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

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

The Senate and the Board of Governors of the University of Waterloo reserve the
right to make changes in this calendar without prior notice.
In accordance with action taken by the University's Board of Governors, the following schedule of fees replaces those shown in the University calendar for 1967-68 on the pages indicated below. While the amounts below include the complete tuition and incidental fees in all cases, it is only the incidental fees and the tuition fee for graduate studies that are revised.

<table>
<thead>
<tr>
<th>Faculty</th>
<th>Page No.</th>
<th>Heading</th>
<th>Change to Read</th>
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</thead>
<tbody>
<tr>
<td>Arts</td>
<td>14</td>
<td>Sessional fees</td>
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<td></td>
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<td>Other Year $373.25</td>
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<td></td>
<td>83</td>
<td>Co-operative fees per term</td>
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<td></td>
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<td>Year One $323.25</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Other Year $348.25</td>
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<td></td>
<td>Incidental 30.75</td>
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<td>Total $323.25</td>
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<td>Mathematics</td>
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<td>Co-operative fees per term</td>
<td>Tuition $292.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Year One $323.25</td>
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<tr>
<td></td>
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<td></td>
<td>Other Year $348.25</td>
</tr>
<tr>
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<td>Incidental 30.75</td>
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<td>One year programme</td>
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<tr>
<td>Physical and</td>
<td>137</td>
<td>Regular full time graduate</td>
<td>Per Year of required</td>
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<tr>
<td>Health</td>
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<td>students</td>
<td>resident study $395.00</td>
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<td>Education</td>
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<td>Per Term of required</td>
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<td>138</td>
<td>Incidental &amp; Miscellaneous Fees</td>
<td>resident study $197.50</td>
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<td></td>
<td>Additional resident</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>graduate study--</td>
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<td></td>
<td></td>
<td></td>
<td>Per year $60.00</td>
</tr>
<tr>
<td>Graduate Studies</td>
<td></td>
<td></td>
<td>Per Term $30.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Student activities</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>(compulsory) $22.00</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Athletic (compulsory)</td>
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</table>
|                  |          |                                  | $22.00
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12. English
13. French
14. General Engineering
15. Geography and Planning
16. German
17. Greek
18. History
19. Latin
20. Management and Systems Engineering
21. Mathematics
22. Mechanical Engineering
23. Music
24. Philosophy
25. Physical and Health Education
26. Physics
27. Political Science
28. Psychology
29. Religious Knowledge
30. Russian
31. Science
32. Sociology and Anthropology
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I

The University
of Waterloo
The University of Waterloo

The University of Waterloo is incorporated as a non-denominational institution of higher learning offering courses, both at the undergraduate and graduate level, in Arts, Engineering, Mathematics, 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 the Physics and Mathematics Building, the Engineering Buildings, the Arts Buildings and Theatre of the Arts, the Chemistry-Biology Building and the University Residence Village.

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

A continuing programme of expansion presently includes a lecture hall, a Mathematics building, a Physical and Health Education building, a Food Services building and a Campus Centre as well as additions to the Biology and Engineering buildings.
The general administrative offices are temporarily located in the Arts Library Building. The University Cafeteria is located in the new Food Services Building scheduled to open in September, 1967. The student offices are located in the Federation Buildings west of the Chemistry-Biology Building.

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

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

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

The Faculty of Arts
The Faculty of Arts

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

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

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

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

Degrees

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

Pass Course (3 years)
The General Course in Arts

Honours Courses (4 years)

<table>
<thead>
<tr>
<th>Course</th>
<th>Honours Courses (4 years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economics</td>
<td>German (with appropriate minor)</td>
</tr>
<tr>
<td>Economics and Political Science</td>
<td>German and Russian</td>
</tr>
<tr>
<td>English</td>
<td>History</td>
</tr>
<tr>
<td>English and French</td>
<td>History and Philosophy</td>
</tr>
<tr>
<td>English and German</td>
<td>Latin</td>
</tr>
<tr>
<td>English and History</td>
<td>Philosophy</td>
</tr>
<tr>
<td>English and Latin</td>
<td>Philosophy and Literature</td>
</tr>
<tr>
<td>English and Philosophy</td>
<td>Philosophy and Mathematics</td>
</tr>
<tr>
<td>English and Russian</td>
<td>Philosophy and Political Science</td>
</tr>
<tr>
<td>English and Spanish</td>
<td>Philosophy and Psychology</td>
</tr>
<tr>
<td>French and German</td>
<td>Political Science</td>
</tr>
<tr>
<td>French and Latin</td>
<td>Psychology</td>
</tr>
</tbody>
</table>
French and Political Science
French and Russian
French and Spanish
Geography, Urban and Regional Planning

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

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

Admission and Registration

General

Application for admission to the Faculty of Arts should be made as early in the year as possible on forms provided by the Office of the Registrar. Academic certificates (not diplomas) and other supporting documents should be forwarded as soon as they become available. Students applying for Arts through Renison College or St. Jerome's College should submit all necessary documents to the appropriate College. Admission cannot be granted until all the requirements have been met and all documents submitted.

Admission to Year I.

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

Standing is required in seven Grade 13 credits as follows:
- A minimum of four credits chosen from: English, one language other than English, Mathematics
- 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 follow-
ing may be counted as an “additional” credit: Accountancy Practice, Secretarial Practice, Mathematics of Investment, Art, or Music (Departmental Examination). 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.

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

<table>
<thead>
<tr>
<th>Province</th>
<th>Certificate Description</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 Indies, East and West Africa</td>
<td>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.</td>
</tr>
<tr>
<td>Scotland</td>
<td></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.
Admission and Registration

Admission as an Adult Student

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

Admission as a Part-time Student

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

Admission of Students from Other Countries

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

Re-Admission

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

Registration

September 15  Friday  Faculty of Arts

Fees

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

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

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

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

The fee schedule shown is the one in effect for the 1966-67 year and at the time of printing is still subject to review and possible change for the 1967-68 year. If a fee change is made, a notice will be issued with a new fee schedule; however, the University does not undertake or accept responsibility to so notify all recipients of this calendar. The Board of Governors reserves the right to make changes in the published schedule of fees without notice.

Sessional Fees

<table>
<thead>
<tr>
<th>Description</th>
<th>Fee</th>
</tr>
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<tbody>
<tr>
<td>Tuition</td>
<td>$10.50</td>
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<tr>
<td>Incidental †</td>
<td>46.00</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>$556.50</strong></td>
</tr>
</tbody>
</table>

Part-time Students

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

Miscellaneous Fees

- Examination — Supplemental, each paper $10.00
- — Presiding fee (at an outside centre, each half day) 7.00
- Photograph (at first registration only) 1.00
- Late Registration 10.00
- Transcript of record 1.00
- Degree and Graduation — Final year only 10.00

† Incidental fees include student activities, athletics, health insurance and health services.

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

Residence fee for both men and women is:

<table>
<thead>
<tr>
<th>Type of Room</th>
<th>Single</th>
<th>Semi-Private</th>
<th>Double</th>
</tr>
</thead>
<tbody>
<tr>
<td>per academic year</td>
<td>$850.</td>
<td>$810.</td>
<td>$750.</td>
</tr>
<tr>
<td>per term</td>
<td>$425.</td>
<td>$405.</td>
<td>$375.</td>
</tr>
</tbody>
</table>

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

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

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

Examinations and Promotions

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

Students should note that the Faculty of Arts operates under the 'year system' and not the 'unit credit system'.

1. Final Examinations

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

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

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

2. Term Examinations

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

3. Standing

(a) Letter grades signify the following standings in individual subjects:
- A - - - - 75 - 100%
- B - - - - 66 - 74%
- C - - - - 60 - 65%
- D - - - - 50 - 59%
- F - - - - less than 50% (Failure, no supplemental allowed)
- S - - - - less than 50% (Supplemental allowed)

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

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

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

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

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

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

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

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

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

## 4. Failure

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

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

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

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

(e) All failings papers are re-read.

## 5. Supplemental Examinations

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

(i) must have attended a reasonable number of lectures in the course in which he proposes to write, and must have satisfied all term work requirements;

(ii) must not have failed more than two full courses;

(iii) must not have defaulted the final examination except for a properly certified reason;

(iv) must have obtained a final overall average of at least 50%.

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

(i) must have shown satisfactory term work progress to at least grade “C” in the subject in question;

(ii) must not have failed more than two full courses;

(iii) must not have defaulted the final examination except for a properly certified reason;

(iv) must have obtained a final overall average of 50% and an average of 60% in the subjects of specialization in a General Course, and a final over-all average of 60% and an average of 66% in the subjects of specialization in an Honours Course.
(c) A student who fails to obtain at least 40% in a final examination may be granted supplemental privileges only at the discretion of the Council of the Faculty of Arts.

(d) Supplemental examinations are held in late July or early August. Application for these examinations must be filed by June 28, 1967, on forms provided by the Office of the Registrar. Applications received after this date will not be accepted and the student will be considered to have defaulted the examinations. Fees for supplemental examinations must accompany the application and, if the student subsequently decides not to write the examination, this fee is not refunded. Supplemental examinations must be written at the next regular supplemental period.

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

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

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

The Arts Lecture Building
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 must choose six.

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

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

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

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

2. Students may choose courses from the following groups:

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

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

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

† Where prerequisites can be met.
**Year One.** (Common to both Honours Courses and General Courses)

The student must select six courses from the above groups.

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

**Notes:**

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

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

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

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

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

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

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

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

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

Year I (For Year I programme refer to pages 19 to 20)

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

<table>
<thead>
<tr>
<th>Anthropology</th>
<th>Greek</th>
<th>Psychology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economics</td>
<td>History</td>
<td>Russian</td>
</tr>
<tr>
<td>English</td>
<td>Latin</td>
<td>Sociology</td>
</tr>
<tr>
<td>French</td>
<td>Mathematics</td>
<td>Spanish</td>
</tr>
<tr>
<td>Geography</td>
<td>Philosophy</td>
<td></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.

2. Before graduation each student must take a minimum of four courses, not all in one subject, 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 any circumstances only one language course numbered below 100 may 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. The Department of Political Science does offer a few courses which are full courses but extend over one term only.
Honours Courses

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

2. Before graduation each student must take a minimum of four courses, not all in one subject, from Group A; 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. The Department of Political Science does offer a few courses which are full courses but extended over one term only.

5. Joint Honours Programmes not found in this section may be arranged by consultation between the student and the department concerned.
## Honours Economics

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

### Year I

<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</td>
<td>3</td>
</tr>
<tr>
<td>English 101</td>
<td>3</td>
</tr>
<tr>
<td>History 100, or Philosophy 100 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 or either Economics 240 or 261*/262*</td>
<td>3</td>
</tr>
<tr>
<td>History 100, or Philosophy 100 or equivalent (whichever not elected in Year I)</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>Economics 320</td>
<td>3</td>
</tr>
<tr>
<td>Two of Economics 330, 340, 370, 380, 385</td>
<td>6</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>Economics 400 or 470</td>
<td>3</td>
</tr>
<tr>
<td>Economics 440</td>
<td>3</td>
</tr>
<tr>
<td>Three other courses (a minimum of two in economics) of which one must be on the 400 level</td>
<td>9</td>
</tr>
</tbody>
</table>

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

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

## Honours Economics and Political Science

### Year I

<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</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>
<tr>
<td>Year</td>
<td>Courses</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Year II</td>
<td>Economics 201*/202*/</td>
</tr>
<tr>
<td></td>
<td>Economics 230</td>
</tr>
<tr>
<td></td>
<td>Economics 240</td>
</tr>
<tr>
<td></td>
<td>Political Science 280</td>
</tr>
<tr>
<td></td>
<td>Political Science 270</td>
</tr>
<tr>
<td></td>
<td>One elective</td>
</tr>
<tr>
<td>Year III</td>
<td>Economics 300</td>
</tr>
<tr>
<td></td>
<td>One of Economics 320, 330, 340, 380</td>
</tr>
<tr>
<td></td>
<td>Political Science 250</td>
</tr>
<tr>
<td></td>
<td>Political Science 364</td>
</tr>
<tr>
<td></td>
<td>One other full course in Political Science</td>
</tr>
<tr>
<td></td>
<td>or the equivalent in half courses</td>
</tr>
<tr>
<td></td>
<td>One elective</td>
</tr>
<tr>
<td>Year IV</td>
<td>At least one further course in each of Economics and Political Science</td>
</tr>
<tr>
<td></td>
<td>selected in consultation with the Departments</td>
</tr>
<tr>
<td></td>
<td>3 other courses selected in consultation with the Departments</td>
</tr>
</tbody>
</table>

**Honours English**

**Year I**

- *Recommended Programme:*

  - English 101                                               3
  - *One of* French 100, German 100, Latin 100                3-4
  - Philosophy 100 or equivalent                             3
  - History 100                                             3

  Two courses from Group B or one course from Group B and a course in Religious Knowledge  6

**Year II**

- English 251, 261, 270, 280                                 11
- Two supporting courses†                                    6

**Year III**

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

**Year IV**

- English 300, 451, 460, 470 and either 480 or 495            14
- One supporting course††                                    3
- Comprehensive Examination                                 3

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

†† English 475 may be chosen as one of the supporting courses.
Honours English and French

Year I  
*Recommended Programme:*  
- English 101  
- French 160  
- History 100, or Philosophy 100 or equivalent  
  *One of History 100, Philosophy 100, or equivalent, a course in German, Latin, or Spanish*  
- Two courses from Group B or one course from Group B and a course in Religious Knowledge  

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

Year II  
- English 251 and one other English course (see Note 1)  
- French 250, 260  
- Two other courses  

<table>
<thead>
<tr>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-6</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>6</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-6</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

Year IV  
- Two English courses (see Note 1)  
- French 450, 460, 470, 480  
- Senior Honours Essay or English 480  
- Comprehensive Examination  

<table>
<thead>
<tr>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-6</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

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

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 and one other English course (see Note 1)  
- German - minimum of two full courses or equivalent  
- Two additional courses  

<table>
<thead>
<tr>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-6</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>6</td>
</tr>
</tbody>
</table>

Year III  
- Two English courses (see Note 1)  
- German - minimum of two full courses or equivalent  
- Two additional courses  

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

25
### Year IV

**Recommended Programme:**

- Two English courses (see Note 1)  
- German - minimum of two full courses or equivalent  
- Senior Honours Essay or English 480 or one additional course in German  
- One additional course  
- Comprehensive Examination

**Hours**  

- 4-6  
- 3  
- 3

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

**Note 2:** Before graduation students must complete a minimum of seven full German courses.

**Note 3:** Before graduation students must complete the requirements for Honours Courses as described on page 22 of the Calendar.

### Honours English and History

#### Year I

<table>
<thead>
<tr>
<th>Recommended Programme</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>English 101</td>
<td>3</td>
</tr>
<tr>
<td>History 100 or 110</td>
<td>3</td>
</tr>
<tr>
<td>One of French 100, German 100, Latin 100</td>
<td>3-4</td>
</tr>
<tr>
<td>Three of Economics 101*/102*, Geography 101*/100*, Science 100, and a course in Religious Knowledge</td>
<td>9-10</td>
</tr>
</tbody>
</table>

#### Year II

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

**Hours**  

- 5-6  
- 6  
- 3  
- 3

#### Year III

- Two English courses (see Note 1)  
- Two History courses (see Note 2)  
- One other course

**Hours**  

- 4-6  
- 6  
- 3

#### Year IV

- Two English courses (see Note 1)  
- Two of History 470-479  
- One other History course (see Note 2)  
- Senior Honours Essay or English 480  
- Comprehensive Examination

**Hours**  

- 4-6  
- 4  
- 2-3  
- 3

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

**Note 2:** The five undesignated courses in History beyond the first year will normally be selected from History 250, 255, 260, 295, 350, 361, 362, 370, 380.
## Honours English and Latin

**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>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 the social sciences</td>
<td>6</td>
</tr>
<tr>
<td>One further course</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 and one other English course (see Note 1)</td>
<td>5-6</td>
</tr>
<tr>
<td>Latin 250, 260</td>
<td>4</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</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two English courses (see Note 1)</td>
<td>4-6</td>
</tr>
<tr>
<td>Latin 350, 360, 370</td>
<td>7</td>
</tr>
<tr>
<td>Classical Civilization 260</td>
<td>3</td>
</tr>
<tr>
<td>One other course</td>
<td>3</td>
</tr>
</tbody>
</table>

**Year IV**

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two English courses (see Note 1)</td>
<td>4-6</td>
</tr>
<tr>
<td>Latin 450, 460, 470</td>
<td>7</td>
</tr>
<tr>
<td>Senior Honours Essay or English 480</td>
<td>3</td>
</tr>
<tr>
<td>Comprehensive Examination</td>
<td>3</td>
</tr>
</tbody>
</table>

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

## Honours English and Philosophy

**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><em>One of</em> French 100, German 100, Latin 100, Greek 100</td>
<td>3-4</td>
</tr>
<tr>
<td><em>One of</em> Philosophy 221*/222* or 280*/281*</td>
<td>3</td>
</tr>
<tr>
<td>Psychology 110 or Political Science 100</td>
<td>3</td>
</tr>
<tr>
<td><em>One of</em> History 100 or a foreign language course</td>
<td>3-4</td>
</tr>
<tr>
<td>One other course</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 and one other English course (see Notc 1)</td>
<td>5-6</td>
</tr>
<tr>
<td><em>One of</em> Philosophy 221*/222* or 280*/281*</td>
<td>3</td>
</tr>
<tr>
<td>Philosophy 282*/283* and one other Philosophy course</td>
<td>6</td>
</tr>
<tr>
<td>One other course</td>
<td>3</td>
</tr>
</tbody>
</table>
Year III

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

Year IV

Two English courses (see Note 1) 4-6
Two Philosophy courses 6
One other course 3
Senior Honours Essay or English 480 or Philosophy 499 3
Comprehensive Examination 3

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

Note 2: 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 English and Russian

Year I

Recommended Programme: Hours
English 101 3
Russian - one full course or equivalent 3
History 100, or Philosophy or equivalent 3
Three additional courses taken in accordance with general Arts Faculty regulations. 9

Year II

English 251 and one other English course 5-6
Russian - minimum of two full courses or equivalent 6
Two additional courses 6

Year III

Two English courses (see Note 1) 4-6
Russian - minimum of two full courses or equivalent 6
Two additional courses 6

Year IV

Two English courses (see Note 1) 4-6
Russian - minimum of two full courses or equivalent 6
Senior Honours Essay or English 480 or one additional course in Russian 3
One additional course 3
Comprehensive Examination
Note 1: Before graduation students must complete the following English courses: English 101; 251; either 270 or 280; 360; either 350 or 370; either 380 or 451; either 300 (or 330J) or 460.

Note 2: Before graduation students must complete a minimum of seven full Russian Courses.

Note 3: Before graduation students must complete the requirements for Honours Courses as described on page 22 of the Calendar.

Honours English and Spanish

<table>
<thead>
<tr>
<th>Year</th>
<th>Recommended Programme</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>English 101</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>French 100</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Spanish 100</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>History 100, or Philosophy 100 or equivalent</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Psychology 110 or Political Science 100</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>A course in Religious Knowledge or a second social science</td>
<td>3</td>
</tr>
<tr>
<td>II</td>
<td>English 251 and one other English course (see Note 1)</td>
<td>5-6</td>
</tr>
<tr>
<td></td>
<td>Spanish 250, 260</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Two other courses</td>
<td>6</td>
</tr>
<tr>
<td>III</td>
<td>Two English courses (see Note 1)</td>
<td>4-6</td>
</tr>
<tr>
<td></td>
<td>Spanish 350, 360, 370</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>One other course</td>
<td>3</td>
</tr>
<tr>
<td>IV</td>
<td>Two English courses (see Note 1)</td>
<td>4-6</td>
</tr>
<tr>
<td></td>
<td>Spanish 450, 460, 470, 480</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Senior Honours Essay or English 480</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Comprehensive Examination</td>
<td></td>
</tr>
</tbody>
</table>

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

Honours French and German

<table>
<thead>
<tr>
<th>Year</th>
<th>Recommended Programme</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>French 160</td>
<td></td>
</tr>
<tr>
<td></td>
<td>German one full course or equivalent</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Four more courses</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>French 250, 260</td>
<td></td>
</tr>
<tr>
<td></td>
<td>German minimum of two full courses or equivalent</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Two more courses</td>
<td></td>
</tr>
</tbody>
</table>
### Year III
- French 350, 360, 370
- German minimum of two full courses or equivalent
- One more course

#### Year IV
- French 450, 460, 470, 480
- German minimum of two full courses or equivalent

**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 German courses.

**Note 3:** Before graduation students must complete the requirements for Honours Courses as described on page 22 of the Calendar.

