid Plan
Beginning with the academic year 1961-62 Uniroyal 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.

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.

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.

The Canadian Ophthalmic Laboratories' and Suppliers' Prizes.
The Canadian Ophthalmic Laboratories' and Suppliers' provide funds to award the following prizes. Since the amount in the fund varies from year to year, they will be awarded in the following sequence until the fund is exhausted each year.

(a) Four General Proficiency Prizes (Value $200.00 each) awarded to the student in The School of Optometry standing highest in General Proficiency in each of the second, third, fourth and fifth years.
(b) Four General Proficiency Prizes (Value $100.00 each) awarded to the student in The School of Optometry standing second highest in General Proficiency in each of the second, third, fourth and fifth years.

All of the above prizes are made available through the contributions of the following Canadian Suppliers and Laboratories:-

Bausch and Lomb Optical Company (Canada) Limited Toronto, Ontario.
Dominion Contact Lens Laboratory New Toronto, Ontario.
Imperial Optical Company Limited Toronto, Ontario.
Kahn Optical Company Limited Toronto, Ontario.
Monarch Optical Company Limited Toronto, Ontario.
Scholarships, Bursaries, Prizes and Financial Aid

The Optometrical Women's Auxiliary Prize (Value $100.00).
The gift of the Women's Auxiliary to the Optometrical Association of Ontario is awarded to a student in Second Year in the School of Optometry standing highest in the subject of Physiological Optics.

The Optometrical Women's Auxiliary Prize (Value $100.00).
The gift of the Women's Auxiliary to the Optometrical Association of Ontario is awarded to a student in third year in the School of Optometry standing highest in the subject of Optometry.

The J. C. Thompson Memorial Prize (Value $100.00).
The award of the Alumni Association in memory of the late Dean J. C. Thompson is made to a final year student in the School of Optometry who has ranked highest in Optometry.

The General Proficiency Prizes (Value $200.00 and $100.00).
The gifts of Sydney Hermant are awarded to the final year students in the School of Optometry ranking first and second in general proficiency.

The General Proficiency Medal.
The gift of the Board of Directors, College of Optometrists of Ontario, is awarded to the final year student in the School of Optometry ranking highest in General Proficiency.

The Arthur A. Johnson Medal.
The gift of Arthur A. Johnson is awarded to the final year student in the School of Optometry ranking highest in Optometrical Optics.

The T. T. Beattie Medal.
The bequest of T. T. Beattie is awarded to the final year student in the School of Optometry ranking highest in Orthoptics or Visual Training. The award is made once every three years, approximately, as funds permit.

The E. F. Attridge Medal.
The gift of E. F. Attridge is awarded to the final year student in the School of Optometry ranking highest in Pathology.

K. & W. Optical Company Limited Prize (Value $500.00).
This is awarded to the graduating student in the School of Optometry who has made the greatest contribution to the profession during his undergraduate course.

The Canadian Contact Lens Society Prize (Value approximately $75.00).
The proceeds of a fund invested on behalf of the Canadian Contact Lens Society will be awarded to a final year student in the School of Optometry who shows the greatest proficiency in the theoretical and practical application of Contact Lenses.

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.

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.

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.

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.

The Bruce Wyler Kelley 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.

The Engineering Institute of Canada Student Prize
The E.I.C. Student Prize is awarded to a Student Member of the Institute in the year prior to the graduating year on the basis of the marks made in his academic year, and his activities in the student engineering organization or in the local branch of a recognized engineering society.

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
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writing in any of the following categories: short story, novelette, 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.

Student Loans

Canada Student Loans Plan
The purpose of the Canada Student Loans Plan is to make bank loans available to students who need financial help to enable them to engage in full-time studies directed towards a degree or diploma at universities or certain other educational institutions above the high-school level.

The Canada Student Loans Plan is a Federal Government programme which is administered for it by the provincial agencies. The provisions of the plan are set out in a brochure issued by the Federal Authority. For more detailed information, reference should be made to that publication. Eligibility for a loan is based on need as determined by criteria established by the Federal Government in consultation with the provinces.

The following extract from the brochure under the heading “How do I establish that I need a loan” sets out in a general way the basis on which need is determined:

“The Canada Student Loans Plan was set up to supplement family and other financial sources available to students, not to replace them. It follows that Certificates of Eligibility may be issued only if you can establish that the financial resources available to you including those of your parents, are not enough to meet what the awarding authority considers to be reasonable costs for the academic year. To this end, you will be asked to give a signed statement which will include information concerning your financial resources.”

Since, in general, parents remain primarily responsible for the costs of post-secondary education, your parents will normally be asked to give information concerning their income. Under the plan, a ceiling is placed on the total
loans that may be authorized by a province, and a Provincial Authority cannot be expected to use its part of the loan funds to approve loans to students who are really not in need of such assistance.”