### Honours French and Latin

<table>
<thead>
<tr>
<th>Year</th>
<th><strong>Recommended Programme:</strong></th>
<th><strong>Hours</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Latin 100</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>French 160</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Two courses in the social sciences</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>English 101 or History 100</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>One elective</td>
<td>3</td>
</tr>
<tr>
<td>II</td>
<td>Latin 250, 260</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>French 250, 260</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Philosophy 100 or equivalent</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>One elective</td>
<td>3</td>
</tr>
<tr>
<td>III</td>
<td>Latin 350, 360, 370</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>French 350, 360, 370</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>One elective</td>
<td>3</td>
</tr>
<tr>
<td>IV</td>
<td>Latin 450, 460, 470</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>French 450, 460, 470</td>
<td>8</td>
</tr>
</tbody>
</table>

### Honours French and Political Science

<table>
<thead>
<tr>
<th>Year I</th>
<th><strong>Recommended Programme:</strong></th>
<th><strong>Hours</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Political Science 110</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>French 160</td>
<td>4</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>

30
Year II
Political Science 270  3
Political Science 280  3
French 250  3
French 370  3
History 260  3
†Elective  3

Year III
Two approved Political Science courses  6
French 350  2
French 360  3
History 380  3
†Elective  3

Year IV
Two approved Political Science courses at the 300 or 400 level  6
French 450  2
French 480  2
†Two Electives  6

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

Honours French and Russian

Year I
Recommended Programme:
French 160
Russian one full course or equivalent
Four more courses

Year II
French 250, 260
Russian minimum of two full courses or equivalent
Two more courses

Year III
French 350, 360, 370
Russian minimum of two full courses or equivalent
One more course

Year IV
French 450, 460, 470, 480
Russian minimum of two full courses or equivalent

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 Russian courses.

Note 3: Before graduation students must complete the requirements for Honours Courses as described on page 22 of the Calendar.
Honours French and Spanish

**Prerequisite:** Students registering in Honours French and Spanish must present satisfactory standing in Grade 13 English, French and Latin. Those who begin Spanish in the University will take Spanish 1-50 in the first year, and Spanish 100, 250 and 260 in the second year.

**Year I**  
*Recommended Programme:*  
- French 160  
- Spanish 100  
- Latin 100 or Italian 12J  
- One course in the social sciences  
- Two electives  

**Year II**  
- French 250, 260  
- Spanish 250, 260  
- History 260  
- Italian 50J (for those who took 12J) or one elective  

**Year III**  
- French 350, 360, 370  
- Spanish 350, 360, 370  
- English 380  

**Year IV**  
- French 450, 460, 470, 480  
- Spanish 450, 460, 470, 480  

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

Honours Geography

<table>
<thead>
<tr>
<th>Year</th>
<th>Courses</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Geography 101* / 100*</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Earth Science 130</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Economics 101*/102*</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>A language other than English</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Two courses chosen after consultation</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>with the Department</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Geography 211*, 210*, 220, 260*, 275*</td>
<td>2-3</td>
</tr>
<tr>
<td></td>
<td>Three courses chosen after consultation</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>with the Department</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Geography 300*, 301*, 375, 380</td>
<td>2-3</td>
</tr>
<tr>
<td></td>
<td>Three courses chosen after consultation</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>with the Department</td>
<td>2</td>
</tr>
</tbody>
</table>
Year IV

Geography 420, one of 421-30, 480, 490, 491*

One course chosen after consultation with the Department

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

5. 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>Hours</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
</table>

**Year I**

Planning 156*

Geography 101*

Economics 101*/102*

Philosophy 125*, 140*

A language course other than English

Two courses chosen after consultation with the Department (preferably Political Science and Sociology)

**Year II**

Planning 255*, 256*

Geography 100*, 211*, 220, 250, 260*, 275*

One course from the Humanities chosen after consultation with the Department

(Summer employment related to Planning)
### Year III

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning 357*, 358*</td>
<td>2-3</td>
<td></td>
</tr>
<tr>
<td>Geography 355*, 375</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Economics 450</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Philosophy 371*</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Political Science 371*</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Sociology 260*</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>One course chosen after consultation with the Department</td>
<td>3</td>
<td>(Summer employment related to Planning)</td>
</tr>
</tbody>
</table>

### Year IV

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning 456, 480, 490, 491*</td>
<td>3</td>
</tr>
<tr>
<td>Civil Engineering 61*</td>
<td>3</td>
</tr>
<tr>
<td>Two courses chosen after consultation with the Department</td>
<td>6</td>
</tr>
</tbody>
</table>

**Notes:**

1. This programme is designed to 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 102 and Sociology 100). Alternatives may be selected in consultation with the Department.

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 options in Years II, III, and IV to meet the graduation requirement of four courses from the Humanities.
Honours German and Russian

**Recommended Programme:**

<table>
<thead>
<tr>
<th>Year</th>
<th>German</th>
<th>Russian</th>
<th>Four more courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>one full course or equivalent</td>
<td>one full course or equivalent</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>minimum of two full courses or equivalent</td>
<td>minimum of two full courses or equivalent</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>minimum of two full courses or equivalent</td>
<td>minimum of two full courses or equivalent</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>minimum of two full courses or equivalent</td>
<td>minimum of two full courses or equivalent</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>German</th>
<th>Russian</th>
<th>Two more courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>one full German course or equivalent</td>
<td>one full English course or equivalent</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>minimum of two full German courses or equivalent</td>
<td>minimum of two full English courses or equivalent</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>minimum of three full German courses or equivalent</td>
<td>minimum of one full English course or equivalent</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>minimum of three full German courses or equivalent</td>
<td>minimum of one full English course or equivalent</td>
<td></td>
</tr>
</tbody>
</table>

**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 22 of the Calendar.

**Honours German with minor in English or any other discipline**

<table>
<thead>
<tr>
<th>Year</th>
<th>One full German course or equivalent</th>
<th>One full English course or equivalent</th>
<th>Four more courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Minimum of two full German courses or equivalent</td>
<td>Minimum of two full English courses or equivalent</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Minimum of three full German courses or equivalent</td>
<td>Minimum of one full English course or equivalent</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Minimum of three full German courses or equivalent</td>
<td>Minimum of one full English course or equivalent</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Minimum of three full German courses or equivalent</td>
<td>Minimum of one full English course or equivalent</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Before graduation students must complete the requirements for Honours Courses as described on page 22 of the Calendar.
Honours History

Year I

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

Year II

Two of History 250, 255, 260 6
One other History course 3
Three other courses (see Note 1) 9

Year III

Three of History 350, (361 or 362), 370, 380 9
Two other courses (see Note 1) 6

Year IV

Two of History 470-479 4
History 499
Three of History or approved alternative senior courses (see Note 2) 9
Comprehensive examination

Notes:

1. 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.

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

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

Honours History and Philosophy

Year I

*Recommended Programme:* Hours
One of Philosophy 221*/222* or 280*/281* 2-3
History 100 3
Four other courses to fulfill the general requirements (see page 20)

Year II

One of Philosophy 221*/222* or 280*/281* 2-3
Philosophy 282*/283* and one other Philosophy course 4-6
Three of History 250, 260, 270, (274*/276*) 350, 361, 362, 370, 380 9
Honours Latin

<table>
<thead>
<tr>
<th>Year</th>
<th>Recommended Programme:</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year I</strong></td>
<td>Latin 100</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>One of English or Philosophy</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Two courses in Social Sciences</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Classical Civilization 251*/252*</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>One elective</td>
<td>3</td>
</tr>
<tr>
<td><strong>Year II</strong></td>
<td>Latin 250, 260, 360</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Classical Civilization 260</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Two electives</td>
<td>6</td>
</tr>
<tr>
<td><strong>Year III</strong></td>
<td>Latin 350, 370, 380</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Classical Civilization 350</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Two electives</td>
<td>6</td>
</tr>
<tr>
<td><strong>Year IV</strong></td>
<td>Latin 450, 460, 470, 480</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Two electives</td>
<td>6</td>
</tr>
</tbody>
</table>

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

Honours 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>One of French, German, Latin or Greek</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Two electives</td>
<td>6</td>
</tr>
</tbody>
</table>

37
Year II
Philosophy 240 or 340, 282*/283*, and 299 or one other Philosophy course 10
Three electives 6-9

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

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

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

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

Year II
Philosophy 221*/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) 10
One elective 2-3

Honours Philosophy and Literature

Year I
Recommended Programme: Hours
One of Philosophy 221*/222* or 280*/281* 3
French 160 (or German 100) 3
English 101† 3
A Social Science 3

Two of A Natural Science
Mathematics
History
Another language††
Another Social Science 6
### Year II

- One of Philosophy 221*/222* or 280*/281* 3
- Philosophy 282*/283* and one other Philosophy course 6
- French 250, 260 (or German 260 and one of German 250, 270) 5-6
- One elective (Social Science, if requirement not met in first year) 3

### Year III

- Philosophy 299, 331 and one other Philosophy course 7
- French 350, 360, 370 (or German 350, 360, 380) 7
- One elective 3

### Year IV

- Three Philosophy courses 6
- French 450, 460, 470, 480 (or German 450, 460, 470) 8
- Senior Essay

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

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

**Note:** Students who decide on their Honours programme on entry into Year II should take both Philosophy 221*/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 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

#### Year II

- Mathematics 230, and (a) 231, 232 or (b) 237 and either 236 or 238. 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 331, 337, 433, 446 7
- Three Philosophy courses 6
- Elective (may be another Math.) 2-3

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### Honours Philosophy and Political Science

#### Year I

<table>
<thead>
<tr>
<th><strong>Recommended Programme:</strong></th>
<th><strong>Hours</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>One of Philosophy 221*/222* or 280*/281*</td>
<td>3</td>
</tr>
<tr>
<td>Political Science 110</td>
<td>3</td>
</tr>
<tr>
<td>History</td>
<td>3</td>
</tr>
<tr>
<td>One of French, German, Russian, Greek, or Latin (language or civilization)</td>
<td>3</td>
</tr>
<tr>
<td>A Social Science other than Political Science</td>
<td>3</td>
</tr>
<tr>
<td>One elective</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Year II

<table>
<thead>
<tr>
<th><strong>Recommended Programme:</strong></th>
<th><strong>Hours</strong></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>3</td>
</tr>
<tr>
<td>One of Political Science 281, 282; or alternatively 283 or 284, and another half course in Political Science</td>
<td>3</td>
</tr>
<tr>
<td>One elective</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Year III

<table>
<thead>
<tr>
<th><strong>Recommended Programme:</strong></th>
<th><strong>Hours</strong></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>Political Science 250</td>
<td>3</td>
</tr>
<tr>
<td>Political Science 270</td>
<td>3</td>
</tr>
<tr>
<td>One other full course in Political Science or equivalent in half courses</td>
<td>3</td>
</tr>
<tr>
<td>One elective</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Year IV

<table>
<thead>
<tr>
<th><strong>Recommended Programme:</strong></th>
<th><strong>Hours</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Philosophy 325*/326*</td>
<td>3</td>
</tr>
<tr>
<td>Philosophy 499</td>
<td>1</td>
</tr>
<tr>
<td>Two full courses in Political Science or equivalent in half courses</td>
<td>6</td>
</tr>
<tr>
<td>Two electives</td>
<td>6</td>
</tr>
</tbody>
</table>

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

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

The recommended programme for the Honours Philosophy and Psychology degree includes the following courses and hours:

### Year I
- One of Philosophy 221*/222* or 280*/281* 3
- Psychology 150 2
- A language other than English 3
- English 101 3
- A Social Science other than Psychology 3
- Mathematics or a Natural Science 2-3 0-3

### Year II
- One of Philosophy 221*/222* or 280*/281* 3
- One of Philosophy 240 or 340 or 282*/283* 3
- One other Philosophy course 3
- Psychology 211*, 212*, 280, 290 7 4
- Mathematics, a Natural Science, or a Social Science other than Psychology 3 (see Note 1)

### Year III
- One of Philosophy 240 or 340 or 282*/283* 3
- Philosophy 299 and two other Philosophy courses 7
- Psychology 300, 351 and 352, or 390 2-3 0-2
- Mathematics, a Natural Science, or a Social Science other than Psychology (See Note 1) 2-3 0-3

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

**Note 1:** Biology 131 is recommended for students who lack Grade 13 Biology, Mathematics 85 for students who lack Grade 13 Mathematics. Students may benefit from including Mathematics 130, 233, 449 and Biology 231 within their programmes. A Physics, Chemistry, Sociology, or Political Science sequence will also be acceptable.

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

**Year I**  
*Recommended Programme:*  
Political Science 110  
One of Economics 101*/102*, Psychology 110, Sociology 100, Geography 101*/100*  
One of History 100, another approved History course, Philosophy 100 or equivalent  
One of English 101, a language other than English, a Foreign Culture Course  
Two other courses to be selected in consultation with the Department  

**Year II**  
Political Science 280, and two other Political Science courses at the 200 level selected in consultation with the Department  
An approved course in History, Philosophy or Economics  
Two other courses, at least one of which must be in a subject taken in Year I  

**Year III**  
Political Science 250, 364, and two further Political Science courses selected in consultation with the Department  
Two other approved courses  

**Year IV**  
Four Political Science courses, at least two of which must be at the 400 level  
One other approved course  

---

Honours Psychology

**Year I**  
*Recommended Programme:*  
Psychology 150  
Philosophy 100 or two of Philosophy 125, 135, 140, 150  
Biology  
A language other than English (see Note 1)  
Mathematics (see Note 2)  
A Social Science other than Psychology or a Natural Science other than Biology  

**Year II**  
Psychology 280, 290  
One other full-year course in Psychology or the equivalent in half-year courses  

---

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Philosophy 240 or Mathematics
(see Note 2)
A language other than English
A Natural Science or a Social Science
other than Psychology

Year III
Psychology 360
Three full-year Psychology courses or their
equivalent in half-year courses
Philosophy or Mathematics (see Note 2)
A Natural Science or a Social Science
other than Psychology

Year IV
Psychology 430 and 499
Two full-year Psychology courses or their
equivalent in half-year courses
A Natural Science or a Social Science
other than Psychology

Notes:

1. Russian is strongly recommended.

2. Students lacking Grade 13 Mathematics are urged to take Mathematics 85 in Year I. All Psychology Honours students should complete Mathematics 130 by the end of Year III. A student wishing to take both Philosophy and Mathematics in Year II, III, IV may omit one of the other recommended courses.

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

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

Honours Psychology and Sociology

<table>
<thead>
<tr>
<th>Year</th>
<th>Courses</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Psychology 150</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Sociology 100</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Philosophy 100 or equivalent</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Biology</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>A language other than English</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Elective (see Note 1)</td>
<td>3</td>
</tr>
<tr>
<td>II</td>
<td>Psychology 211, 212 and 290</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Sociology 210, 212, and one other full course at the 200 level</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Philosophy 240</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Elective (see Note 1)</td>
<td>2-3</td>
</tr>
<tr>
<td>Year</td>
<td>Program</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Psychology 300, 351, 352 6</td>
<td>Sociometry 320 and one other course in Sociology at the 300 level 6</td>
</tr>
<tr>
<td>IV</td>
<td>Psychology 410 and 430 5</td>
<td>Sociology 450 and 465 6</td>
</tr>
<tr>
<td></td>
<td>Senior Honours Essay (Psychology - Sociology 499)</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

1. Students lacking Grade 13 Mathematics should elect Mathematics 85. Other Electives recommended include Mathematics 130 and 499 and Biology 231.

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

**Honours Russian with minor in English or any other discipline**

*Recommended Programme:*

**Year I**
- One full Russian course or equivalent
- One full English course or equivalent
- Four more courses

**Year II**
- Minimum of two full Russian courses or equivalent
- Minimum of two full English courses or equivalent
- Two more courses

**Year III**
- Minimum of three full Russian courses or equivalent
- Minimum of one full English course or equivalent
- Two more courses

**Year IV**
- Minimum of three full Russian 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 22 of the Calendar.

**Honours Sociology**

**Year I**

*Recommended Programme:*

Sociology 100 3
History 100 3
Philosophy 100 or equivalent 3
English 101 3
Psychology 110 3
A language other than English 3
Year II
Anthropology 102 and Sociology 210, and two other full courses in Sociology
Three electives

Year III
Sociology 320, 325 and two other courses in Sociology
Two electives

Year IV
Sociology 450, 465, 470 and 499
One elective

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.

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.
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, as is a substantial part of the work of the second year. Starting with the second year, students elect one of the four principal divisions of engineering. The curriculum for each of the four basic programmes combines required "core" subjects essential to the field, and "elective" subjects permitting considerable diversity in individual programmes of study. An important part of the curriculum is a series of electives in the Humanities and Social Sciences.

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

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

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

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

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

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

Degree requirements 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 cooperative 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 49, 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></th>
<th>1967</th>
<th>1968</th>
<th>1969</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fall</td>
<td>Winter</td>
<td>Spring</td>
</tr>
<tr>
<td>Stream &quot;A&quot;</td>
<td>First Term</td>
<td>Second Term</td>
<td>Work Period</td>
</tr>
<tr>
<td>Stream &quot;B&quot;</td>
<td>First Term</td>
<td>Work Period</td>
<td>Second Term</td>
</tr>
</tbody>
</table>
Degrees

<table>
<thead>
<tr>
<th></th>
<th>1970</th>
<th></th>
<th>1971</th>
<th></th>
<th>1972</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Winter</td>
<td>Spring</td>
<td>Fall</td>
<td>Winter</td>
<td>Spring</td>
</tr>
<tr>
<td>Stream</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;A&quot;</td>
<td>Fifth</td>
<td>Work</td>
<td>Sixth</td>
<td>Work</td>
<td>Seventh</td>
</tr>
<tr>
<td></td>
<td>Term</td>
<td>Period</td>
<td>Term</td>
<td>Period</td>
<td>Term</td>
</tr>
<tr>
<td>Stream</td>
<td>Work</td>
<td>Fifth</td>
<td>Work</td>
<td>Sixth</td>
<td>Work</td>
</tr>
<tr>
<td>&quot;B&quot;</td>
<td>Period</td>
<td>Term</td>
<td>Period</td>
<td>Term</td>
<td>Term</td>
</tr>
</tbody>
</table>

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

Admission and Registration

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

Admission to Year I

In order to qualify for admission to the first year of the Engineering programme, the applicant 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. Nine credits are required for applicants who have taken more than one year to complete the work of Grade 13.

Standing is required in seven Grade 13 credits as follows:
- Five credits from Chemistry, Physics, Mathematics A and 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 follow-
ing may be counted as an “additional” credit: Accountancy Practice, Secretarial Practice, Mathematics of Investment, Art, or Music (Departmental Examination). 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.

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

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 and Registration

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

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

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

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

Registration
September 16 Saturday Faculty of Engineering

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

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

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

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

The fee schedule shown is the one in effect for the 1966-67 year and at the time of printing is still subject to review and possible change for the 1967-68 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.

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

**Miscellaneous Fees**

- Examination — Supplemental, each paper $10.00
- — Presiding fee (at an outside centre, each half day) 7.00
- Photograph (at first registration only) 1.00
- Late Registration 10.00
- Transcript of record 1.00
- Degree and Graduation - Final year only 10.00

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

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

**Residence Fees**

Residence fee for both men and women is:

<table>
<thead>
<tr>
<th>Type of Room</th>
<th>Single (per academic year)</th>
<th>Semi-Private (per term)</th>
<th>Double (per term)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>$850.</td>
<td>$810.</td>
<td>$750.</td>
</tr>
<tr>
<td>Semi-Private</td>
<td>$425.</td>
<td>$405.</td>
<td>$375.</td>
</tr>
</tbody>
</table>
All students may pay residence fees on a term basis; payments are due and payable on or before the day of registration or the first day of each term.

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

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

Examinations and Promotions

The Faculty constitutes the examining body for all University examinations. The arrangement of the undergraduate engineering programme is shown on page 50. The first two terms or semesters comprise the "First Year" and courses in the first year extend over the full two terms, with final examinations at the end of the second term. Beyond the first year, all courses are of single term duration, and final examinations are held at the end of each term.

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

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

2. Standings in individual subjects are indicated by numerical grades in the scale 0 to 100, and may be interpreted according to the following:

<table>
<thead>
<tr>
<th>Grade Range</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>85 - 100</td>
<td>Excellent</td>
</tr>
<tr>
<td>75 - 84</td>
<td>Very Good</td>
</tr>
<tr>
<td>66 - 74</td>
<td>Good, Above Average</td>
</tr>
<tr>
<td>60 - 65</td>
<td>Fair, Average to Below Average</td>
</tr>
<tr>
<td>50 - 59</td>
<td>Passing</td>
</tr>
<tr>
<td>Below 50</td>
<td>Failing</td>
</tr>
</tbody>
</table>

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

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

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

5. Overall average of grades or standings may be interpreted according to the following:

<table>
<thead>
<tr>
<th>Grade Range</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>75.0 - 100</td>
<td>First Class Honours</td>
</tr>
</tbody>
</table>
Examinations and Promotions

66.0 - 74.9 Second Class Honours
60.0 - 65.9 Third Class Honours
Conditional - (Supplemental Examination Required)

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

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

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

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

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

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

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

13. 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.
Academic Programmes

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

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

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

The optional programmes that are made available under the curricula indicated should not be construed as specialization, but are rather intended to foster independent study and maturity of learning by permitting special undergraduate activity in subject areas which hold maximum interest. Certain courses, normally taken only at the post-graduate level, may in fact be included in undergraduate programmes where necessary prerequisites are met. It must be emphasized that professional specialization in engineering requires intensive study beyond the Bachelor's degree as well as extensive experience in practice.