Copies of the application form are available at all designated post-secondary institutions and at all secondary schools. When completed in accordance with the instructions on the application form the required number of copies should be sent to:

Awards Officer
Office of the Registrar
University of Waterloo
Waterloo, Ontario

When need has been determined in accordance with the established criteria, the student and the institution he proposes to attend will be informed of the loan assistance the student can expect to receive.

If the student feels that he or his family has had exceptional costs or that there have been substantial changes in the financial situation, he may request a review by the student awards officer of the institution he proposes to attend or is attending. The student awards officer of the institution may, if he considers the circumstances merit it, recommend an adjustment in the calculation of need.

The amount of loan finally authorized can be secured by the student after registration. Applications submitted after this date may also be processed in time for registration but, to ensure this, the forms should be received by the date specified.

Grants under Ontario Student Awards Programme
The Province of Ontario offers a grant to meet part of the need as determined by the criteria for the Canada Student Loans Plan as set out above. To be eligible for a grant the following requirements must be met:

1. The student must be a Canadian citizen, or have landed immigrant status or have filed application for citizenship.

2. The parent of a “dependent” student must have been permanent resident of Ontario for at least twelve months prior and up to June 1 of the academic session for which the student is applying for assistance.

3. An “independent” student must have been a permanent resident of Ontario for at least twelve months prior to June 1 of the academic session in which he will first enrol or in which he first enrolled in an eligible post-secondary institution in Ontario.

4. A student must be enrolled in a full-time programme in a course other than Divinity at one of the eligible post-secondary institutions include all Canadian universities.

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 stu-
Scholarships, Bursaries, Prizes and Financial Aid

dent 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.

Ginny Lee Memorial 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.

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.

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 up to a maximum of $2600 per year. 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, bursaries, and science 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. Completed applications forms from students in attendance at the University of Waterloo for postgraduate scholarships, bursaries, and science scholarships must be submitted to the department before January 10.

Applications for postdoctorate and PIER scholarships must be filed with NRC 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 1968 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, 1967*

**Rotary Foundation Fellowships**

Rotary Foundation offers a Fellowship for one fully paid academic year of graduate study abroad.

Applicants of high scholastic ability and attainment must hold a Bachelor's Degree by the time the Fellowship is to begin.

*Further information may be obtained from the Awards Officer, Office of the Registrar, University of Waterloo.*

*Application for the 1969/70 Fellowship should be made before April 15, 1968, to the Awards Officer, Office of the Registrar, University of Waterloo.*

**Woodrow Wilson National Fellowship Foundation**

The Woodrow Wilson National Fellowship Foundation offers 100 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 $2,000 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, 1968.*

**Imperial Oil Graduate Research Fellowships**

Imperial Oil Limited in 1946 established for annual competition Graduate Research Fellowships, now five in number, and having a potential value of $9,000 each ($3,000 a year for a maximum of three years). There are no restrictions on other concurrent awards held.

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 (three fellowships), and Social Sciences and Humanities (two fellowships). Nomination of students for the fellowships is made by the university—such nominations to be received by the Secretary, Committee on Higher Education, Imperial Oil Limited, 111 St. Clair Avenue West, Toronto 7, Ontario, not later than March 1 of 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, 151 Slater 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
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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, 151 Slater Street, Ottawa 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, 151 Slater 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 universi-
ties 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 and Planning.

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 Association 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, 151 Slater Street, Ottawa 4, Ontario.

Completed applications must be received no later than March 1st.

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.
Scholarships, Bursaries, Prizes and Financial Aid

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, 151 Slater 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.
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Vacancies—3
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Cowan, J.A. Physics
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Murtry, U.S.R.  
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Sociology and Anthropology  
Geography  
Combinatorics and Optimization  
Classics and Romance Languages  

Psychology  
Philosophy  
Applied Analysis and Computer Science  
Combinatorics and Optimization  
Economics  
Political Science  
Mechanical Engineering  
Mechanical Engineering  
Mechanical Engineering  
Geography and Planning  
Physical Education  
Electrical Engineering  

English  
Geography and Planning  
Physics  
Mathematics  

Chemistry  
German and Russian  
Environmental Studies—Architecture  
Biology  
Mathematics  
History  
Fine Arts  
Mechanical Engineering  
Physical Education  
Civil Engineering  
Chemical Engineering  
Optometry  
Psychology  
English  
Physics  
Sociology and Anthropology  
Mechanical Engineering  
Mechanical Engineering  
Mathematics  
Religious Studies
Faculty

Pindera, J.T.  Civil Engineering
Pintar, M.M.  Physics
Plumtree, A.  Mechanical Engineering
Pollock, J.  Optometry
Ponzo, P.J.  Applied Mathematics
Poorooshasb, H.B.  Civil Engineering
Porter, R.L.  Classics and Romance Languages
Power, G.  Biology
Prasad, T.  Civil Engineering
Price, J.D.  Optometry
Priddle, R.E. (Mrs.)  Physical Education
Pugliese, D.J.  Physical Education

Qualter, T.H.  Political Science

Ralston, Z.T.  Classics and Romance Languages
Ramshaw, R.S.  Electrical Engineering
Rao, V.K.  Mechanical Engineering
Ratz, H.C.  Electrical Engineering
Rawling, K.E. (Miss)  Political Science
Ray, D.M.  Geography and Planning
Ray, W.H.  Chemical Engineering
Rees, A.W.  History
Reesor, G.E.  Physics
Reeve, J.  Electrical Engineering
Reilly, P.M.  Chemical Engineering
Rhodes, E.  Classics and Romance Languages
Rich, G.  Geography and Planning
Rich, G.  German and Russian
Richter, M.  Philosophy
Roberts, D.D.  Earth Sciences
Roberts, R.G.  Combinatorics and Optimization
Robertson, G.N.  Statistics
Robinson, P.  Applied Analysis and Computer Science
Roden, R.B.  Electrical Engineering
Roe, P.H.O’N.  Classics and Romance Languages
Romanyschyn, O.  Civil Engineering
Roorda, J.  Sociology and Anthropology
Roosa, W.B.  History
Rosenberg, Z. (Miss)  Psychology
Ross, R.R.  Electrical Engineering
Roulston, D.J.  Pure Mathematics
Rowe, K.A.  Psychology
Rowe, P.M.  Chemistry
Rudin, A.  Geography and Planning
Russwurm, L.H.  Psychology

Saleh, S.D.  Earth Sciences
Salter, D.L.  History
Sandler, S.L.  History
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<thead>
<tr>
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Thompson, J.E.  Biology
Thomson, B.S.  Pure Mathematics
Thornton-Trump, A.B.  Mechanical Engineering
Thysell, M.G. (Mrs.)  English
Thysell, R.V.  Statistics
Tomlinson, G.  Chemistry
Toogood, G.E.  Chemistry
Topper, T.H.  Civil Engineering
Torney, D.J.  Psychology
Torrie, B.H.  Physics
Totzke, C.A.W.  Physical Education
Turnour, N.C.  Optometry
Trim, D.W.  Applied Mathematics
Turner, G.A.  Chemical Engineering
Tutte, W.T.  Combinatorics and Optimization
Tuyn, H.  English

Unny, T.E.  Civil Engineering
Uram, E.M.  English

van der Hoff, B.M.E.  Chemical Engineering
Van Evra, J.A. (Mrs.)  Psychology
Van Evra, J.W.  Philosophy
van Heeswijk, R.G.  Electrical Engineering
Vaz, E.W.  Sociology and Anthropology
Vellinga, J.H.  Applied Analysis and Computer Science
Vetter, W.J.  Electrical Engineering
Viswanatha, T.  Chemistry
Vogel-Sprott, M.D.  Psychology
Vranch, J.K.  Pure Mathematics
Vuorinen, P.A.  Electrical Engineering

Wahl, J.M.  History
Wainwright, J.  Applied Mathematics
Walter, D. (Mrs.)  Classics and Romance Languages
Wang, S.F.  Physics
Watkins, M. (Mrs.)  Classics and Romance Languages
Watkins, M.E.  Mathematics
Watson, R.B.  Optometry
Watt, L.A.K.  Electrical Engineering
Weaver, S.M. (Mrs.)  Sociology and Anthropology
Wei, L.Y.  Electrical Engineering
Wentzell, R.A.  Applied Mathematics
Wertheim, D.G.  Pure Mathematics
White, J.  Optometry
White, O.L.  Civil Engineering
Widmeyer, W.N.  Physical Education
Wigley, T.M.L.  Mechanical Engineering
Wiljer, R.  English
Wilkinson, B. (Miss)  Applied Mathematics
Wills, B.L.  Design
Wilson, J.C.  Applied Analysis and Computer Science
Wilson, J.M.  Political Science
Wilton, R.C.  Pure Mathematics
Wine, J.J.  Psychology
Wipper, A. (Miss)  Sociology and Anthropology
Wise, M.R.  Statistics
de Witte, P.  Pure Mathematics
Woodruff, M.E.  Optometry
Woolford, R.G.  Chemistry
Woolner, K.A.  Physics
Wright, D.T.  Civil Engineering
Wubnig, J. (Miss)  Philosophy
Wynne, R.E.  History

Young, L.  Physics
Young, M.  Physics
Young, M.M.  Chemical Engineering
Younger, D.  Mathematics

Zachariah, K.  Biology
Zafriiu, L.  Electrical Engineering
Zarnke, C.R.  Applied Analysis and Computer Science
Zweers, A.  German and Russian
**Academic Calendar**

The University of Waterloo reserves the right to change its academic calendar at any time.