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

*(For Admission Requirements see page 51)*

### Course Arrangement:

<table>
<thead>
<tr>
<th></th>
<th>First Term</th>
<th>Second Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math. 12</td>
<td>Calculus I</td>
<td></td>
</tr>
<tr>
<td>Math. 21</td>
<td>Algebra and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Solid Geometry</td>
<td>2</td>
</tr>
<tr>
<td>Physics 11</td>
<td>Physics</td>
<td>3</td>
</tr>
<tr>
<td>G.E. 23</td>
<td>Measurement</td>
<td>2</td>
</tr>
<tr>
<td>Chem. 11</td>
<td>General Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>G.E. 11</td>
<td>Synthesis</td>
<td>3</td>
</tr>
<tr>
<td>G.E. 21</td>
<td>Graphics I</td>
<td>4*</td>
</tr>
<tr>
<td>G.E. 22</td>
<td>Graphics II</td>
<td>2</td>
</tr>
<tr>
<td>G.E. 24</td>
<td>Tutorial</td>
<td>1</td>
</tr>
<tr>
<td><strong>One of:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geography</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Political Science</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Psychology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Sociology</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

*Note: * signifies a course given on alternate weeks.

Detailed course descriptions commence on page 140.

All courses are of single term duration unless specifically indicated.

At the completion of the First Year, students are required to select one of the following major divisions of engineering:

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

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

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

### Chemical Engineering

The course offered by the Department of Chemical Engineering is intended to prepare students for professional careers in those fields of engineering where physical-chemical transformation of matter play a significant role. The academic curriculum is based on the concept that undergraduate studies, to be most effective in a scientific industrial age, must deal primarily with basic scientific and engineering principles. In the earlier years the subject matter is analytical and closely prescribed—mathematics, physics, and chemistry form the foundation. In the senior years, subjects such as transport processes, process system design, and economic analysis, enables the student to reach a more comprehensive understanding of his previous work. A certain degree of
Chemical Engineering

specialization is available in the final year through options oriented towards Chemistry, Chemical Engineering, Applied Mathematics, and Industrial Management. The co-operative work assignments form an introduction to the different aspects of engineering such as research, development, design, production, economic factors, etc., and provide for relating theory and practice in education. Work programmes are carefully planned and developed to enable the students to obtain maximum experience in industry.

A. Core Programme

a. Mathematics and Science Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lect.</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math. 22</td>
<td>Calculus II</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Math. 23</td>
<td>Numerical Methods</td>
<td>-</td>
<td>2</td>
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<tr>
<td>Math. 31</td>
<td>Differential Equations</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Math. 32</td>
<td>Numerical Analysis</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Chem. 22</td>
<td>Analytical Chemistry</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Chem. 26</td>
<td>Organic Chemistry I</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Chem. 31</td>
<td>Atomic and Molecular Structure</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Chem. 35</td>
<td>Electrochemistry</td>
<td>3</td>
<td>3*</td>
</tr>
<tr>
<td>Chem. 36</td>
<td>Organic Chemistry II</td>
<td>3</td>
<td>3*</td>
</tr>
</tbody>
</table>

b. Engineering Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lect.</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>G.E. 32</td>
<td>Fluid Mechanics (Transport Processes I)</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>G.E. 61</td>
<td>Philosophy of Science</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>E.E. 12</td>
<td>Electricity and Magnetism I</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>E.E. 13</td>
<td>Electricity and Magnetism II</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Ch.E. 11</td>
<td>Chem. Process Principles I</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Ch.E. 12</td>
<td>Chem. Process Principles II</td>
<td>3</td>
<td>2*</td>
</tr>
<tr>
<td>Ch.E. 16</td>
<td>Inorganic Chemistry</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Ch.E. 17</td>
<td>Applied Mathematics I</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Ch.E. 18</td>
<td>Engineering Statistics</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Ch.E. 22</td>
<td>Transport Processes II</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Ch.E. 23</td>
<td>Transport Processes III</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Ch.E. 31</td>
<td>Physical-Chemical Principles I</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Ch.E. 32</td>
<td>Thermodynamics I</td>
<td>3</td>
<td>2*</td>
</tr>
<tr>
<td>Ch.E. 33</td>
<td>Thermodynamics II</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Ch.E. 36</td>
<td>Physical-Chemical Laboratory</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Ch.E. 41</td>
<td>Reaction Kinetics I</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Ch.E. 42</td>
<td>Reaction Kinetics II</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Ch.E. 51</td>
<td>Process Dynamics and Control I</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Ch.E. 52</td>
<td>Process Dynamics and Control II</td>
<td>3</td>
<td>2*</td>
</tr>
<tr>
<td>Ch.E. 61</td>
<td>Engineering Economics</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Ch.E. 62</td>
<td>Process System Design</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Ch.E. 71</td>
<td>Chemical Engineering Lab. I</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>Ch.E. 72</td>
<td>Chemical Engineering Lab. II</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>Ch.E. 91</td>
<td>Seminar</td>
<td>1</td>
<td>-</td>
</tr>
</tbody>
</table>
B. Elective Courses

A minimum of 5 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 four courses are to be technical electives, and three of these are to be selected from any one of the optional groups listed below. The fourth elective can be chosen from other Chemical Engineering courses or from other science or engineering course lists according to interest, but this choice must be approved by the Department.

Optional Groups

(I) Chemical Engineering Science
   Ch.E. 34 Physical-Chemical Principles II
   Ch.E. 43 Reactor Design and Catalysis
   Ch.E. 54 Chem. Eng. Analysis

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

(III) Metallurgical Science
   Ch.E. 34 Physical-Chemical Principles II
   Ch.E. 43 Reactor Design and Catalysis
   Ch.E. 85 Chemical Metallurgy

(IV) Systems Option
   Ch.E. 54 Chem. Eng. Analysis
   Math. 55 Digital Computer Programming
   One approved course from Graduate
   Ch.E. courses in Systems and Controls e.g. Ch.E. 650; or from Management Science

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

(VI) Biochemical Engineering
   Ch.E. 90 Biochemical Engineering Processes
   Two additional electives selected in consultation with Department
Academic Programmes for Each Term (1967/68)

Chemical Engineering

Year IIA. Fall 1967 - Winter 1968
- Math. 22
- Math. 23
- E.E. 12
- Chem. 22
- Chem. 26
- Ch.E. 11
- Ch.E. 31
- Ch.E. 36

Year IIIB. Fall 1967 and Summer 1968
- Math. 31
- Math. 32
- E.E. 13
- Chem. 36
- Ch.E. 12
- Ch.E. 16

Year IIIA. Winter 1968 and Summer 1968
- Ch.E. 17
- Ch.E. 18
- Chem. 31
- G.E. 32
- Ch.E. 32
- Ch.E. 41

Year IIIB. Fall 1967 and Winter 1968
- Chem. 35
- Ch.E. 22
- Ch.E. 33
- Ch.E. 42
- Ch.E. 71
- Tech.Elect.

Year IVA. Fall 1967 and Summer 1968
- Ch.E. 23
- Ch.E. 51
- Ch.E. 61
- Ch.F. 72
- Elective
- Elective

Year IVB. Winter 1968
- G.E. 61
- Ch.E. 52
- Ch.E. 62
- Ch.E. 91
- Elective
- Elective
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 sanitation and design of municipal facilities.

(c) **Transportation Engineering** — is intended for the student interested in the planning, design, construction and traffic operation of streets and highways. Emphasis is placed on planning and design related to traffic demands.

(d) **Geotechnical Engineering** — is designed to provide the student with an understanding of the engineering properties of soils and enable him to appreciate the methods behind the design of foundations of structures, earth retaining structures, earth dams and highway pavements.

(e) **Engineering Mechanics** — for students with a strong interest in 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.
Civil Engineering

A. Core Programme

a. Engineering Courses

G.E. 12 Introduction to Engineering Systems
G.E. 31 Thermodynamics
G.E. 32 Fluid Mechanics
G.E. 41 Mechanics of Deformable Solids I
G.E. 42 Kinematics and Dynamics
G.E. 53 Structure and Properties of Matter I
G.E. 61 History and Philosophy of Science

b. Civil Engineering Core Courses

C.E. 221 Calculus II
C.E. 222 Differential Equations
C.E. 223 Statistics and Computer Programming
C.E. 232 Economics and Social Sciences
C.E. 241 Measurement II
C.E. 301 Mechanics of Deformable Solids II
C.E. 304 Structural Analysis
C.E. 321 Applied Mathematics
C.E. 322 Engineering Analysis
C.E. 351 Hydraulics
C.E. 361 Urban Planning
C.E. 371 Introduction to Geology and Engineering Materials
C.E. 372 Soil Mechanics
C.E. 400 Project
C.E. 401 Structural Steel
C.E. 402 Reinforced Concrete I
C.E. 452 Water Resources Engineering
C.E. 461 Transportation Engineering
C.E. 471 Soil 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.

G.E. 54 Structures and Properties of Materials II
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. 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. 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. 640 Highway Engineering (Planning and Design)
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

Academic Programmes for Each Term (1967 - 68)
Civil Engineering

Year IIA. Fall 1967 - Winter 1968
C.E. 241
C.E. 232
G.E. 41
C.E. 221
C.E. 223
Problems

Year IIB. Fall 1967
G.E. 31
G.E. 12
C.E. 222
C.E. 223
Problems

Year IIIB. Summer 1968
C.E. 222
G.E. 31
G.E. 42
G.E. 12

Year IIIA. Summer 1968
G.E. 32
G.E. 53
C.E. 301
C.E. 321
C.E. 371

Year IIIA. Winter 1968
G.E. 31
G.E. 32
C.F. 321
C.E. 223
C.E. 371 (Special)

Year IIIB. Fall 1967
G.E. 12
C.E. 321
C.E. 351
G.F. 31
C.E. 223
C.E. 471

64
<table>
<thead>
<tr>
<th>Year IIB. Winter 1968</th>
<th>Year IVA. Fall 1967</th>
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<tbody>
<tr>
<td>C.E. 321</td>
<td>C.E. 33</td>
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<tr>
<td>C.E. 351</td>
<td>C.E. 84</td>
</tr>
<tr>
<td>C.E. 361</td>
<td>G.E. 61</td>
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<tr>
<td>C.E. 372</td>
<td>1 Arts or Social Science elective</td>
</tr>
<tr>
<td>C.E. 223</td>
<td>2 Technical Electives</td>
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</table>

<table>
<thead>
<tr>
<th>Year IVA. Summer 1968</th>
<th>Year IVB. Winter 1968</th>
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</thead>
<tbody>
<tr>
<td>C.E. 400</td>
<td>C.E. 81</td>
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<tr>
<td>C.E. 401</td>
<td>C.E. 85</td>
</tr>
<tr>
<td>C.E. 402</td>
<td>C.E. 86</td>
</tr>
<tr>
<td>C.E. 452</td>
<td>one of</td>
</tr>
<tr>
<td>C.E. 461</td>
<td>3 Technical Electives</td>
</tr>
<tr>
<td>C.E. 322</td>
<td></td>
</tr>
</tbody>
</table>
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
   - Communication
   - Geography
   - Commerce
   - Engineering
   - Economics
   - Psychology
   - Industrial Design
   - Graphics
   - Sociology
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 specialties 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</th>
<th>Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math. 22</td>
<td>Calculus II</td>
<td>3</td>
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<tr>
<td>Math. 23</td>
<td>Numerical Methods</td>
<td>1</td>
</tr>
<tr>
<td>Math. 31</td>
<td>Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>Math. 32</td>
<td>Numerical Analysis</td>
<td>2</td>
</tr>
<tr>
<td>Math. 33</td>
<td>Differential Calculus</td>
<td>2</td>
</tr>
<tr>
<td>Math. 34</td>
<td>Integral Calculus</td>
<td>2</td>
</tr>
<tr>
<td>Math. 44</td>
<td>Complex Variables</td>
<td>2</td>
</tr>
<tr>
<td>Math. 51</td>
<td>Probability and Statistics</td>
<td>2</td>
</tr>
<tr>
<td>Phys. 15</td>
<td>Modern Physics</td>
<td>3</td>
</tr>
</tbody>
</table>

b. Engineering Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>G.E. 12</td>
<td>Introduction to Engineering Systems</td>
<td>2</td>
</tr>
<tr>
<td>G.E. 31</td>
<td>Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>G.E. 41</td>
<td>Mechanics of Deformable Solids I</td>
<td>2</td>
</tr>
<tr>
<td>G.E. 42</td>
<td>Dynamics</td>
<td>2</td>
</tr>
<tr>
<td>E.E. 12</td>
<td>Electrical Circuits</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 13</td>
<td>Electricity and Magnetism</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 25</td>
<td>Application of Electronic Computers</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 26</td>
<td>Design of Computing Machines</td>
<td>3</td>
</tr>
<tr>
<td>F.E. 33</td>
<td>Physical Electronics</td>
<td>2</td>
</tr>
<tr>
<td>E.E. 34</td>
<td>Physical Properties of Materials</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 42</td>
<td>Network Theory I</td>
<td>2</td>
</tr>
<tr>
<td>E.E. 543</td>
<td>Network Theory II</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 51</td>
<td>Electronics I</td>
<td>2</td>
</tr>
<tr>
<td>E.E. 52</td>
<td>Electronics II</td>
<td>2</td>
</tr>
<tr>
<td>E.E. 61</td>
<td>Electrodynamic Energy Conversion</td>
<td>2</td>
</tr>
<tr>
<td>E.E. 62</td>
<td>Electromechanics</td>
<td>2</td>
</tr>
<tr>
<td>E.E. 76</td>
<td>Electromagnetic Fields</td>
<td>3</td>
</tr>
</tbody>
</table>
C. Non-Technical Courses

G.E. 61 History and Philosophy of Science 3 -
Arts elective 3 -

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 -

3.
G.E. 13 Management Science I 3 -
E.E. 63 Power System Control and Protection 3 3**
E.E. 565 Power Systems Analysis 3 -
E.E. 582 Control Systems II 3 -

Academic Programmes for Each Term (1967/68)

Electrical Engineering

Year IIA. Fall 1967 - Winter 1968
Math. 22
Math. 23
G.E. 41
G.E. 42
E.E. 12
Arts elective

Year IIB. Fall 1967 - Summer 1968
Math. 31
Math. 32
Phys. 15
G.E. 12
G.E. 31
E.E. 13
Electrical Engineering

Year IIIA. Winter 1968 - Summer 1968
Math. 33
Math. 34
E.E. 33
E.E. 42
E.E. 51
E.E. 61

Year IIIB. Fall 1967 - Winter 1968
Math. 44
E.E. 25
E.E. 34
E.E. 52
E.E. 62
E.E. 76

Year IVA. Fall 1967
E.E. 23
E.E. 72
E.E. 81
E.E. 99
Electives (2)
Math. 51
Math. 55
Math. 56
E.E. 24
E.E. 44
E.E. 55

Year IVA. Summer 1968
Math. 51
G.E. 61
E.E. 26
E.E. 77
E.E. 81
E.E. 99

Year IVB. Winter 1968
E.E. 82
E.E. 96
E.E. 99
Electives (3)
E.E. 45
E.E. 64
E.E. 65
E.E. 74
E.E. 75
E.E. 83
Math. 51
Mechanical Engineering

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

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

(a) Thermo-Fluid Mechanics Option — is to accommodate students chiefly interested in the 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) Engineering Mechanics Option — is intended primarily for those interested in research and development careers in engineering. The courses are oriented for the student to obtain depth of understanding in the basic sciences (mathematics, physics, and chemistry) and the engineering sciences (particularly with respect to the mechanics of solids) and to gain insight and skill in the application of these sciences to engineering problems.
(c) **Mechanical Design Option** — is intended for the student with a strong interest in design. The over-all system approach to design is followed. Since mechanical design often extends into the field of structures, particularly when the unit being designed is large, structural engineering courses are suggested. Similarly of value are courses in heat transfer, fluid mechanics and manufacturing science.

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

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

### A. Core Programme

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lect.</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math. 22</td>
<td>Calculus II</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Math. 23</td>
<td>Numerical Methods</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Math. 31</td>
<td>Differential Equations</td>
<td>3</td>
<td>-</td>
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<td>Math. 32</td>
<td>Numerical Analysis</td>
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<td>4</td>
</tr>
<tr>
<td>Math. 41</td>
<td>Applied Analysis</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>G.E. 12</td>
<td>Introduction to Engineering Systems</td>
<td>3</td>
<td>3°</td>
</tr>
<tr>
<td>G.E. 31</td>
<td>Thermodynamics</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>G.E. 32</td>
<td>Fluid Mechanics</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>G.E. 41</td>
<td>Mechanics of Deformable Solids I</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>G.E. 42</td>
<td>Dynamics</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>G.E. 53</td>
<td>Structure and Properties of Matter I</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>G.E. 54</td>
<td>Structure and Properties of Matter II</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 12</td>
<td>Electricity and Magnetism I</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>E.E. 13</td>
<td>Electricity and Magnetism II</td>
<td>2</td>
<td>3°</td>
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<td>E.E. 32</td>
<td>Electronics</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 81</td>
<td>Control Systems</td>
<td>3</td>
<td>3°</td>
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<td>M.E. 13</td>
<td>Kinematics</td>
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<tr>
<td>M.E. 21</td>
<td>Mechanics of Machinery</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>M.E. 53</td>
<td>Heat Transfer I</td>
<td>3</td>
<td>3°</td>
</tr>
<tr>
<td>M.E. 81</td>
<td>Seminar</td>
<td>-</td>
<td>1</td>
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<tr>
<td>M.E. 82</td>
<td>Mechanical Engineering Projects</td>
<td>-</td>
<td>9</td>
</tr>
<tr>
<td>C.E. 22</td>
<td>Mechanics of Deformable Solids II</td>
<td>2</td>
<td>-</td>
</tr>
</tbody>
</table>

73
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. Some of these are prerequisites for other higher level elective subjects, and should therefore be chosen on the basis of a decision on the part of the student to enter one or other of the options. The subjects offered in the various options are listed below. Higher level electives are offered depending on the availability of faculty. It is not necessary (or even desirable) to choose all electives from a single option. Furthermore, electives may be chosen from the offerings of other Engineering Departments. Mathematics or indeed any other Arts or Science Department, provided only that the timetables are compatible.

a. Thermodynamics — Fluid Mechanics Option

Prerequisites:
M.E. 54 Thermodynamics II
M.E. 62 Fluid Dynamics

Higher level electives:
M.E. 55 Statistical Thermodynamics
M.E. 56 Heat Transfer II
M.E. 63 Turbomachines I
M.E. 65 Gas Dynamics I
M.E. 66 Turbulent Flow I
M.E. 631 Fluid Power Control Systems
M.E. 655 Combustion
M.E. 666 Wave phenomena in Fluids

Suggested electives from other options or departments:
Math. 54 Differential Equations of Mathematical Physics
C.E. 79 Engineering Hydraulics
C.E. 611 Elementary Mechanics of Continua

b. Engineering Mechanics Option

Prerequisites:
M.E. 24 Advanced Dynamics
M.E. 62 Fluid Dynamics

Higher level electives:
M.E. 23 Mechanical Design II
M.E. 25 Mechanical Vibrations
M.E. 625 Experimental Mechanics

Suggested electives from other options or departments:
M.E. 22 Mechanical Design I
Math. 54 Differential Equations of Mathematical Physics
M.E. 56 Heat Transfer II
M.E. 65 Gas Dynamics
M.E. 66 Turbulent Flow I
M.E. 41 Manufacturing Science I
C.E. 611 Elementary Mechanics of Continua
c. Mechanical Design Option
Prerequisites:
M.E.  22 Mechanical Design I
Suggested Electives:
M.E.  23 Mechanical Design II
M.E.  24 Advanced Dynamics
M.E.  25 Mechanical Vibrations
M.E.  26 Mechanical Design III
M.E.  41 Manufacturing Science I
M.E.  45 Manufacturing Science VI
M.E.  56 Heat Transfer II
M.E.  62 Fluid Dynamics
E.E.  61 Electromechanics I
C.E.  35 Structural Design
M.E.  625 Experimental Mechanics
M.E.  49 Metrology

d. Manufacturing Sciences Option
Electives:
M.E.  41 Manufacturing Science I
M.E.  42 Manufacturing Science III
M.E.  43 Manufacturing Science IV
M.E.  44 Manufacturing Science V
M.E.  647 Manufacturing Science VII
M.E.  49 Metrology
M.E.  645 Machinery of Manufacture
Suggested electives from other options or departments:
M.S.  13 Management Science I
M.S.  14 Management Science II
M.S.  83 Project Management
M.E.  26 Human Factors Engineering
M.E.  631 Fluid Power Control Systems
Soc.  339 Industrial Sociology
Math.  55 Digital Computer Programming
Ch.E.  55 Polymer Chemistry
Ch.E.  37 Ceramics
M.E.  31 Physical Metallurgy I
M.E.  32 Physical Metallurgy II

e. Engineering Materials Option
Mechanical Engineering Electives:
M.E.  31 Physical Metallurgy I
M.E.  32 Physical Metallurgy II
M.E.  34 Impurities and Imperfections in Solids
M.E.  37 Ceramics
M.E.  38 Materials in Nuclear Technology
M.E.  641 Theory of Metals
M.E.  642 Behaviour of Materials
Suggested electives from other options and departments:
M.E.  41 Manufacturing Science I
M.E. 26 Human Factors Engineering
M.E. 643 Manufacturing Science II
C.E. 611 Elementary Mechanics of Continua
E.E. 55 Solid State Electronics
Chem. 25 Polymer Chemistry and Physics

Mechanical Engineering

Year IIA. Fall 1967 and Winter 1968
Math. 22
Math. 23
E.E. 12
G.E. 41
M.E. 13
G.E. 42

Year IIB. Summer 1967 and Fall 1967
Math. 32
Math. 31
E.E. 13
G.E. 31
G.E. 12
G.E. 53

Year IIIA. Winter 1968 and Summer 1968
G.E. 54
G.E. 32
M.E. 21
C.E. 22
E.E. 32

Year IIIB. Fall 1967 and Winter 1968
Math. 41
M.E. 53
G.E. 61
2 Technical electives
Arts elective

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

Year IVB. Winter 1968
M.E. 81
M.E. 82
3 Technical electives
Arts elective

Note: For Graduate Programme in Design see page 66.
For Graduate Programmes in Management and Systems Engineering, page 241
IV

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 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.
Faculty of Mathematics

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 undergraduate 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 85 to 89 show, specialize in Applied Mathematics, Computer Science, Pure Mathematics, or Statistics.