**1968-69**

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Event</th>
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<tr>
<td>July 1, 1968</td>
<td>Monday</td>
<td>Lectures Begin—Post Degree Programme</td>
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<tr>
<td>July 22</td>
<td>Monday</td>
<td>Supplemental Examinations Begin</td>
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<tr>
<td>August 3</td>
<td>Saturday</td>
<td>Examinations Begin—Co-operative Programmes</td>
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<tr>
<td>August 8</td>
<td>Thursday</td>
<td>Examinations—Post Degree Programme</td>
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<tr>
<td>August 9</td>
<td>Friday</td>
<td>Examinations End—Co-operative Programmes</td>
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<td>August 23</td>
<td>Friday</td>
<td>Spring Work Term Ends—Co-operative Programmes</td>
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<tr>
<td>August 26</td>
<td>Monday</td>
<td>Fall Work Term Begins—Co-operative Programmes</td>
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<tr>
<td>September 2</td>
<td>Monday</td>
<td>Labour Day—University Buildings Closed</td>
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<tr>
<td>September 7</td>
<td>Saturday</td>
<td>Registration (Morning Only)—Part-time Undergraduates</td>
</tr>
<tr>
<td>September 11</td>
<td>Wednesday</td>
<td>Registration</td>
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<tr>
<td>September 12</td>
<td>Thursday</td>
<td>Registration</td>
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<tr>
<td>September 13</td>
<td>Friday</td>
<td>Registration</td>
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<tr>
<td>September 16</td>
<td>Monday</td>
<td>Lectures Begin</td>
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<tr>
<td>September 23</td>
<td>Monday</td>
<td>Registration—Graduate Studies</td>
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<tr>
<td>October 10</td>
<td>Thursday</td>
<td>Meeting—Senate Executive Committee</td>
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<tr>
<td>October 14</td>
<td>Monday</td>
<td>Thanksgiving Day—University Buildings Closed</td>
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<tr>
<td>October 24</td>
<td>Thursday</td>
<td>Meeting—University Senate</td>
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<td>October 25</td>
<td>Friday</td>
<td>Fall Convocation</td>
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<tr>
<td>November 4</td>
<td>Monday</td>
<td>Supplemental Examinations Begin—Co-operative Programmes</td>
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<tr>
<td>November 14</td>
<td>Thursday</td>
<td>Meeting—Board of Governors</td>
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<tr>
<td>December 5</td>
<td>Thursday</td>
<td>Meeting—Senate Executive Committee</td>
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<td>December 13</td>
<td>Friday</td>
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<tr>
<td>December 14</td>
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<td>Examinations Begin—Fall Term</td>
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<tr>
<td>December 19</td>
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<td>Meeting—University Senate</td>
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<tr>
<td>December 20</td>
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<td>Examinations End—Fall Term</td>
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<td>December 24</td>
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<td>December 25</td>
<td>Wednesday</td>
<td>Christmas Day—University Buildings Closed</td>
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<tr>
<td>December 26</td>
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<td>Winter Work Term Begins—Co-operative Programmes</td>
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<td>December 27</td>
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<td>Supplemental Examinations—Post Degree</td>
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<td>New Year's Day—University Buildings Closed</td>
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<td>Registration—Undergraduate Co-operative Programme</td>
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<td>January 10</td>
<td>Friday</td>
<td>Registration—Winter Term—Graduate Students in Engineering</td>
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<td>January 16</td>
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<td>Meeting—Board of Governors</td>
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<td>February 6</td>
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<td>March 10</td>
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<td>Supplemental Examinations Begin Co-operative Programmes</td>
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<td>April 3</td>
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<td>Good Friday—University Buildings Closed</td>
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<td>June 19</td>
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Campus Guide
1. Conrad Grebel College
2. St. Paul's College
3. Renison College
4. St. Jerome's College
5. Theatre and Modern Languages
6. I. Bowman Social Science Building
7. Arts Lecture Building
8. Food Services and Book Store
9. Chemical Engineering (Eng. I)
10. Engineering II
11. Engineering Lecture Building
12. Physics and Mathematics
13. Dana Porter Arts Library
14. Chemistry and Biology
15. Mathematics and Computer Building
16. Campus Centre
17. Physical Education, Gymnasium
18. Central Stores and Heating
19. Village Residences