Admission and Registration

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

Admission to Year 1

In order to qualify for admission to the first year in 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 60% in the three credits in Mathematics. Nine credits are required for applicants who have taken more than one year to complete the work of Grade 13.
Standing is required in seven Grade 13 credits as follows:
Three credits from Mathematics A and Mathematics B.
Four additional credits chosen wherever possible in accordance with the student's major field of study.

Students wishing to take Science electives must present Physics and/or Chemistry among their additional credits.

Students entering the Co-operative programme must have a minimum of 66% in the 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, Secretarial Practice, Mathematics of Investment, Art, or Music (Departmental Examination). 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 "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 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

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 I 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
**Admission and Registration**

<table>
<thead>
<tr>
<th>Region</th>
<th>Qualification</th>
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</thead>
<tbody>
<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</td>
</tr>
<tr>
<td>East and West Africa</td>
<td>with passes in at least five subjects, two of which</td>
</tr>
<tr>
<td></td>
<td>must be at Advanced Level.</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</td>
</tr>
<tr>
<td></td>
<td>formal study in subjects comparable to Ontario</td>
</tr>
<tr>
<td></td>
<td>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. 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 14 Thursday Faculty of Mathematics

Fees

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

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

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

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

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

Incidental fees are not refundable.

The fee schedule shown is the one in effect for the 1966-67 year and at the time of printing is still subject to review and possible change for the 1967-68 year. If a fee change is made, a notice will be issued with a new fee schedule; however, the University does not undertake or accept responsibility to so notify all recipients of this calendar. The Board of Governors reserves the right to make changes in the published schedule of fees without notice.

Sessional Fees

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuition</td>
<td>$510.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incidental†</td>
<td>46.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>68.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$510.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>46.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>82</td>
</tr>
</tbody>
</table>
Co-operative Programme in Mathematics —

Fees per term

<table>
<thead>
<tr>
<th>Item</th>
<th>Year One</th>
<th>Other Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuition</td>
<td>$292.50</td>
<td>$317.50</td>
</tr>
<tr>
<td>Incidental†</td>
<td>24.75</td>
<td>24.75</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$317.25</strong></td>
<td><strong>$342.25</strong></td>
</tr>
</tbody>
</table>

Part-Time Students

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

Miscellaneous Fees

- Examination — Supplemental, each paper $10.00
- Presiding fee (at an outside centre, each half day) 7.00
- Photograph (at first registration only) 1.00
- Late Registration 10.00
- Transcript of record 1.00
- Degree and Graduation - Final year only 10.00

† Incidental fees include student activities, athletics, health insurance and health services.

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

Residence Fees

Residence fees for both men and women are:

<table>
<thead>
<tr>
<th>Type of Room</th>
<th>Single per academic year</th>
<th>Semi-private per academic year</th>
<th>Double per academic year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$850.</td>
<td>$810.</td>
<td>$750.</td>
</tr>
<tr>
<td>per term</td>
<td>$425.</td>
<td>$405.</td>
<td>$375.</td>
</tr>
</tbody>
</table>

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

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

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

The Faculty constitutes the examining body for all 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.

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 28, 1967, 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 examinations, 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, conditional 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 General 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.

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.

† Certain students in the Regular Programmes may be allowed to substitute a fourth elective for Mathematics 132.

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

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

The above choices are suggested, but are not compulsory.

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

The General Course in Mathematics

Year I — Common to General and Honours programmes.
Year II — Two courses from Mathematics 235, 236, 237, 238. Three elective courses from outside mathematics.
Year III — Two courses from Mathematics 230, 233, 330, 334, 446. Three elective courses from outside mathematics.

Honours Courses in Mathematics

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

Year II — Mathematics 230, 233.

— Mathematics 231, 232, or Mathematics 237 and one of Mathematics 236, 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 department 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 23, 236, 237.

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

(4) Students desiring minor fields of specialization should normally include the following choices among their electives:

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

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Applied Mathematics Programme

Third Year — Mathematics 331, 332.
- Three or four additional Mathematics courses.
- Two electives.

Fourth Year — Mathematics 432, 434.
- Three or four of Mathematics 441, 442, 443, 444, 445, 447.
- Two electives.

Computer Science Programme

Third Year — Mathematics 331, 332, 334, 340.
- One or both of Mathematics 333, 338.
- Two electives.

Fourth Year — Mathematics 431, 436, 427.
- Two or three additional Mathematics courses†
- Two electives.

†Students interested in Numerical Analysis should select Mathematics 434.

Pure Mathematics Programme

Year III — Mathematics 330, 331, 332.
- Two or three additional mathematics courses.
- Two electives.

Year IV — Two of (i), (ii), (iii) below:
(i) — A 400 level algebra course.
(ii) — A 400 level analysis course.
(iii) — Mathematics 426 or 430 or 448.
- Three or four additional mathematics courses.
- Two electives.

Statistics Programme

Year III — Mathematics 331, 332, 338.
- Two additional mathematics courses.
- Two electives.

Year IV — Mathematics 438, 439, 440
- Two additional mathematics courses.
- Two electives.
### Honours Mathematics and Philosophy

#### 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>One of 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

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 230, 231, 232</td>
<td>8</td>
</tr>
<tr>
<td>One of Philosophy 221/222 or 280/281</td>
<td>3</td>
</tr>
<tr>
<td>One of Philosophy 240 or 340 or 282/283</td>
<td>3</td>
</tr>
<tr>
<td>Elective</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Year III

<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>One of 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

<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>6</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 or 280/281 during that year, and should consult the Department concerning rearrangement of their courses.

### Honours Mathematics and Psychology

#### Prerequisite:

Students entering this programme should have an overall average of 66% in the Grade 13 examinations in Mathematics (Mathematics A, Mathematics B).

#### Year I

**Recommended Programme:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 130, 131, 132</td>
<td>6</td>
</tr>
<tr>
<td>Psychology 110</td>
<td>3</td>
</tr>
<tr>
<td>Philosophy 100 or two of Philosophy 125, 135, 140, 150</td>
<td>3</td>
</tr>
<tr>
<td>A language other than English</td>
<td>3</td>
</tr>
<tr>
<td>Biology (see Note 1)</td>
<td>2</td>
</tr>
</tbody>
</table>

#### Year II

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 230 and 231, 232 or 237, 238</td>
<td>8</td>
</tr>
<tr>
<td>Psychology 280, 290</td>
<td>4</td>
</tr>
<tr>
<td>One other course in Psychology at the 250-299 level</td>
<td>2</td>
</tr>
<tr>
<td>Philosophy 240</td>
<td>3</td>
</tr>
<tr>
<td>Biology or Zoology (see Note 1)</td>
<td>2</td>
</tr>
</tbody>
</table>

88
Honours Mathematics and Psychology

<table>
<thead>
<tr>
<th>Year</th>
<th>Courses</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year III</td>
<td>Mathematics 233, 331, 332</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Two other courses in Psychology at the 350-399 level</td>
<td>4-5</td>
</tr>
<tr>
<td></td>
<td>Philosophy 340</td>
<td>2</td>
</tr>
<tr>
<td>Year IV</td>
<td>Mathematics 439 or 449</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Two of Mathematics 333, 334, 335, 446</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Psychology 430, 499</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Elective (may be another Math. or Psych.)</td>
<td>2-3</td>
</tr>
</tbody>
</table>

Note 1: Students lacking Grade 13 Biology must take Biology 131. Biology 231 should be completed before the end of Year II.

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

The Co-operative Programme in Honours Mathematics

(Actuarial and Computer Science 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 131, Physics 131.

Group B — Students interested in Arts minors normally choose English 15, Philosophy 100, Psychology 110.

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 230, 233, 235, 237, 238.

— Two elective subjects.

Year III — Mathematics 331, 332, 334.

— Mathematics 336 or 340.

— One of Mathematics 335, 336, 338 and 340 if not taken above.

— Two elective subjects.

Year IV — Five courses in Mathematics.

— Two elective subjects.

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 79.
The IBM System 360 Computer in the University's Computer Centre
V

The Faculty of Science
The Faculty of Science

The University issued its first calendar for the Faculty of Science in 1959, and enrolled its first Science students that autumn. By the autumn of 1966 there were 1092 full-time undergraduate and 127 graduate students, and a full-time teaching staff of 70. In each year since its inception the Faculty has introduced new programmes and extended its facilities.

In 1967 the association between the Department of Mathematics and the Faculty of Science will be modified by the creation of a separate Faculty of Mathematics. The B.Sc. programme in Mathematics will be continued for third and fourth-year students who had begun work in this Faculty and elect to remain in it. First- or second-year students desiring a major in Mathematics should enrol in the Faculty of Mathematics.

The programme in Earth Sciences is being extended to the fourth year of the General Course and by the introduction of an Honours programme in Geology.

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

All Science students are enrolled on a full-time basis. All courses in this Faculty except Co-operative Applied Physics and Co-operative Applied Chemistry are offered in two terms throughout a conventional academic year. The Applied Physics and Applied Chemistry courses are given exclusively on a co-operative basis with alternating terms of academic and industrial work in the same manner as the courses in the Faculty of Engineering (see chart on page 50).

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

Degrees

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

General

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

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

Admission to Year I

In order to qualify for admission to the first year of the Science programme, the applicant 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. Nine credits are required for applicants who have taken more than one year to complete the work of Grade 13.

Standing is required in seven Grade 13 credits as follows:

Five credits from Chemistry, Physics, Mathematics A and Mathematics B or Biology.

Two additional credits.

Students intending to take an Honours course 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.

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, Secretarial Practice, Mathematics of Investment, Art, or Music (Departmental Examination). 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 as 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 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

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  

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 the advanced level in subjects appropriate to the candidate's intended field of study.  
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. Each application will be considered on its merits by the Admissions Committee. Under certain circumstances, the applicant may be required to write a qualifying examination.

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

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

Registration
September 13 Wednesday Faculty of Science.

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

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

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

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

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

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<table>
<thead>
<tr>
<th>Fee Category</th>
<th>Year One</th>
<th>Other Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuition</td>
<td>$510.50</td>
<td>$317.50</td>
</tr>
<tr>
<td>Incidental†</td>
<td>$6.00</td>
<td>$7.00</td>
</tr>
<tr>
<td>Total</td>
<td>$516.50</td>
<td>$324.50</td>
</tr>
</tbody>
</table>

### Co-operative Programmes in Science

#### Fees per term

<table>
<thead>
<tr>
<th>Fee Category</th>
<th>Year One</th>
<th>Other Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuition</td>
<td>$292.50</td>
<td>$317.50</td>
</tr>
<tr>
<td>Incidental†</td>
<td>$24/75</td>
<td>$24/75</td>
</tr>
<tr>
<td>Total</td>
<td>$317.25</td>
<td>$342.25</td>
</tr>
</tbody>
</table>

### Part-Time Students

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

### Miscellaneous Fees

<table>
<thead>
<tr>
<th>Fee Category</th>
<th>Amount</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>Photograph (at first registration only)</td>
<td>1.00</td>
</tr>
<tr>
<td>Late Registration</td>
<td>10.00</td>
</tr>
<tr>
<td>Transcript of record</td>
<td>1.00</td>
</tr>
<tr>
<td>Degree and Graduation - Final year only</td>
<td>10.00</td>
</tr>
</tbody>
</table>

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

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

### Residence Fees

Residence fees for both men and women are:

<table>
<thead>
<tr>
<th>Type of Room</th>
<th>Single</th>
<th>Semi-private</th>
<th>Double</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per academic year</td>
<td>$850</td>
<td>$810</td>
<td>$750</td>
</tr>
<tr>
<td>Per term</td>
<td>425</td>
<td>405</td>
<td>375</td>
</tr>
</tbody>
</table>

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Fees

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

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

Examinations and Promotions

The Faculty constitutes the examining body for all University examinations.

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

Co-operative Programmes
In Year I final examinations are held at the end of the second term and cover the whole work of each course in Year I. 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 subjects will be granted by letter grade as follows.

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

(In this and subsequent sections the term "subject" will apply to individual courses, e.g. Chemistry 131, and the term "course" will apply to groups of subjects, e.g. the Chemistry and Biology Course).
3. Standing in an individual subject is determined by combining the marks assigned for term work with those obtained on written examinations. The ratio in which these marks are combined is at the discretion of the individual departments. To pass in a subject, a candidate must obtain 50% in his examination and a minimum of 50% in the combined term mark and examination mark. A student whose term work is deficient in a subject may, at the discretion of the department concerned and the Dean, be barred from writing the final examination in that subject.

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

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

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

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

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

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

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

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

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

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

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

14. Supplemental examinations will be held in July for regular programmes. Applications for these supplemental examinations must be filed by June 28, 1967, 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 were written. Fees for supplemental examinations must accompany the application. If the student subsequently decides not to write the examination, the fee is not refunded.

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

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

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

Academic Programmes

First Year

(For all students except Co-operative Applied Physics (see page 100) and Co-operative Applied Chemistry (see page 100).

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

Two of:

- Biology 131 or 132 An introduction to Biology or Principles of Biology.
Earth Sciences 130  Introductory Geology
Mathematics 131  Algebra and Solid Geometry
Mathematics 132  Numerical Procedures
Psychology 110 or 150 Introductory Psychology or
                   Experimental Methods in Psychology

*indicates a laboratory taken in alternative weeks.

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

<table>
<thead>
<tr>
<th>Major Field of Study</th>
<th>Required in First Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>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 &amp; Physics</td>
<td>Mathematics 131 (Mathematics 132 recommended)</td>
</tr>
<tr>
<td>Earth Sciences</td>
<td>Earth Sciences 130, Biology 131 or 132</td>
</tr>
<tr>
<td>Mathematics</td>
<td>Mathematics 131</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 subject for students in the third year of the General Course with a major in Biology.

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

**Note 4.** Earth Sciences 130 and Biology 131 or 132 should be selected by those planning to major in Earth Sciences. Another Science or Mathematics subject may be chosen in place of Biology 131 or 132 by students who have achieved a good standing in post-1964 Grade 13 Biology or equivalent.

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

<table>
<thead>
<tr>
<th>Year IA</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 101</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Chemistry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The normal route to attain professional standing in science is to take an Honours course in the appropriate field or combination of fields. The Honours courses are of four years' duration; they are rather specialized in content, and the syllabus in each is rather rigidly prescribed. Those graduating with at least second-class honours standing are granted preferred treatment for postgraduate study in Canadian Universities. Graduates of certain Honours courses are eligible for admission to Type A (specialist) courses for prospective high school teachers at the Ontario College of Education.

The following Honours programmes are available.

Honours Biology

(For Year I, see page 99)

<table>
<thead>
<tr>
<th>Year II</th>
<th></th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 235</td>
<td></td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 234</td>
<td></td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 235</td>
<td></td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 236</td>
<td></td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Physics 200</td>
<td></td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Elective</td>
<td></td>
<td>as specified</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year III</th>
<th></th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 333</td>
<td></td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 334</td>
<td></td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 335</td>
<td></td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 337</td>
<td></td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 337</td>
<td></td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Elective</td>
<td></td>
<td>as specified</td>
<td></td>
</tr>
</tbody>
</table>
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 99)

<table>
<thead>
<tr>
<th>Year II</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 231</td>
<td>Chemical Bonding and Structure</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 232</td>
<td>Analytical Chemistry</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 236</td>
<td>Organic Chemistry I</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 236</td>
<td>Differential Equations</td>
<td>2</td>
</tr>
<tr>
<td>Two of: 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
| Chemistry 325 | General Physical Chemistry | 2 | 3 |
| Chemistry 336 | Organic Chemistry II | 2 | 3 |
| Chemistry 337 | Biochemistry I | 2 | 0 |
| Physics 242 | Electricity and Magnetism | 2 | 3 |
| Two of: Biology 333 | Invertebrate Zoology | 2 | 3 |
| Biology 334 | Taxonomy and Evolution | 2 | 3 |
| Biology 335 | Microbiology I | 2 | 3 |
| Biology 337 | General Physiology | 2 | 3 |

Year IV
| Chemistry 331 | Inorganic Chemistry I | 2 | 3 |
| Chemistry 437 | Biochemistry II | 2 | 3 |
| Mathematics 233 | Probability and Statistics | 2 | 1 |
| Three of: Any 400-level courses offered in Biology | as specified |

Honours Biology and Psychology
(For Year I, see page 99)

<table>
<thead>
<tr>
<th>Year II</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 231</td>
<td>Genetics and Evolution</td>
<td>3</td>
</tr>
<tr>
<td>Biology 233</td>
<td>Vertebrate Zoology</td>
<td>2</td>
</tr>
<tr>
<td>Psychology 251</td>
<td>Comparative Psychology (half course)</td>
<td>2</td>
</tr>
<tr>
<td>Psychology 252</td>
<td>Physiological Psychology (half course)</td>
<td>2</td>
</tr>
</tbody>
</table>
Honours Biology and Psychology

<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychology 360</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 236</td>
<td></td>
<td></td>
</tr>
<tr>
<td>German or Russian</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year III</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biology 333</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 337</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Psychology 370</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Psychology 380</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 233</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 337</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Year IV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biology 431</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Biology 434</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 436</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Psychology 499</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biology 499</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychology 430</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Mathematics 449</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 437</td>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>

Honours Chemistry

(For Year I, see page 99)

Year II

<table>
<thead>
<tr>
<th>Course</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>
</tr>
<tr>
<td>Chemistry 236</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Physics 242</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics 236</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Year III

<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 331</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 335</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Chemistry 336</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>One of:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics 235</td>
<td>2</td>
<td>3*</td>
</tr>
<tr>
<td>Physics 332</td>
<td>2</td>
<td>3*</td>
</tr>
<tr>
<td>One or two of:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 337</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 230</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Lectures</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Mathematics 233</td>
<td>Probability and Statistics</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 238</td>
<td>Principles of Computer Science</td>
<td>2</td>
</tr>
<tr>
<td>Physics 332</td>
<td>Electronics (if not elected above)</td>
<td>2</td>
</tr>
</tbody>
</table>

**Year IV**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 431</td>
<td>Inorganic Chemistry II</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 435</td>
<td>Physical Chemistry III</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 436</td>
<td>Organic Chemistry III</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 439</td>
<td>Advanced Laboratory</td>
<td>0</td>
<td>9</td>
</tr>
</tbody>
</table>

*Two or three of:*

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 337</td>
<td>Biochemistry I</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 440</td>
<td>Polymer Chemistry</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Physics 332</td>
<td>If not chosen above</td>
<td>2</td>
<td>3*</td>
</tr>
<tr>
<td>Mathematics 233</td>
<td>If not chosen above</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Mathematics 450</td>
<td>Applied Analysis</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 437</td>
<td>Biochemistry II</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics 230</td>
<td>If not chosen above</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 238</td>
<td>If not chosen above</td>
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<td>Abstract Algebra II</td>
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*indicates a laboratory taken in alternate weeks.

**Honours Chemistry (Mathematics Option)**

*(Mathematics Option)*

**Year II**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lectures</th>
<th>Labs.</th>
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<tbody>
<tr>
<td>Chemistry 231</td>
<td>Chemical Bonding &amp; Structure</td>
<td>2</td>
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<td>Chemistry 232</td>
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<tr>
<td>Physics 232</td>
<td>Electricity and Magnetism</td>
<td>2</td>
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<tr>
<td>Mathematics 236</td>
<td>Differential Equations</td>
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<tr>
<td>Mathematics 238</td>
<td>Principles of Computer Science</td>
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<tr>
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**Year III**

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<th>Course Title</th>
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<th>Labs.</th>
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<tr>
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<td>Inorganic Chemistry I</td>
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**Year IV**

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Honours Chemistry

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*indicates a laboratory taken in alternate weeks.

Co-operative Applied Chemistry

(Honours)

Year IIA

(For Year I, see page 100)

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<td>Introductory Organic Chemistry</td>
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Year IIB

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<td>Introductory Inorganic Chemistry</td>
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Year IIIA

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<td>Chemistry 306</td>
<td>Applied Organic Chemistry</td>
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<td>Chemistry 308</td>
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Year IIIB

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<td>Chemistry 305</td>
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Year IVA

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<td>Electrochemistry and Corrosion</td>
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<td>Chemistry 402</td>
<td>Modern Organic Analysis</td>
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<td>Digital Computer Programming</td>
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One of:

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<td>Physical Chemistry of Polymers</td>
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<td>Chemistry 405</td>
<td>Surface Chemistry</td>
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<td>Chemistry 407</td>
<td>Applied Biochemistry</td>
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<td>Mech. Eng. 36</td>
<td>Physical Metallurgy</td>
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### Year IVB

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<td>Analysis of Materials</td>
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<td>Industrial Economics</td>
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<td>Water Resources Engineering</td>
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<td>Properties of Polymers</td>
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<td>Chemistry 415</td>
<td>Catalysis</td>
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<td>Ceramics</td>
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<td>Biology 235A</td>
<td>Microbiology</td>
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### Honours Chemistry and Physics

*(For Year I, see page 99)*

#### Year II

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<th>Labs.</th>
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<tbody>
<tr>
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<td>Chemistry 235</td>
<td>Physical Chemistry I</td>
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<td>1</td>
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<tr>
<td>Mathematics 237</td>
<td>Differential and Integral Calculus</td>
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<tr>
<td>Mathematics 238</td>
<td>Principles of Computer Science</td>
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<td>0</td>
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<tr>
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<td>Electricity and Magnetism</td>
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#### Year III

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<tr>
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<td>Organic Chemistry I</td>
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<td>Chemistry 335</td>
<td>Physical Chemistry II</td>
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<td>Mathematics 233</td>
<td>Probability and Statistics</td>
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<td>Physics 331</td>
<td>Classical Mechanics I</td>
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<td>Atomic and Nuclear Physics I</td>
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<td>Physical Mathematics I</td>
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#### Year IV

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<tr>
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<td>Organic Chemistry II</td>
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### Option A (Chemistry)

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<tr>
<td>Chemistry 435</td>
<td>Physical Chemistry III</td>
<td>2</td>
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Honours Chemistry and Physics

One of:
Chemistry 337  Biochemistry I
Chemistry 440  Polymer Chemistry
one Arts Elective

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

*indicates a laboratory taken in alternate weeks.

Honors Earth Sciences

(Geology Option)

(For Year I see page 99 and note 4)

Year II (Commencing 1967)
Earth Sciences 230  Mineralogy 2 2
Earth Sciences 232#  Petrography (half course) 2 2
Earth Sciences 237#  Field Geology (half course) 4
Earth Sciences 238#  Historical Geology (half course) 2 2
Earth Sciences 240#  Geomorphology (half course) 2 3
Chemistry 241  Principles and Applications of Chemical Bonding 2 1
Biology 333 or Invertebrate Zoology 2 3
Biology 131  Introduction to Biology 2 3

One of:
Sociology 100  Introductory 3
Psychology 110  Introductory 3
Economics 101# /102#  Introductory 3

Year III (Commencing 1968)
Earth Sciences 330  Igneous and Metamorphic Petrology 2 2
Earth Sciences 334  Paleontology 2 2
Earth Sciences 335  Stratigraphy and Sedimentation 2 2
Earth Sciences 340  Structural Geology 2 2

One of:
Mathematics 238  Principles of Computer Science 2
Mathematics 243  Statistics for the Social Sciences 3
Physics 237  Astronomy I 3
Physics 243  Electricity and Magnetism (one term) 3 3*
Physics 245  Structure of Solids I (one term) 3 3*
One of:

- History 100 Western Civilization 2
- Philosophy 100 Introductory 3
- Political Science 100 Introductory 3

Year IV (Commencing 1969)

- Earth Sciences 430 Economic Geology 2
- Earth Sciences 435 Seminar 3
- Earth Sciences 436 Thesis 3
- Earth Sciences 437 Crustal Evolution 2
- Earth Sciences 440 Quaternary Geology (half course) 3

Two of:

- Earth Sciences 338 Geophysics 2
- Earth Sciences 431 Geochemistry 2
- Earth Sciences 432 Precambrian Geology (half course) 2
- Earth Sciences 434 Biostratigraphy (half course) 2
- Earth Sciences 438 Engineering Geology (half course) 2
- Earth Sciences 439 Groundwater Geology (half course) 3

Arts elective

Note 1: Courses marked * are half courses: two of these make the equivalent of one course selection.

Honours Mathematics

Year III (Pure Mathematics Option) (1967-68 only)

- Mathematics 330 Euclidean and Projective Geometry 3
- Mathematics 331 Algebra II 2
- Mathematics 332 Theory of Functions 3
- Mathematics 333 Differential Equations 2

One or two Additional Mathematics Courses: as specified

One Science Elective as specified
One Non-Science Elective as specified

(Statistics Option)

- Mathematics 331 Algebra II 2
- Mathematics 332 Theory of Functions 3
- Mathematics 335 Finite Differences 2
- Mathematics 338 Mathematical Statistics 2

Two of:

- Mathematics 330 Euclidean and Projective Geometry 3
- Mathematics 333 Differential Equations 2
- Mathematics 334 Numerical Methods 2

One Science Elective as specified
One Arts Elective as specified
Honours Mathematics

(Applied Mathematics Option)

<table>
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<td>One Non-Science Elective</td>
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* Indicates a laboratory taken in alternate weeks.

(Teaching Option)

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Year IV (Pure Mathematics Option) (1967-68; 1968-69 only)

Three or four of:

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<td>Finite Projective Geometries</td>
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Two or three Additional Mathematics Courses | as specified |     |

One Science Elective     | as specified |     |
One Non-Scicnce Elective | as specified |     |

(Statistics Option)

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Two or Three Courses from:

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

One Science Elective     | as specified |     |
One Non-Science Elective | as specified |     |
(Applied Mathematics Option)

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

**Three or Four Courses from:**

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

(Teaching Option)

<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 446</td>
<td>History of Mathematics</td>
<td>2 0</td>
</tr>
<tr>
<td>Four additional Mathematics courses numbered above 200</td>
<td>as specified</td>
<td></td>
</tr>
<tr>
<td>One Science Elective</td>
<td>as specified</td>
<td></td>
</tr>
<tr>
<td>One Non-Science Elective</td>
<td>as specified</td>
<td></td>
</tr>
</tbody>
</table>

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

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

**Non-science electives for the third and fourth years:** English 201, 210 or 235, German 1-50, History 200, Psychology 110, Russian 1-50, Science 400.

Other electives may be chosen subject to the restrictions of the student’s timetable and the consent of the departmental chairman.

**Note 1:** Students completing this programme may qualify for the High School Assistant’s Certificate, Type “A”, in Mathematics.

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

(For Year I, see page 99)

Basic Programme

The basic Honours Physics programme (including Co-operative Applied Physics) is in the form of a core required courses, plus three or four other courses as follows:

Year II

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

Electives: Three other courses.

Year III

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

Electives: Three other courses.

Year IV

<table>
<thead>
<tr>
<th>Core: Physics 433A</th>
<th>Advanced Laboratory (half course)</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 434</td>
<td>Atomic &amp; Nuclear Physics II</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Physics 435</td>
<td>Solid State Physics (half course)</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Physics 441</td>
<td>Electromagnetic Theory</td>
<td>2</td>
<td>0</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  
(with extra emphasis on experimental (or theoretical) physics)
Core plus: Year II: Physics 237, 245, Mathematics 51, 238.
Year III: Physics 332, 336, Arts elective.
Year IV: Physics 433B (or 437), 431, 432 (or 443), 436, Arts, Mathematics or Science elective.

Ex. 2. Honours Physics  
(especially suitable as preparation for high school teaching)
Core plus: Year II: Chemistry 231, Mathematics 230, 238.
Year III: Physics 332, 338, Chemistry 325.

Ex. 3. Honours Physics  
(a typical Co-operative Applied Physics Programme)
Core plus: Year II: Physics 245, Mathematics 51, 238, Arts elective.
Year III: Physics 337, 336, Science or Engineering elective.

Ex. 4. Honours Physics  
(with Mathematics)
Core plus: Year II: Mathematics 230, 233, elective.
Year III: Physics 336, Mathematics 331, 334.
Year IV: Physics 436, 431, Mathematics 422, elective.

Ex. 5. Honours Physics  
(with Computing)
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  
(with Chemistry)
Core plus: Year II: Chemistry 231, 235, Mathematics 238.
Year III: Physics 332, 336, Chemistry 236.
Year IV: Physics 422, Chemistry 331, 335, Arts, Mathematics or Science elective.

Co-operative Applied Physics (Honours)

(For Year I, see page 100)

<table>
<thead>
<tr>
<th>Year IIA</th>
<th>Lectures</th>
<th>Labs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 232 Electricity and Magnetism</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Physics 235 Optics</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Physics 233 Laboratory</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Mathematics 236 Differential Equations</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 237 Differential and Integral Calculus</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 51 Probability and Statistics</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>One Elective †</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

112
<table>
<thead>
<tr>
<th>Year IIB</th>
<th>Applied Physics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 232</td>
<td>Electricity and Magnetism</td>
</tr>
<tr>
<td>Physics 235</td>
<td>Optics</td>
</tr>
<tr>
<td>Physics 245</td>
<td>Structure of Solids</td>
</tr>
<tr>
<td>Physics 233</td>
<td>Laboratory</td>
</tr>
<tr>
<td>Mathematics 236</td>
<td>Differential Equations</td>
</tr>
<tr>
<td>Mathematics 237</td>
<td>Differential and Integral Calculus</td>
</tr>
<tr>
<td>Physics 341A</td>
<td>Electronics I</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year IIIA</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 331</td>
<td>Classical Mechanics I</td>
</tr>
<tr>
<td>Physics 335</td>
<td>Thermodynamics and Statistical Mechanics</td>
</tr>
<tr>
<td>Physics 340</td>
<td>Quantum Physics I</td>
</tr>
<tr>
<td>Physics 333</td>
<td>Laboratory</td>
</tr>
<tr>
<td>Physics 336</td>
<td>Physical Mathematics I</td>
</tr>
<tr>
<td>Physics 341B</td>
<td>Electronics II</td>
</tr>
<tr>
<td>One Elective</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year IIIIB</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 334</td>
<td>Nuclear Physics</td>
</tr>
<tr>
<td>Physics 331</td>
<td>Classical Mechanics I</td>
</tr>
<tr>
<td>Physics 335</td>
<td>Thermodynamics and Statistical Mechanics</td>
</tr>
<tr>
<td>Physics 333</td>
<td>Laboratory</td>
</tr>
<tr>
<td>Physics 336</td>
<td>Physical Mathematics I</td>
</tr>
<tr>
<td>One Elective</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year IVA</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 435</td>
<td>Solid State Physics</td>
</tr>
<tr>
<td>Physics 441</td>
<td>Electromagnetic Theory</td>
</tr>
<tr>
<td>Physics 433</td>
<td>Senior Laboratory</td>
</tr>
<tr>
<td>Mathematics 334</td>
<td>Numerical Analysis</td>
</tr>
<tr>
<td>Physics 436</td>
<td>Physical Mathematics II</td>
</tr>
<tr>
<td>One Elective</td>
<td></td>
</tr>
<tr>
<td>One of:</td>
<td></td>
</tr>
<tr>
<td>Physics 442</td>
<td>Metal Physics</td>
</tr>
<tr>
<td>Electrical Eng. 83</td>
<td>Information Theory</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year IVB</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 440</td>
<td>Quantum Physics II</td>
</tr>
<tr>
<td>Physics 441</td>
<td>Electromagnetic Theory</td>
</tr>
<tr>
<td>Physics 433</td>
<td>Senior Laboratory</td>
</tr>
<tr>
<td>Mathematics 334</td>
<td>Numerical Analysis</td>
</tr>
<tr>
<td>Physics 436</td>
<td>Physical Mathematics II</td>
</tr>
<tr>
<td>One Elective</td>
<td></td>
</tr>
</tbody>
</table>
One of:

- Leclures
- Labs.

Physics 432  Device Physics  3  0
Physics 443  Hydrodynamics  3  0
Physics 437  Topics in Theoretical Physics  3  0

† At least two electives must be humanities or social sciences

General Courses

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

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

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:

<table>
<thead>
<tr>
<th>Three Year Course</th>
<th>Four Year Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>* arts or mathematics</td>
<td>* arts or mathematics</td>
</tr>
<tr>
<td>Year</td>
<td>Major Field</td>
</tr>
<tr>
<td>II</td>
<td>2 subjects</td>
</tr>
<tr>
<td>III</td>
<td>2 subjects</td>
</tr>
<tr>
<td></td>
<td>2 or 3</td>
</tr>
<tr>
<td></td>
<td>2 or 3</td>
</tr>
</tbody>
</table>
General Courses

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

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

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

**Extra Subjects**

The following regulations apply to both General and Honours programmes. An extra subject may be taken, but it must be in addition to the programme specified by the calendar or by the departmental chairman. It must be designated as an extra on the Registration Form (e.g. Chem. 337x). If dropped during the first term it will not appear on the student’s record; if dropped in the second term, but before the final examinations, it will appear on the transcript as “Incomplete.” The mark in the extra subject will not be averaged with those from the required courses for overall standing.

There will be no supplemental privileges with extra subjects.

**Biology Major**

**Year I**

Including Biology 131 or 132

**Year II**

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

**Three-year course**

**Year III**

*Two of:* Biology 333, 334, 335, 337
Chemistry 337
Earth Sciences 130
Arts or Mathematics Elective

**Four-year course**

**Year III**

*Two of:* Biology 333, 334, 335, 337
Chemistry 337
Earth Sciences 130
Arts or Mathematics Elective
Year IV

Three Biology courses acceptable to 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 course),
Physics 237
One of: Physics 242, Biology 233, 234,
235+
Arts Elective

Three-year course

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

Four-year course

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

Year IV
Chemistry 341, 335 (3 hours lab.)
One of: Chemistry 336+, 337, or 445
One other subject in Mathematics, Physics, or Biology acceptable to the Department of Chemistry
Arts Elective

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

Earth Sciences Major

Year I
Including Earth Science 130 and Biology 131†
†Another course from the option list may be selected by students who have achieved a-good standing in post-1964 grade 13 Biology or equivalent.

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

Three-year course

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

Four-year course

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

Year IV
One or two of: Biology 233, 333, a Science option not previously elected.
One Arts elective not previously elected.

* Half courses; 2 of these make the equivalent of one course selection.

Mathematics Major

Year III (1967-68 only)
Mathematics 446
One of: Mathematics 230, 233, 235, 330, 334
One of: Physics 235, 237, 242, 338
One of: Biology 231, Chemistry 325, Earth Science 130
Arts Elective

Physics Major

Year I
Including Mathematics 131

Year II
Physics 234, 236, 242.
One of: Mathematics 132, 236, 237
One of: Chemistry 236, Biology 231
Arts Elective

Three-year course

Year III
Physics 339
One of: Physics 237, 332, 338
One of: Mathematics 230, 233
One of: Chemistry 231, 325
Arts or Mathematics Elective
Four-year course

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

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

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 one year post degree programme in Physical Education is offered for the last time in 1967-68.

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 of the College of Education of 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.

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.
Degrees

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>1967</th>
<th>1968</th>
<th>1969</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>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1970</th>
<th>1971</th>
<th>1972</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td>Spring</td>
<td>Fall</td>
</tr>
<tr>
<td>Fifth Work Period</td>
<td>Sixth Work Period</td>
<td>Seventh Work Period</td>
</tr>
</tbody>
</table>

All Year I students enrol in September. Year I 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, on the forms provided by the Office of the Registrar. Academic certificates (not diplomas), and other supporting documents should be forwarded as soon as they become available. Admission cannot be granted until all requirements have been met and all documents submitted.

Admission To Year I

In order to qualify for admission to the first year of the Physical and Health Education programme, the applicant should have completed Ontario Grade 13, or its equivalent, showing a minimum overall average of 60% in seven required credits. Nine credits are required for applicants who have taken more than one year to complete the work of Grade 13.

Standing is required in seven Grade 13 credits as follows:
(a) A minimum of four credits chosen from: English, one language other than English, Mathematics.
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, and Mathematics B or Biology
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, Secretarial Practice, Mathematics of Investment, Art, or Music (Departmental Examination). 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 "additional" credit on the same terms as these subjects except the marks 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

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 I 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)
Admission and Registration

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 the advanced level in subjects appropriate to the candidate's intended field of study.

Scotland
United States of America
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. Each application will be considered on its merits by the Admissions Committee. Under certain circumstances, the applicant may be required to write a qualifying examination.

Admission of Students from Other Countries

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

Re-admission

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

Registration

September 13 Wednesday 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

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

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

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

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

Refunds of tuition fees are made at the discretion of the University. Incidental fees are not refundable.
The fee schedule shown is one in effect for the 1966-67 year and at the time of printing is still subject to review and possible change for the 1967-68 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.

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**Co-operative programme in Physical and Health Education**

<table>
<thead>
<tr>
<th>Fees per term</th>
<th>Year 1</th>
<th>Other Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuition</td>
<td>$292.50</td>
<td>$335.25</td>
</tr>
<tr>
<td>Incidental†</td>
<td>24.75</td>
<td>30.75</td>
</tr>
<tr>
<td></td>
<td>$317.25</td>
<td>$360.00</td>
</tr>
</tbody>
</table>

**One-year programme in Physical Education**

<table>
<thead>
<tr>
<th>Fees per term</th>
<th>Year 1</th>
<th>Other Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuition</td>
<td>$50.00</td>
<td>$56.00</td>
</tr>
<tr>
<td>Incidental†</td>
<td>46.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$66.50</td>
<td>$68.00</td>
</tr>
</tbody>
</table>

**Part-time students**

Fee per 1 Term Course (Limit one, 1 Term Course per Term) $50.00

**Miscellaneous Fees**

- Examination—Supplemental, each paper $10.00
- Presiding fee (at an outside centre, each half day) 7.00
- Photograph (at first registration only) 1.00
- Late Registration 10.00
- Transcript of Record 1.00
- Degree and Graduation - Final year only 10.00

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

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

**Residence Fees**

Residence fees for both men and women are:

<table>
<thead>
<tr>
<th>Type of Room</th>
<th>Single</th>
<th>Semi-private</th>
<th>Double</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per academic year</td>
<td>$830</td>
<td>$810</td>
<td>$750</td>
</tr>
<tr>
<td>Per term</td>
<td>425</td>
<td>405</td>
<td>375</td>
</tr>
</tbody>
</table>

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

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

Examinations and Promotions

The Faculty constitutes the examining body for all University Examinations. The arrangement of the co-operative physical and health education programme is shown on page 121. 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 of 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:

<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></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>Promotion</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 over-all 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.
Examinations and Promotions

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. 380</td>
<td>Basic Skills</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Three Electives</td>
<td></td>
</tr>
</tbody>
</table>

127
| Term # 2 (Winter) |  
|------------------|---
| Psychology 110   | Introductory Psychology | 3  
| Biology 131      | An Introduction to Biology | 2 3 hrs.  
| P.E. 110         | Administration of Physical Education and Recreation | 3  
| P.E. 380         | Basic Skills |  
|                  | Three Electives |  
| Term # 3 (Fall)  |  
| Chemistry 16     | Introductory Organic Chemistry | 3  
| P.E. 200         | Anatomy and Kinesiology (Part I) | 3 2 hrs.  
| P.E. 220         | Comparative Programmes in Physical Education and Recreation | 3  
| P.E. 380         | Basic Skills |  
|                  | †Three Electives |  
|                  | *English 101 must be included if not selected as an elective. |  
| Term # 4 (Spring) |  
| Psychology 211   | Developmental Psychology | 3  
| Biochem. 37      | Biochemistry | 3  
| P.E. 210         | Anatomy and Kinesiology (Part II) | 3 2 hrs.  
| P.E. 230         | Administration of Facilities | 3  
| P.E. 240         | Basic Movement Education | 2 2 hrs.  
| P.E. 250         | Care and Prevention of Athletic Injuries | 2 1 hr.  
| P.E. 380         | Basic Skills |  
| Term # 5 (Winter) |  
| P.E. 300         | Anatomy and Physiology (Part I) | 3 2 hrs.  
| P.E. 320         | Adapted Physical Education | 2 1 hr.  
| P.E. 330         | Measurement and Evaluation | 2 1 hr.  
| P.E. 380         | Basic Skills |  
|                  | †Three Electives |  
|                  | *English 101 must be included if not selected as an elective. |  
| Term # 6 (Fall)  |  
| P.E. 310         | Anatomy and Physiology (Part II) | 3 2 hrs.  
| P.E. 340         | Institutional Physical Education | 3  
| P.E. 350         | Research Methods and Materials | 3  
| P.E. 360         | Health Foundations (Part I) | 3  
| P.E. 380         | Basic Skills |  
|                  | Two Electives |  
| Term # 7 (Spring) |  
| Psychology 212   | Social Motivation | 3  
| P.E. 400         | Physiology of Exercise (Part I) | 3 1 hr.  
| P.E. 420         | Physical Growth and Development | 3  
| P.E. 430         | Health Foundations (Part II) | 3  
| P.E. 440         | Research Project | 1 1 hr.  
| P.E. 450         | Coaching Foundations | 3  
| P.E. 380         | Basic Skills |
### Term # 8 (Winter)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.E. 410</td>
<td>Physiology of Exercise (Part II)</td>
<td>3</td>
<td>1 hr.</td>
</tr>
<tr>
<td>P.E. 440</td>
<td>Research Project</td>
<td>1</td>
<td>1 hr.</td>
</tr>
<tr>
<td>P.E. 460</td>
<td>Seminar in Health</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>P.E. 470</td>
<td>Seminar in Physical Education &amp; Recreation</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>P.E. 480</td>
<td>Advanced Skills</td>
<td>5 hrs.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Two Electives</td>
<td></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 149.

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
 Degrees

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 M.A. and Ph.D.

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. Seven full courses, acceptable for graduate credit, plus an M.Phil. thesis are required for the M.Phil. Degree. Candidates entering after a Master’s Degree will have their Master’s courses subtracted from this total. Students must obtain an average of at least 66% in the set of courses which they present in fulfillment of course requirements for the degree.

Each candidate shall have his programme of study approved by a committee and will be responsible to a thesis supervisor who shall be appointed 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 the minimum time must pass a comprehensive examination, as determined by his department, in order to be eligible for the degree. The requirements for the degree must be completed within a total period of six consecutive academic years from the Honours degree level. In exceptional circumstances, extensions may be made beyond the maximum time allowance upon petition to the Graduate Council at least four months prior to the normal date for completion of degree requirements.
A student may transfer from the M.Phil. programme to the Ph.D. programme in the same field, in exceptional circumstances, by petitioning to the Graduate 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 Degree. A student who has not passed the Ph.D. comprehensive exams must pass the M.Phil. comprehensive before he can become eligible to receive the M.Phil. Degree.

Admission

In addition to fulfilling the general requirements of the 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 Ph.D. Degree

The candidate should have an adequate knowledge of at least one language other than English as specified by the department with which he is enrolled. However, with the permission of his department and the concurrence of the Dean of Graduate Studies, a candidate may substitute for the foreign language requirements an approved full year course in a department other than his major one.

The candidate shall sit for comprehensive examinations, as determined by the department in which he is enrolled. The amount of course work which the candidate shall take will be determined by the department, but will normally not be more than four courses beyond the Master's level. Students must obtain an average of at least 66% in the set of courses which they present in fulfillment of course requirements for the degree.

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

Admission of Students from Other Countries

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

Re-Admission

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

Registration (Fall Term)

September 25 Monday Graduate Studies.

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

Fees

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

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

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

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

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

The fee schedule shown is one in effect for the 1966-67 year and at the time of printing is still subject to review and possible change for the 1967-68 year. If a fee change is made, a notice will be issued with a new fee schedule; however, the University does not undertake or accept responsibility to so notify all recipients of this calendar. The Board of Governors reserves the right to make changes in the published schedule of fees without notice.
**Fees**

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

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

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

**Specified registration for regular part-time graduate students:**

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

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

**Definitions:**

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

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

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

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

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

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

Residence Fees

Residence fees for both men and women are:

<table>
<thead>
<tr>
<th>Type of Room</th>
<th>Single</th>
<th>Semi-private</th>
<th>Double</th>
</tr>
</thead>
<tbody>
<tr>
<td>per academic year</td>
<td>$850.</td>
<td>$810.</td>
<td>$750.</td>
</tr>
<tr>
<td>per term</td>
<td>425.</td>
<td>405.</td>
<td>375.</td>
</tr>
</tbody>
</table>

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

Examinations

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

- A 75 - 100%
- B 66 - 74%
- C 60 - 65%
- F Less than 60% (failure)

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”.
VIII

Course Descriptions
Notes on Numbering of Courses

1. Courses offered to students in the Faculties of Arts and Science numbered:
   - 1 - 49 are at the beginning level
   - 50 - 99 are at the Ontario Grade 13 level
   - 100 - 500 are at the undergraduate level
   - Courses marked with an asterisk are half courses.

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

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

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

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

Department of Biology

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

Professor and Chairman of Department
C. H. Fernando, B.Sc. (Ceylon), D.Phil. (Oxford), F.R.E.S.

Professor
H. R. N. Eydt, M.Sc., Ph.D. (McMaster)  -  -  -  Associate Professor
W. E. Inniss, M.S.A. (Toronto), Ph.D. (Michigan State)  -  Associate Professor
W. B. Kendrick, B.Sc., Ph.D. (Liverpool)  -  -  -  Associate Professor
P. E. Morrison, M.Sc. (Western), Ph.D. (McMaster)  -  -  Associate Professor
G. Power, B.Sc (Durham), Ph.D. (McGill)  -  -  Associate Professor
J. C. H. Carter, B.A. (Toronto), M.Sc., Ph.D. (McGill)  -  Assistant Professor
A. M. Charles, M. Sc., Ph.D. (Manitoba)  -  -  -  Assistant Professor
E. B. Dumbroff, M. Forestry, Ph.D. (Georgia)  -  -  Assistant Professor
H. C. Duthie, B.Sc., Ph.D. (Wales)  -  -  -  Assistant Professor
A. G. Kempton, M.S.A. (Toronto), Ph.D. (Michigan State)  -  -  Assistant Professor
J. J. Pasternak, M.A. (Toronto), Ph.D. (Indiana)  -  -  Assistant Professor
B. S. D. Raj, M.A., M.Sc. (Madras), Ph.D. (Oregon)  -  Assistant Professor

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Department of Biology

Undergraduate Course Descriptions

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

132 - Principles of Biology: A first year course for students who have achieved a good standing in post-1965 Grade 13 Biology or equivalent and have passed Grade 13 Chemistry. Selected topics in elementary biology.
2 lectures, 3 hours laboratory.

231 - Genetics and Evolution: The principles, methods and application of genetics. The implications of genetics in the modern evolutionary theory.
3 lectures.
(Primarily for students in the General programme and those from other departments. Not available for students whose major subject is Biology except as a Science elective or as an extra subject.)

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

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

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

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

334 - Evolution and Systematics: An exploration of current concepts in evolution and systematics, with particular reference to the plant kingdom.
Pre-requisite Biology 234.
2 lectures, 3 hours laboratory.

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

431 - Ecology: An analysis of the freshwater, marine and terrestrial environments and the communities of organisms they support. The distribution and numbers of plants and animals. Animal movements and migrations. 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.

433 - Entomology: An introduction to the classification, functional anatomy and physiology of insects. 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.

435 - Microbial Physiology: The study of microorganisms with special reference to the structure, physiology and metabolism of bacteria. Structure-function inter-relationships, biosynthetic processes, cellular regulatory mechanisms, quantitative experimental methodology. Prerequisites: Biology 235, Chemistry 337. 2 lectures, 3 hours laboratory.

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

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

438 - Non-vascular plants: A survey of the lower plants with emphasis on variation and evolutionary advance in the algae and fungi. Prerequisite: Biology 234. 2 lectures, 3 hours laboratory.
**Department of Biology**

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

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

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

443 - **Microbiology II:** Properties of pathogenic microorganisms and special groups related to food and fermentation microbiology.
Prerequisite Biology 235.
2 lectures, 3 hours laboratory.

449 - **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 fluviatile 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.

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.
Department of Biology

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.

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 and Chairman of the Department

T. L. Batke, B.A.Sc., M.A.Sc., Ph.D. (Toronto),
Professor and Academic Vice-President

F. A. L. Dullien, Dipl. Ing. (Budapest Technical University),
M.A.Sc., Ph.D. (British Columbia) - - - Professor

G. A. Turner, 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

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

C. E. Gall, B.A.Sc. (Toronto), M.A.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. Pei, 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

J. J. Byerley, B.A.Sc., M.A.Sc. (Toronto),
Ph.D. (British Columbia) - - - Assistant Professor

K. S. Chang, B.S. (Hanyang Inst. Tech., Seoul), M.Sc.,
Ph.D. (Northwestern) - - - Assistant Professor

J. D. Ford, B.Eng. (McGill), M.A.Sc. (Toronto) - 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

Assistant Professor

I. D. Doig, B.Sc. (Imperial College, London),
Ph.D. (New South Wales) - - - Visiting Professor

P. M. Reilly, B.A.Sc. (Toronto), D.I.C., Ph.D. (London),
F.S.S. - - - Adjunct Professor
Undergraduate Course Descriptions

11. Chemical Process Principles I. Practice in applied stoichiometry. Mass and energy balances. The simple unit operations such as evaporation, drying, etc.
Prerequisite: Chem. 11.
3 lectures, 2 hours problems, one term.

12. Chemical Process Principles II. Equilibrium between phases; the equilibrium stage concept. Cascades of stages with and without reflux; examples of their analysis when used to separate components by distillation, extraction, absorption and leaching.
Small solids; their description in quantitative terms; separation by differences of size and density. Thickening.
3 lectures, 2 hours problems, alternative weeks.

Prerequisite: Chem. II.
3 lectures, one term.

3 lectures, one term.

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.

Prerequisite: ChE 33.
3 lectures, one term.

36. Physical-Chemical Laboratory. A laboratory to demonstrate physical chemical principles and techniques of physical measurement. Concurrently with ChE 31.
3 hours laboratory, one term.

41. Reaction Kinetics I. Introduction to kinetics and mechanism of elementary chemical processes in 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.

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

51. Process Dynamics and Control I. The differential equations of common processes are derived and linearized. The dynamic behaviour is analyzed when uncontrolled and when standard process controllers provide feedback control. Optimal controller settings are established for stable operation.
Prerequisite: Math 41, ChE 22.
3 lectures, one term.
52. **Process Dynamics and Control II.** Open and closed loop behaviour of complex processes is considered. Modern approaches to process control are introduced.

54. **Chemical Engineering Analysis.** A general approach to the analysis of chemical engineering problems based on the underlying physical and mathematical concepts.


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.

71. **Chemical Engineering Laboratory I.** Experiments in the application of physical and chemical principles to engineering analysis, phase equilibrium, fluid flow and heat transfer.

72. **Chemical Engineering Laboratory II.** Experimental studies with pilot plant equipment in the representative unit operations: evaporation, distillation, absorption, extraction, drying, humidification and reactors.

73. **Chemical Engineering Laboratory III.** Chemical reactors, process dynamics steady-state and transient behaviour, and applications of digital and analog computers.

81. **Physical Chemistry of Polymers.** Polymeric solutions, determination of molecular weights, molecular weight distributions, kinetics of polymerization, rheology, mechanical properties and polymer structure.
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.

90. **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 and related factors on process design in the manufacturing industries. Food and beverage. Enzymes. Antibiotics. Vitamins. Effluent disposal.

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.

**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.

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.
Department of Chemical Engineering

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 for students in this option. 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 Ph.D. 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 and mass transfer in biological processes of industrial interest, chemical engineering design of fermentation, food processes, 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 required for the professional M.A.Sc. Option.

600. Applications of Transport Theory I. The use of the rate equations in design and in the analysis and performance of flow systems, heat transfer equipment and mass transfer operations. Particular attention is given to non-ideal and multi-component systems.
3 lectures, one term.

601. Applications of Transport Theory II. A continuation of Chemical Engineering 600, with transfer problems in reacting systems also considered. Prerequisite: Chem. Eng. 600.
3 lectures, one term.

3 lectures, one term.

697. Engineering Report. Every professional student is expected to complete the solution of, and prepare a report, on a major problem in process design or evaluation. Problems may be suggested by the student of by the staff.

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.
Department of Chemical Engineering

621. **Advanced Theory of Transport Phenomena.** A survey of the evaluation of transport properties, kinetic theory of gases, introduction to kinetic theory of liquids; equations of mass, heat, and momentum and their constitutive relations; boundary layer and turbulence theory; transport processes in nonisothermal and reacting systems. 
Prerequisite: Chemical Engineering 23 or the equivalent.
3 lectures, one term.

635. **Advanced Thermodynamics.** Review of the basic principles of classical thermodynamics. Derivation of these and some additional thermodynamic principles by the methods of statistical thermodynamics. Applications to include gases, chemical and phase equilibria, crystals, thermal radiation, magnetization. Introduction to the thermodynamics of irreversible processes.
3 lectures, one term.

640. **Advanced Chemical Kinetics.** Kinetics of homogeneous reactions: Gas phase reactions and theories of reaction, liquid phase reactions including ionic reaction and acid-base catalysis. Kinetics of heterogeneous catalysis: adsorption, theories of adsorption and catalysis; modelling complex mechanisms; detailed examination of a few systems.
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 or of his faculty advisor. The courses described below are of a broader scope than those listed as Special Topics in Groups A, B or C.

640. **Chemical Reactors for Homogeneous Systems.** Structure of stoichiometry, determination of kinetic parameters, polymerization kinetics, optimal design reactor stability, optimal control, mixing and residence time distributions.
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.

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.

3 lectures, one term.

3 lectures, one term.


686. Topics in Hydrometallurgy.


Special Topics
Group A — (Topics in Transport Theory)

605. Particle - Fluid Dynamics

606. Turbulence Theory

607. Non-Newtonian Flow

608. Compressible Flow

615. Radiant Heat Transfer

616. Heat Transfer in Two Phase Systems
625. Gas-Liquid Mass Transfer Processes
626. Dissolution and Crystallization
627. Ionic Transport Processes

Group B — (Topics in Thermodynamics and Chemical Kinetics)
636. Surface Chemistry
637. Topics in Chemical Thermodynamics
645. Physical Processes in Heterogeneous Catalysis
646. Kinetics of Consecutive and Chain Reactions
647. Kinetics of Biological Systems
648. Residence Time Distributions, Reactor Flow Models and Reactor Stability

Group C — (Topics in Control Theory and Applied Mathematics)
655. Analysis of Non-linear Processes
656. Control of Complex Processes
657. Optimization Problems in Chemical Processes
665. Applied Statistics in Chemical Engineering
666. Topics in Advanced Process Control
667. Special Topics in Analysis of Processes

698. Research Thesis for the Master's Degree
699. Research Thesis for the Doctoral Degree
Department of Chemistry

H. G. McLeod, M.A., Ph.D. (Toronto)  
Professor and Chairman of Department

Professor

W. A. E. McBryde, M.A. (Toronto), Ph.D. (Virginia)  
Professor and Dean of the Faculty of Science

T. Viswanatha, M.Sc., Ph.D. (Mysore)  
Professor

R. H. F. Manske, B.Sc., 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. Brisbin (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

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

H. D. Sharma, M.Sc. (Delhi), Ph.D. (California)  
Associate Professor

G. E. Toogood, B.Sc., Ph.D. (Nottingham)  
Associate Professor

R. G. Woolford, M.Sc. (Western), Ph.D. (Illinois)  
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

A. Balasubramanian, M.Sc. (Madras), Ph.D. (Indian Institute of Science - I. I. Sc.)  
Lecturer

D. R. Raj (Mrs.), B.S. (Rochester), Ph.D. (Oregon)  
Lecturer

W. J. Byars, H.N.C. (Dundee Technical College)  
Senior Demonstrator

W. A. Cameron, H.N.C. (Hendon Technical College)  
Senior Demonstrator

M. C. Michael (Miss) B.Sc. (Waterloo)  
Senior Demonstrator

G. Tomlinson, H.N.C. (North Staffordshire Technical College)  
Senior Demonstrator

R. W. A. Oliver, B.Sc., M.Sc. (Bristol)  
Visiting Adjunct Professor

Undergraduate Course Descriptions

Details of the undergraduate programmes offered by the Faculty of Science are to be found on page 99.

3 lectures, two terms. Laboratory: A term 3 hours alternate weeks.
B term 3 hours alternate weeks.

16. Introduction to General Chemistry. Introductory chemistry for Physical Education majors.
A concise introduction to the states of matter, atomic structure and bonding, oxidation/reduction, chemical equilibria and solution laws, organic chemistry.
3 hours lectures, one term.

1 lecture, 3 hours laboratory, one term.

25. Polymer Chemistry and Physics. The organic and physical chemistry of elementary polymerization reactions. A study of the physical properties of polymeric materials as related to molecular structure. An introduction to polymer technology.
Prerequisite: Chem. 11 and Phys. 15.
3 lectures, one term.

26. Organic Chemistry I. The basic chemistry of the important classes of aliphatic and aromatic compounds.

3 lectures, one term.

Prerequisite: ChE 32, Chemistry 22.
3 lectures, 3 hours laboratory alternate weeks, one term.

36. Organic Chemistry II. An introduction to the important classes of heterocyclic compounds and natural products. A laboratory course on preparative organic chemistry and organic techniques accompanies the lectures.
Prerequisite: Chemistry 26.
3 lectures, 3 hours laboratory, one term.

37. Biochemistry. Carbohydrates. lipids, proteins, hormones, nucleic acids, and vitamins. Metabolism of these groups of compounds. Physico-chemical aspects of biochemistry.
Prerequisite: Chemistry 36.
3 lectures, one term.
3 lectures, one term.

45. **Surface Phenomena.** A study of absorption, wetting, foams, electrical surface phenomena, and principles of heterogeneous catalysis.
3 lectures, one term.

46. **Organic Chemistry III.** Selected topics in organic chemistry of interest and importance to Chemical Engineering students.
3 lectures, one term.

55. **Polymer Physics and Chemistry.** The Chemistry and physics of natural and synthetic polymers, covering the following topics: condensation and addition polymers and their reaction kinetics; properties of polymers, their measurement and relation to structure: isotactic polymers, copolymers, and polymer reactions.
3 lectures, one term.

101. **General Chemistry.** An elementary study of the states of matter, changes of state and the solution laws; stoichiometry; oxidation-reduction, chemical equilibria; descriptive chemistry of the common elements.
3 hours lectures, 3 hours laboratory for *two* terms.

131. **General Chemistry.** Elementary study of the states of matter, changes of state, solution laws; atomic structure and bonding; stoichiometry of equations, oxidation-reduction, chemical equilibria; descriptive chemistry of the commoner elements in terms of the periodic table.
3 lectures, 3 hours laboratory.

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

201. **Introductory Inorganic Chemistry.** Descriptive chemistry of the elements and their compounds based on the periodic table with special reference to metallurgical and other industrial processes. The laboratory will illustrate various methods of preparation of metals, non-metals and their compounds.
3 hours lectures, 3 hours laboratory, one term.

3 hours lectures, 9 hours laboratory, one term.

205. **Introductory Physical Chemistry.** Introduction to transport processes and reversible thermodynamics; reaction kinetics and phase equilibria. Thermo-
Department of Chemistry

3 hours lectures, 3 hours laboratory, one term.

206. Introductory Organic Chemistry. Basic Chemistry and structure of the important classes of aliphatic and aromatic compounds.
3 hours lectures, 3 hours laboratory, one term.

209. Technical Literature. Use of library; instruction and practice in searching technical literature; preparation of literature reviews, special topic assignments.
2 hours laboratory, one term.

231. Chemical Bonding and Structure: Classical and wave theories of the electronic structure of atoms developed and applied to the rationalisation of the periodic table and the problems of chemical bonding. The formation and properties of the covalent bond; bonding in ionic and metallic solids; methods for the establishment of the shapes of molecules.
2 hours lectures, 3 hours laboratory. (Laboratories to be taken only by Honours Chemistry students).

232. Analytical Chemistry. Theory and practice of quantitative inorganic analysis. Representative classical and instrumental techniques will be carried out and studied with relation to the chemical phenomena which make them possible and to the general principles which they exemplify. A knowledge of ionic equilibria will be assumed and extended.
2 lectures. 6 hours laboratory.

235. Physical Chemistry I. A study of the thermodynamics of ideal systems, the chemical kinetics of simple systems, and a short introduction to the phase rule.
2 lectures, 1 hour problems.

236. Organic Chemistry I. The properties, preparations, reactions, and basic structural theory of the common classes of aliphatic and aromatic compounds. A laboratory course on preparative organic chemistry accompanies the lectures.
2 lectures, 3 hours laboratory.

241. Principles and Application of Chemical Bonding: Classical and wave theories of the electronic structure of atoms developed and applied to the rationalisation of the periodic table and the problems of chemical bonding. Application to the systematic chemistry of the non-transition elements.
2 hours lectures. 1 hour problems.

242. Chemical Analysis. The determination of inorganic chemical species by volumetric, gravimetric and selected instrumental procedures. The role of analysis as a service function will be stressed.
2 lectures, 6 hours laboratory.
301. Applied Inorganic Chemistry. The physical principles of bonding and structure developed and applied to such industrial processes and materials as extractive metallurgy, synthesis of industrial chemicals; ceramics and alloys. 3 hours lectures, 3 hours laboratory, one term.

303. Introductory Polymer Chemistry. The chemistry of natural and synthetic polymers, covering condensation and addition polymers, and their elementary reaction kinetics; properties of polymers, their measurement and relation to structure; isotactic polymers, copolymers and polymer reactions. 3 hours lectures, 3 hours laboratory, one term.

305. Applied Physical Chemistry. The application of reversible thermodynamics to chemical reactions. Kinetics of complex homogeneous and heterogeneous reactions. Chemical reactors. Phase equilibria applied to distillation and crystallization. 3 hours lectures, 3 hours laboratory, one term.

306. Applied Organic Chemistry. Petroleum chemistry; the production of important industrial chemicals; synthesis of dyestuffs pharmaceuticals, pesticides and surfactants. 3 hours lectures, 3 hours laboratory, one term.

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

308. Instrumental Measurements I. Introduction to the use of instruments to obtain accurate measurements of physical and chemical properties of materials. 1 hour lecture, 3 hours laboratory, one term.

318. Instrumental Measurements II. Extension of Chemistry 308 to dynamic measurements following the course of a chemical reaction or monitoring a continuous process. 1 hour lecture, 3 hours laboratory, one term.

325. Physical Chemistry. An introduction to the study of matter from the macroscopic and molecular point of view. Classical kinetic theory of gases, thermodynamics, electrochemistry, kinetics, molecular structure, surface phenomena, phase equilibria and macromolecules. A knowledge of calculus is assumed. 2 lectures, 3 hours laboratory.

331. Inorganic Chemistry I: Systematic inorganic chemistry of the non-transition elements based on the principles established in Chemistry 231; introduction to nuclear-and radio-chemistry. The laboratory illustrates methods of synthesis and characterization of typical inorganic compounds. 2 hours lectures, 3 hours laboratory (except for Honours Chemistry and Physics students).
2 lectures, 6 hours laboratory.

336. Organic Chemistry II: Correlation between electronic structure and chemical properties and reactivity; stereochemistry; synthetic methods, especially enolate and related condensations, and cyclo-addition reactions; carbohydrate and peptide chemistry.
2 hours lectures, 3 hours laboratory.

337. Biochemistry I. Carbohydrates, lipids, proteins, hormones, nucleic acids, and vitamins. Metabolism of these groups of compounds. Physico-chemical aspects of biochemistry.
Prerequisite: Chem. 236 or equivalent.
2 lectures. (For General students and Honours Biology. 3 hours laboratory).

341. Inorganic and Nuclear Chemistry. The chemistry of the transition elements. Introduction to nuclear and radiochemistry.
2 lectures, 3 hours laboratory.

400. Electrochemistry and Corrosion. Electrolytic conductance and transport; thermodynamics of electrolytic solutions; electrode potentials; the measurement of pH; metallic corrosion.
3 hours lectures, 3 hours laboratory alternate weeks, one term.

2 hours lectures, 3 hours laboratory, one term.

403. Physical Chemistry of Polymers. Polymerization kinetics including condensation polymers, free radical, ionic and stereoregular addition polymers, and copolymers; structure of polymers molecules; degradation; solution properties of crystalline and amorphous polymers; molecular weight distributions.
3 hours lectures, 3 hours laboratory, one term.

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.

3 lecture hours, 3 hours laboratory, one term.
1 hour lecture, 3 hours laboratory, one term.

412. Analysis of Materials. Techniques of separation determination and characterization of complex materials including ores, resistant alloys, ceramics, synthetic polymers, food and drug products and pesticides.
2 hours lectures, 3 hours laboratory, one term.

413. Properties of Polymers. Behaviour of polymers: types of mechanic behaviour, flow and relaxation mechanism, birefringence, orientation and recovery; glass transitions; crystallisation and properties of crystalline polymers; introduction to theory of high elasticity.
3 hours lectures. 3 hours laboratory, one term.

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 hour lecture. 3 hours laboratory, one term.

431. Inorganic Chemistry II: Systematic inorganic chemistry of the transition elements; introduction to selected topics including ligand field theory; magnetochemistry; interpretation of electronic spectra.
2 hours lectures.

435. Physical Chemistry III. Introduction to quantum chemistry and statistical thermodynamics. Applications to kinetics. surface chemistry, and spectroscopy.
2 lectures. 1 hour problems.

436. Organic Chemistry III. The use of spectroscopic techniques in organic chemistry; analysis of reaction mechanisms; free radical chemistry; a brief introduction to natural product chemistry.
2 hours lectures.

437. Biochemistry II. Selected topics and techniques in modern biochemistry; energy transfer, transport across membranes, comparative aspects of metabolism, mechanism and kinetics of enzyme activity, structural macromolecules, 2 lectures, 3 hours laboratory.

439. Advanced Laboratory. An introduction to research methods and techniques. The student will elect to concentrate this study in one of the following fields of chemistry, viz. analytical, inorganic, organic, physical or biochemistry. Honours Chemistry Students, 6 hours laboratory.
Honours Chemistry and Physics Students, 3 hours laboratory.
Department of Chemistry

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 (including biochemistry) and physical chemistry. Course work will be appropriate to the area selected and a research director should be chosen from members of the department who are presently engaged in various fields of endeavour as listed.

Major Areas of Research

Analytical Chemistry - chemical instrumentation based on analog modules; continuous analysis by spectrophotometric or electroanalytical techniques; complex ion systems useful in analysis; application of physical methods e.g., ion exchange, solvent extraction, to separation of metallic constituents in aqueous solutions; 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; spectroscopic studies (using infrared, ultraviolet and electron spin resonance techniques) of molecular conformation and hydrogen bonding.

Biochemistry - effects of irradiation on proteins and aminoacids as studied by electron spin resonance and other techniques; the aging process; synthetic and degradative studies on enzymes, peptides and proteins; nature of materials excreted by algac.

Physical Chemistry - studies in molten salt chemistry, especially mass transport phenomena; kinetics of polymer reactions; experimental and theoretical studies of surfaces, surface reactions and catalysis; quantum chemical calculations on organic molecules; electrochemistry and especially electroplating mechanisms and corrosion studies; spectroscopic studies of species in solution to determine their identity and contribution to the properties of the system.
Details regarding these programmes and the faculty members engaged in them are to be found in a booklet prepared by the Chemistry Department. The booklet also discusses admission procedures, programs of study, teaching and research facilities and equipment and is sent to every potential graduate student who applies for admission. New areas of research are usually added each year.

Graduate Course Descriptions

610. Advanced Nuclear and Radiochemistry. Systematics of atomic nuclei; nuclear models; radioactive decay processes; nuclear reactions; interaction of radiation with matter; radiation detection methods and radiochemical assay; tracers in chemical applications; radiochemical techniques and radiation chemistry.

615. Physical Chemistry of High Polymers. Selected topics in the field.

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; steroids and terpenes. with emphasis on structural determination and biogenesis.

637. Advanced Biochemistry. Selected topics in the field.

642. Chemical Instrumentation. Instrument components and optimum application; rudiments of design; electrical. spectral. migrational and other methods.

646. Theoretical Organic Chemistry. The structure and reactivity of organic molecules emphasizing stereochemistry and reaction mechanisms.

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.


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.


Department of Civil Engineering

W. A. McLaughlin, B.Eng. (Saskatchewan), M.S., Ph.D. (Purdue) - Professor and Chairman of the Department

S. T. Ariaratnam, B.Sc. (Eng.) (Ceylon), M.Sc. (London)
Ph.D. (Cambridge) - Professor

M. Z. Cohn, Candidate of Tech. Sc. (Bucharest) - Professor

W. R. Drynan, B.A.Sc. (Toronto), M.Sc., Ph.D. (Texas) - Professor

N. C. Lind, M.S. (Royal Tech. Univ. of Denmark), Ph.D. (Illinois) - Professor

J. T. Pindera, Dr. of Tech. Science (Poland), Docent habil. (Cracow) - Professor

H. B. Poorooshasb, B.Sc. (Manchester), Ph.D. (Cambridge) - Professor

A. N. Sherbourne, B.Sc. (London), M.S. (Lehigh), M.A., Ph.D. (Cambridge) - Professor and Dean of Engineering

D. T. Wright, B.A.Sc. (Toronto), M.S. (Illinois), Ph.D. (Cambridge) - Professor

R. Green, B.Sc. (Eng.) (London), M.Sc. (Queen's), M.Sc. (Waterloo), Ph.D. (Texas) - Associate Professor

V. K. Handa, B.Sc. (Calcutta), B.Sc. (Eng.) (London), M.Sc. (Queen's) M.Sc., Ph.D. (Waterloo) - Associate Professor

II. M. Ilil, B.Eng., M.Sc. (Saskatchewan), D.Phil. (Oxford) - Associate Professor

B. G. Hutchinson, B.E. (Sydney), M.Sc. (Queen's) Ph.D. (Waterloo) - Associate Professor

T. Prasad, B.Sc., M.Sc. (Banaras Hindu Univ.), Ph.D. (Cambridge) - Associate Professor

T. H. Topper, B.A.Sc. (Toronto), Ph.D. (Cambridge) - Associate Professor and Associate Chairman of the Department

E. F. P. Burnett, B.Sc. (Capetown), D.I.C., M.Sc. (London) Assistant Professor

I. Holubec, B.A.Sc., M.A.Sc. (Toronto), Ph.D. (Waterloo) Assistant Professor

W. C. Lennox, B.A.Sc., M.Sc. (Waterloo), Ph.D. (Lehigh) Assistant Professor

E. L. Matyas, B.A.Sc. (Toronto), D.I.C., Ph.D. (London) Assistant Professor

J. Roorda, B.A.Sc. (Waterloo), Ph.D. (London) Assistant Professor

J. Shortreed, B.Eng.Sc. (Western), M.Sc. (Queen's), Ph.D. (Northwestern) Assistant Professor

T. E. Unny, B.E. (Madras), M.Tech. (Kharagpur), Dr.Eng. (Dresden) Assistant Professor

O. L. White, B.Sc. (Melbourne), M.A.Sc. (Toronto) Assistant Professor

B. LeLievre, B.Eng. (West Australia), M.A.Sc. (Waterloo) Lecturer

B. P. Sangal, B.Sc., M.Sc. (Allahabad University), M.Sc. (Bangalore), M.S. (Queen's) Lecturer

J. Schroeder, B.Eng. (McMaster), M.Eng. (McMaster) Lecturer

J. J. Munk, B.Eng. (McGill), LL.B. (Osgoode Hall) Special Lecturer in Law

J. E. Leisch, B.E. (John Hopkins) Special Lecturer

C. Marsh, M.A. (Cambridge) Adjunct Professor

J. I. Tindall, B.E. (Queensland), M.E. (New South Wales) Visiting Professor

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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.

241. Measurement II. Physical effects used in measurement and measuring systems. Mechanical linkages, optical, pneumatic and acoustic effects; electrical capacitance, inductance and resistance effects; hydraulic effects, X-ray and electron effects, radar and copper effects. The use and combination of these effects in measuring systems. Errors, reliability. The use of surveying instruments.

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 functions, 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. **Introduction to Geology and Engineering Materials.** 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. Steel and concrete as an engineering material.


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.


Department of Civil Engineering

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 Engineering, Transportation Planning and Engineering, and Hydrology and Hydraulic Engineering.

Structural Engineering and Applied Mechanics®. Major subdivisions of study are applied mechanics, structural mechanics, concrete, properties of materials, fluid mechanics and experimental mechanics and nonlinear stochastic systems. Graduate courses are CE 605 to 635 inclusive and CE 698.
Current research includes studies in structural dynamics, plastic instability of structures, inelastic behaviour and design in reinforced concrete, model testing in soil mechanics, plasticity and instability in plate and shell structures, low cycle metal fatigue, large deflections of shells and membranes, theory of design and safety in structures, inelastic behaviour in framed and shell structures, analysis of latticed space structures, ultimate load studies in reinforced concrete, elastic-plastic strength of pressure vessels, plastic wave propagation, infrared photoelasticity and hydroelasticity, and nonlinear stochastic systems.

**Soil Mechanics and Geotechnical Engineering.** Major subdivisions of study in this area are soil mechanics, foundation engineering and engineering geology. Graduate courses in this area are CE 650, 656, 658, 664 and 698.

Current research activities include studies in the yielding of soils, model testing, the behaviour of unsaturated soils and engineering geology. The Department has two fully equipped soil laboratories for experimental study.

**Water Resources Engineering.** Graduate course offerings in this area are CE 671 to 675 inclusive and CE 698. 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.

**Transportation Planning and Engineering.** Major subdivisions of study are highway engineering, traffic engineering, and urban and regional transportation planning. In addition to a core course CE 645, additional courses (e.g. CE 641, 642, 643, and 647) are available. Supplementary courses in urban and regional planning may be taken from the Departments of Geography and Sociology.

Current research activities include investigations into C.B.D. pedestrian circulation patterns, regional highway planning, urban transportation planning, urban land use planning, pavement design and materials. The Department has facilities for experimental studies on bituminous materials.

**Hydrology and Hydraulic Engineering.** The courses available are CE 686, 687, 688, 689 and 698. 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 engineering hydrology. Laboratories are available for experimental study.
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 non-linear analysis; stability; parametric excitation.


631. Introduction to Experimental Strength Analysis. A study of the factors that influence the service life of structures with particular attention paid to the role of stress analysis. Range of validity of common engineering solutions based on analytical idealizations. Elementary methods of deformation and stress analysis: elementary photoelasticity; mechanical, optical and electrical strain gauges; moiré; brittle coatings, and mechanical and mathematical models (Analog methods).


634. Advanced Photoelasticity II. Typical methods for static problems in plane and three-dimensional stress fields: normal incidence, oblique incidence, scat-

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.


642. Transportation Engineering I. (Urban Planning) Land use planning transportation administration. Basic urban transportation studies including origin, destination, inventory, use, parking and transit studies.


647. Geometric Design. Design standards and geometric design of highway alignment, grade, slight distance and cross section by class of highway. Design of intersections and interchanges. Design of planned access facilities in rural and urban areas.


656. Measurement of Soil Properties. Laboratory and field work in soil sampling and testing. Measurement of soil mechanics parameters for design and research problems. Experiments include permeability, consolidation, direct shear, and triaxial shear.

658. Soil Engineering (Case Histories). A critical study by the consideration of case histories of the current procedures or design and construction of foundations, earth retaining structures and earth slopes.
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 soils surveys.


672. **Water Resources Engineering II.** Waste-water treatment and disposal. The physical, chemical and biological processes utilized in the treatment of domestic and industrial waste waters.


674. **Water Resources Engineering IV.** Design and operation of water and waste-water treatment facilities. Practical design of the unit processes of water and waste-water treatment facilities. Design of a complete treatment facility. Operating problems in water and waste-water treatment plants and their elimination or minimization through proper design.

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 particular matter. The engineering design of air cleaning equipment. Public relations, control ordinances, and zoning. Public administration.


698. **Special Directed Studies.**

699. **Thesis.**
Department of Classics

N. H. High, M.S., Ph.D. (Cornell)

Acting Chairman of the Department and Dean of the Faculty of Arts

B. J. Graf, C.R., M.A. (Western) - - - - Professor J

P. G. Keleher, C.R., M.A. (St. Mary's, Kentucky) - Associate Professor J

P. Keresztes, M.A. (Toronto), Ph.D. (Graz) - Associate Professor

Sister M. Stella, S.S.N.D., B.A. (Toronto), M.A. (Catholic University) - - - - Assistant Professor J

R. L. Porter, B.A. (McMaster), M.A. (Princeton) - - Lecturer


W. H. Schnarr, C.R., B.A. (St. Mary's, Kentucky) - - Lecturer J

S. Haag (Mrs.) B.A., M.A. (Queen's) - - Lecturer (part-time)

B. E. Preyer (Miss) B.A. (Bryn Mawr), M.A. (Toronto) - Lecturer

Undergraduate Course Descriptions

Note: The number of hours or lectures shown after the course description is an attempt to indicate the "normal"; each instructor determines how often his particular class will meet.

Except for those numbered below 100, all the following courses are Honours courses, but are also open to students in General Arts.

Greek

10. Introductory Greek. For students who have not matriculated in Greek. 4 lectures.

100. Epic and Philosophy (to Plato). Homer, Iliad, I, VI, IX; Plato, Apology and Crito; prose composition and sight translation.
Prerequisite: Grade 13 Greek, Greek 10, or permission.
4 lectures.

250. Prose Composition and Sight Translation.
1 lecture.

4 lectures.

350. Prose Composition and Sight Translation.
1 lecture.

3 lectures.

370. Drama and Literary Criticism. Aeschylus, Agamemnon; Sophocles, Oedipus Tyrannos; Aristophanes, Clouds; Aristotle, Poetics.
3 lectures
450. Prose Composition and Sight Translation.
1 lecture.

460. Philosophy and Political Theory: Plato and After. Plato, Republic (Selections) and Symposium; Aristotle, Ethics and Politics (Selections).

470. Oratory and Biography. Demosthenes, Philippics I, Olynthiacs; selections from Antiphon, Andocides, Lysias, Isocrates and Isaeus, Plutarch, Demosthenes and Timoleon.
3 lectures.

Latin

10. Introductory Latin. For students who have not matriculated in Latin. Must be followed by Latin 100 in order to gain credit.
4 lectures.

100. Literature of the Republic. Catullus (Selections); Cicero, Pro Archia; Vergil, Eclogues and Georgics I, IV; prose composition and sight translation. Prerequisite: Grade 13 Latin, or Latin 10, or Latin 50J, or permission.
4 lectures.

250. Prose Composition and Sight Translation.
1 lecture.

260. Letters and Epic. Selections from the letters of Cicero and Pliny; Vergil, Aeneid II, IV, VI.
3 lectures.

350. Prose Composition and Sight Translation.
1 lecture.

3 lectures.

370. Lyric and Elegiac Poetry. Horace, Odes and Carmen Saeculare; selections from Tibullus, Propertius, and Ovid.
3 lectures.

380. Literature of the Silver Age. Seneca, Medea, Selections from the Letters; Petronius, Cena Trimalchionis; Apuleius, Apologia, Selection from the Metamorphoses.
3 hours.

450. Prose Composition and Sight Translation.
1 lecture.

460. Philosophy and Satire. Lucretius, De Rerum Natura I, III, and V (Selections); Cicero, De Officiis; Horace, Satires (selections); Juvenal, Satires (selections).
3 lectures.
3 lectures.

3 lectures.

Classical Civilization (Courses in Translation)

251* Near Eastern and Greek History. A survey of the civilizations of the Near East and of Greece emphasizing their political, military, social and economic aspects.
3 lectures per week, half course.

252* Roman History. A military, political, social, economic survey of Rome from earliest times to the Empire's fall.
3 lectures per week, half course.

3 lectures.

350. Classical Art and Archaeology. A survey of art and architecture from the Aegean age through the Roman Empire.
3 lectures.

370. Myth, Religion, and Art. Deities, myths, and sagas correlated with literature, religion, philosophy, politics, and art from the 6th century B.C. to the 4th century A.D.
3 lectures.

Art

100. Introduction to Art. A survey of the history of world art, and a study of the dynamics of visual form, with an examination of the material, conceptual, and sensory elements of art considered under their aesthetic, technical, and rational aspects.
3 lectures, with slides.
Instructor: Nancy-Lou Patterson, B.A. (Washington)
Department of Design

G. N. Soulis, B.A.Sc. (Toronto)  . Professor and Chairman of the Department
J. W. Church, B.Sc. (Queen's), M.A.Sc (Toronto)  -  -  Professor
M. L. Constant, B.Sc. (Toronto)  -  -  -  Associate Professor
V. K. Handa, B.Sc. (Calcutta), B.Sc. (Eng.) (London),
M.Sc. (Queen's), M.Sc., Ph.D. (Waterloo)  -  Associate Professor
M. Krampen, Diploma in Visual Communication
(Hochschule fur Gestaltung, Ulm),
Ph.D. (Michigan State)  -  -  -  -  Associate Professor
(Design and Psychology)
P. H. O'N. Roe, B.A.Sc. (Toronto),
M.Sc., Ph.D. (Waterloo)  -  -  -  -  Associate Professor
A. I. Bernholtz, B.Arch. (Toronto), M.Arch.
(British Columbia)  -  -  -  -  Assistant Professor
P. H. Meincke, B.Sc. (Manitoba)  -  -  -  -  Assistant Professor
O. G. A. Schmidt, B.A.Sc., M.A.Sc. (Toronto)  -  -  -  -  Assistant Professor
P. L. Seeley, B.A.Sc. (Toronto)  -  -  -  -  -  -  Adjunct Professor
F. E. Burke, B.A. (London)  -  -  -  -  -  -  -  -  Lecturer
C. K. G. Hahn  -  -  -  -  -  -  -  -  Special Lecturer
B. H. Henderson  -  -  -  -  -  -  -  -  Special 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.

40. The Theory and Techniques of High Speed Photography. The scientific and engineering uses of high speed photographic methods giving space-time information on mechanical motions and dynamic phenomena in the study of diverse actions.

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.
603. **Creative Synthesis in Design.** The role of association and imagery in solution generation. Types of solution generators. Adaptive and substitutional processes. The role of experimentation and analysis in synthesis.

604. **Design Morphology and Organization.** Generation of problem statements, systems identification, generation of solution sets, feasibility determination. Construction of archetypes; sensitivity, compatibility and stability analysis; behavior prediction, and solution communication.

605. **Decisions, Value and Utility in Design.** Decisions under certainty, risk, and uncertainty, preference measures, ranking and transitivity, quality, dimensional analysis of quality, thresholds, simulation methods.

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.


699. **Thesis.**

**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.**

698. **Special Directed Studies.**
Department of Earth Sciences

P. F. Karrow, B.Sc. (Queen's), Ph.D. (Illinois)
Associate Professor and Acting Chairman of the Department

E. C. Appleyard, B.Sc. (Western), M.Sc. (Queen's), Ph.D. (Cambridge)
Assistant Professor

C. R. Barnes, B.Sc. (Birmingham), Ph.D. (Ottawa) - Assistant Professor
D. L. Salter, B.Sc., Ph.D. (Southampton) - Assistant Professor
D. E. Lawson, B.Sc., M.Sc. (New Brunswick) - Lecturer

Undergraduate Course Descriptions

Details of the undergraduate programmes offered by the Faculty of Science are to be found on page 99.

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, 2 hours laboratory.

2 lectures, 2 hours laboratory (Half course, 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 (Half course, 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 (Half course, winter term).

2 lectures, 3 hours laboratory (Half course, fall term).

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.


340. Structural Geology. Primary and induced structures in igneous, sedimentary, and metamorphic rocks. The physical properties of rocks and the effects of stress on them. The relationship between major and minor structures. Introduction to the methods and interpretation of petrofabrics. 2 lectures, 2 hours laboratory.

430. Economic Geology. Principles and processes governing the formation of ore and industrial mineral deposits. An introduction to mineral economies. The study of important examples, primarily from Canada. Laboratory study will include instruction and practice in ore microscopy. 2 lectures, 2 hours laboratory.

431. Geochemistry. The geological application and interpretation of geochemical data. Chemical characteristics of sedimentary, igneous, and metamorphic rocks. Theory of distribution patterns and co-efficients of major and minor constituents. The recognition and elucidation of metasomatic rocks. Isotope studies and radiometric dating. 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 America and other shield areas throughout the World. 2 lectures, 2 hours laboratory. (Half course, 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. (Half course, 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. (Half course, fall term).

2 lectures, 1 hour problems. (Half course, winter term).

440. Quaternary Geology. Stratigraphy and history of the Quaternary Period with emphasis on glaciomarine. Laboratory studies on glacial deposits. Field trips. A previous course in geomorphology is recommended.
2 lectures, 3 hour laboratory. (Half course, fall term).
Department of Economics

J. S. Minas, B.A. (Wayne), Ph.D. (Illinois) - Professor and Acting Chairman
Dean of Graduate Studies

S. S. Sengupta, M.A., D.Phil. (Calcutta) - Visiting Professor

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 and Deputy Chairman

W. R. Needham, B.Comm. (Carleton), M.A. (Queen's) - Assistant Professor and 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.

Undergraduate Courses in Economics

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 indicates 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, (Half course).

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. (Half course).
Department of Economics

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 Macroeconomic 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).

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 techniques; time series analysis; aggregation and index numbers; the estimation and testing of economic relationships using regression and correlation techniques. Prerequisite: Economics 102. 3 lectures.


340. International Trade and Finance. The pure theory of international trade; balance-of-payments statistics; meaning and measurement of payments imbalances; exchange-rate systems; commercial policy; international investment and foreign aid; problems and suggested modifications of the international monetary system. Prerequisite: Economics 201, 202. 3 lectures.

365. 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.


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.

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 in the fall of 1967 a graduate programme leading to the degree of Master of Arts in Economics. Information regarding this programme is obtainable from the Department.
Department of Electrical Engineering

A. R. M. Noton, B.Sc. (Sheffield), B.Sc. (London), Ph.D. (Cambridge)
Professor and Chairman of the Department

R. G. Anthes, B.A.Sc., M.A.Sc. (Toronto)
Professor and Associate Chairman of the Department

E. L. Heasell, B.Sc., Ph.D. (Imperial College, London) - Professor

H. C. Ratz, B.A.Sc. (Toronto), S.M. (Massachusetts Institute of Technology), Ph.D. (Saskatchewan) - - Professor

K. D. Srivastava, B.Sc. (Roorkee), Ph.D. (Glasgow) - - Professor

L. A. K. Watt, B.Sc. (Manitoba), M.S. (Chicago), Ph.D. (Minnesota) - - - - Professor

L. Y. Wei, B.S. (National Northwestern College, China), M.S., Ph.D. (Illinois) - - - - - Professor

J. B. Ellis, B.A.Sc. (Toronto), D.I.C., M.Sc. (Imperial College, London), Ph.D. (Michigan State)
Associate Professor (Electrical Engineering and Management Sciences)

J. S. Keeler, B.A.Sc., M.A.Sc. (Toronto) - - Associate Professor

R. H. MacPhie, B.A.Sc. (Toronto), M.S., Ph.D. (Illinois) Associate Professor

R. S. Ramshaw, B.Sc., Ph.D. (Nottingham) - Associate Professor

P. H. O’N. Roe, B.A.Sc. (Toronto), M.Sc., Ph.D. (Waterloo) Associate Professor (Electrical Engineering and Design)

D. J. Roulston, B.Sc. (Belfast), D.I.C., Ph.D. (Imperial College, London) - Associate Professor

S. C. Choo, B.Sc., Ph.D. (Imperial College, London) - Assistant Professor

Y. L. Chow, B.Eng. (McGill), M.A.Sc., Ph.D. (Toronto) Assistant Professor

G. J. Dufault, B.A. (Ottawa), B.Ss. (Carleton) - Assistant Professor

J. A. A. Field, B.E. (Saskatchewan), M.A.Sc., Ph.D. (Toronto) - - - - Assistant Professor

J. Hanson, B.A.Sc. (Toronto), D.I.C., M.Sc. (Imperial College, London) - Assistant Professor

W. N. Meikle, B.A.Sc., M.A.Sc. (Toronto) - Assistant Professor

N. Thedchanamoorthy, B.Sc. (Ceylon), Ph.D. (Cambridge) - - - - Assistant Professor

R. G. van Heeswijk, Dipl. Ing. (Delft, Holland) - Assistant Professor

L. Zafiriu, B.Sc. (American College, Istanbul), M.Sc. (Syracuse) - - - - Assistant Professor

P. A. Vuorinen, B.A.Sc. (Toronto), Ph.D. (London) - Assistant Professor

W. J. Vetter, B.A.Sc. (Toronto), M.A.Sc., Ph.D. (Waterloo) Assistant Professor

W. C. Miller, B.S. (Michigan), M.A.Sc. (Waterloo) - - Lecturer
Undergraduate Course Descriptions


3 hours lectures, 3 hours laboratory, 2 hours tutorial, one term.


3 hours lectures, 3 hours laboratory every third week, 1 hour tutorial, 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. Relation between information content of messages and system capacity; transmission through electric networks; modulation systems; periodic sampling, noise, comparative analysis of information transmission systems. The role of system bandwidth and noise in limiting the transmission of information is stressed.

Prerequisite: EE 52.

3 lectures, one term.

32. Electronics. Introduction to the principles and characteristics of diodes, vacuum tubes, transistors, and other electron devices, and to the design and analysis of rectifiers, amplifiers, and other electronic circuits.

Prerequisite: EE 12, EE 13.

3 lectures, 3 hours laboratory, one term.
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.


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. The design and analysis of circuits used in the generation and shaping of non-sinusoidal waveforms, including linear and non-linear wave shaping, and gating, voltage and current sweeps, multivibrators and the blocking oscillator.

Prerequisite: EE 42, EE 52.

3 lectures, 3 hours laboratory every third week, one term.


2 lectures, 1 hour tutorial, 3 hours laboratory alternate weeks, one term.


2 lectures, 1 hour tutorial, 3 hours laboratory alternate weeks, one term.
Department of Electrical Engineering

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.
2 lectures, 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-wave guide analogy.
3 lectures, 3 hours laboratory alternate weeks, one term.

81. Control System I. Review of modelling of dynamic properties for physical components and systems in terms of ordinary differential equations; Laplace domain models and transfer function concepts for linear systems; block diagram manipulations; analysis of linear systems with emphasis on feedback systems, in the time domain, s-domain and frequency domain; stability criteria; performance specifications and system design and compensation through analysis.
Prerequisite: GE 12, EE 51 or EE-32.
3 lectures, 3 hours laboratory every third week, one term.

99. Project. An engineering assignment requiring the student to demonstrate initiative and assume responsibility. Student activity is guided and coordinated by a faculty member. The project will be selected at the end of the IIIB term in consultation with his supervisor. The results are to be communicated in the IVB term as a written report and an oral presentation.
2 terms, 3 hours per week first term, 1 hour per week second term.
Prerequisite: EE26.
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 programs 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.
Department of Electrical Engineering

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 program of study of each graduate student. A new student must meet with his advisor prior to graduate course registration to arrange his course-work program 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 program must be specifically approved prior to registration in the subsequent term.

Master's Degree Programs

The objective of the Master's Degree program (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 program 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 program 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 program 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 program. At any time, a student may be required to withdraw from the program 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 Program

The primary objective of the Ph.D. program 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 program, 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. program 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. program 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 programs are not encouraged, and students may satisfy only the subsidiary requirements of the program 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. program 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 program.

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.
2 hours lectures. One term.
Prerequisite: EE 602.


Wiener-Hopf equation, spectral factoring and the solution for optimum linear systems.
Prerequisite: EE 83.
2 hours lectures. One term.

608. Information Theory. Advanced topics of information theory; coding, filtering, and the properties of information measure; signal processing by non-linear devices, power law representation, and characterization by multidimensional convolution integrals; detection theory, matched filters and maximum likelihood decisions; information theory as applied to language studies, data retrieval, computational transformations, and the thermodynamics of communication systems; equivocation, error limits, noise and the use of stochastic signals for channel characterization.
Prerequisite: EE 607 and EE 613.
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, supergain, pattern synthesis.
One term.

610. Electromagnetic Engineering II. Boundary value problems; Green’s functions, integral equations, variational techniques. Rayleigh-Ritz methods. Microwave circuits; cylindrical waveguide mode expansion, waveguide junctions, network and impedance concepts, scattering matrix, waveguide discontinuities. Introduction to the theory of partial coherence; mutual coherence function, quasi monochromatic analysis, coherent and incoherent limits, interferometer and linear array applications.

611. Advanced Electronics Circuits I. A study in depth of selected circuits used in electronics, using both vacuum tubes and transistors. This is an analysis course in which various techniques are used, but Thevenin and Norton equivalent circuits and the pole zero approach are stressed. Analysis of such amplifier circuits as 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.


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.


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.

621. Ultra-High-Frequency Radio Propagation. Microwave transmission to line-of-night and in tropospheric scatter transmission systems. Meteorological aspects, refraction, diffraction reflection, geometry for smooth earth and rugged
terrain, effective earth radius, angular distance and effective distance. Methods of predicting transmission loss. Effective antennae gains, Rayleigh and Gaussian distributions, fading margins, propagation reliability. Noise levels.
2 hours, one term.

623. Quantum Electronics. Angular momentum and momentum matrices, time-independent and time-dependent perturbations, Einstein transition probabilities, interaction between matter and radiation, line breadth, Raman effect, Larmor theorem, Zeeman and Stark effects, Dirac's wave equation, electron paramagnetic resonance, ammonia beam maser, solid state maser, gaseous and solid state lasers, quantum tunneling through thin films and across junctions between similar or dissimilar materials. Prerequisite: Phys. 431 or equivalent. 3 hours, one term.


626. Semiconductor Device Characteristics. Resume 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 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.

631. Nonlinear Control Theory I. Phase plane and state space methods of analysis of nonlinear second order and higher order systems, stability analysis by the second method of Lyapunov, describing function methods for feedback systems.


633. Nonlinear Systems with Random Inputs. A review of the methods available for the classification, analysis, optimization, and synthesis of nonlinear systems, especially those involving random processes with second and higher order probability distributions. Optimization of certain classes of nonlinear systems and the necessity of digital techniques. Correlation and statistical in-
Department of Electrical Engineering

put-output relationships etc., in the time domain corresponding to second-order probability relationships in the ensemble domain. Self-optimizing digital systems for stochastic processes. Mean square error linear approximations.
Prerequisite: EE 607 or EE 634.
2 hours lectures, one term.

Prerequisite: M 51. 2 hours lectures, one term.


636. System Identification. Transient and frequency response, stochastic inputs, cross correlation techniques, state-space description of multivariable systems. regression analysis, parameter estimation of non-linear systems.
Prerequisite: EE 634 or EE 607.

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.

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, stability, digital compensation, multi-rate sampling systems, random input signals, word lengths and quantization errors.
Prerequisite: EE 634. May be taken simultaneously. One term.

2 hours per week, one term.

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.
651. **Topics in High-Voltage Engineering.** Determination of the electric field for different electrode configurations. Conformal mapping. Discharge phenomena in gases. Electrical breakdown of gases, liquids and solids. Surge voltages, their origin and effects. High voltage measuring equipment and laboratory techniques.

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.

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.

698. **Special Problems in Electrical Engineering.** Directed study of a special topic of interest to the individual student; may be an experimental or design project, or an engineering application related to a particular problem. Credit given as for a course upon completion of a satisfactory engineering report. Individual supervision. Not a reading course. One or two terms.

699. **Thesis.** Research leading to the submission of a thesis as part of the requirements for an advanced degree.
Department of English

W. U. Ober, B.A. (Washington and Lee), Ph.D. (Indiana)
Professor and Chairman of Department

E. Birney, B.A. (British Columbia), M.A., Ph.D. (Toronto)
Visiting Professor and Writer-in-Residence

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. M. Boyd (Miss), A.B. (Grinnell), M.A. (Chicago),
Ph.D. (Columbia) (Roberts Fellow) - - Associate Professor

L. A. Cummings, A.B. (Washington), M.A. (Missouri),
Ph.D. (Washington) - - - Associate Professor

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

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. Levitsky (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. N. Gosselink, B.A. (Kansas), M.A., Ph.D. (Colorado)
Assistant Professor

H. E. Haworth (Mrs.), B.A. (Rollins),
M.A., Ph.D. (Illinois) - - - Assistant Professor

P. M. Hinchcliffe, B.A. (British Columbia), M.A. (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. (Cheyney Hill),
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

P. D. Beam, B.A. (Waterloo), M.A. (McMaster) - - Lecturer

C. H. DeRoo, B.A. (McMaster) - - Lecturer

R. R. Dubinski, B.A., M.A. (Western) - - Lecturer

M. J. Estok, B.A., M.A. (Saskatchewan) - - Lecturer
C. J. Hayward, B.A. (Western) \hspace{1cm} Lecturer
N. M. Hodge, B.A. (Waterloo) \hspace{1cm} Lecturer
R. Lister (Mrs.), B.A., M.A. (Toronto) \hspace{1cm} Lecturer
M. G. Thysell (Mrs.), M.A. (Montana) \hspace{1cm} Lecturer
E. M. Uram, C.R., B.A. (Western), M.A. (St. Louis) \hspace{1cm} Lecturer

English Honours Programmes

For programmes in Honours English, Honours English and French, Honours English and German, Honours English and History, Honours English and Latin, Honours English and Philosophy, Honours English and Russian, and Honours English and Spanish, see pages 24-29.

English Major in General Arts

In Year I the prospective English major should select English 101, Philosophy 100 or equivalent, at least one of French 100, German 100, and Latin 100, and other subjects in accord with the general regulations.

In Year II the English major shall complete at least English 201 and 251.

In Year III he shall complete (a) English 301, (b) another English course chosen from the whole range of courses offered (except 225, 240, and 335), and (c) either English 345 (Senior Essay) or an Honours English course.

Note on numbering: English 101 and 300 are designed for both Honours and General students. Otherwise courses numbered 250-299, 350-399, and 450-499 are Honours courses, and all others are General courses.

Undergraduate Course Descriptions

Note: The number of hours or lectures shown after the course description is an attempt to indicate the "normal"; each instructor determines how often his particular class will meet.

15. English Literature. 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 on topics related to the literature studied.
3 hours a week.

50J. Preliminary Year English. General literature and composition; the Ontario Grade 13 curriculum will be followed.
4 lectures.

101. The Art and Themes of Literature. A study, through representative works, of the major genres, modes, and methods of literature, and its principal recurring themes. For all first-year Arts students electing English.
3 hours a week.
130. The Types of English Literature. An examination of the nature and forms of English literature, to be combined with practice in writing. (Primarily for Science students).
3 hours a week.

201. Masterpieces of English Literature, I. A study of the masterpieces of English literature from the Middle Ages to the latter part of the eighteenth century.
3 hours a week.

210. The Novel. A study, through selected authors, of the principal techniques and movements in the development of the English novel from its beginning to the present day.
3 hours a week.

215. The Development of Drama to 1660. A study of the origins and development of English drama, with special concentration on the contribution of the sixteenth and early seventeenth centuries.
3 hours a week.

220. Drama from 1660. A study of the principal playwrights, plays, and movements in dramatic history from the re-opening of the theatres in 1660 to the present day.
3 hours a week.

3 hours a week.

235. Selections from the Literature of Ideas. This course, which deals chiefly with the moral implications of political, philosophical, and scientific 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.
3 hours a week.

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, including journalese and other technical jargon. Pronunciation, slang, colloquialisms. The practical analysis of structure, semantics, and imagery. Not open to Year I students.
3 hours a week.

251. Literary Criticism: Its Origins and Practice. One part of the course is devoted to a study of the major classical critics and of the transmission of their writings through Italian and French critics. The other part provides a training in the application of critical principles to the works of literature.
3 hours a week.

261. Old English and the History of the Language. An introduction to the Anglo-Saxon language and literature in their historical context, and a study of the development of the English language to modern times.
3 hours a week.
270. Middle English, with Special Emphasis on Chaucer. A study of Middle English literature, partly in translation and partly in the original, with special emphasis on the works of Chaucer, which will be read in the original. 3 hours a week.


300. American Literature. A survey of the development of American literature from the beginning to the present time and an exploration of the themes of such major figures as Poe, Emerson, Thoreau, Hawthorne, Melville, Whitman, Clemens, James, Eliot, and Faulkner. 3 hours a week.

301. Masterpieces of English Literature, II. A study of the masterpieces of English literature from the end of the eighteenth century to the present day. 3 hours a week.

310. Literature of Canada and the Commonwealth. A survey of Canadian and Australasian poetry and prose, with some consideration of the literatures in English, from South Africa and the West Indies. 3 hours a week.

330I. American and Canadian Literature. The literature and literary history of British colonial America, of the Revolution and early American republic, and of the nineteenth and twentieth centuries in the United States and Canada, with some attention to cultural history, studied by means of lectures, reports, tutorials, quodlibets, papers, and tests. 3 meetings per week.

335. Creative Writing. Aimed at encouraging the student to develop his creative and critical potentials, the course consists of supervised practice, tutorials, and seminar discussions. Enrolment is limited and, in order to be accepted, an applicant must first submit a MS as evidence of his ability to profit from the course. 3 hours a week.

345. Supervision of Senior Essay. 3 hours a week.

350. Seventeenth-Century Non-Dramatic Literature. A study of the non-dramatic literature of the Jacobean, Caroline, and Interregnum periods, with special attention to Milton’s major works. 2 hours a week.

360. Drama to 1642. The rise of the drama and dramatic form; the work and influence of Shakespeare’s predecessors; the life and works of Shakespeare; the post-Shakespearean drama to the closing of the theatres. 3 hours a week.
**Department of English**

**370. The Augustan Age.** An historical and critical study, in seminars, of the drama, poetry, novels, and other writings of the age from Dryden to Burns. 3 hours a week.

**380. The Romantic Movement.** A critical study, in seminars, of the principles and practice of the English Romantic authors (poets, novelists, and essayists) from Blake to Keats. 3 hours a week.

**390. Beowulf.** A literary and linguistic study of the Old English epic *Beowulf* (and the *Finnsburg Fragment*) with an investigation of its origins in history and mythology. Prerequisite: English 261. 2 hours a week.

**451. Literature of the Victorian Age.** An historical and critical study of the writers in the period between the Romantic era and the rise of characteristically twentieth-century literature; with special emphasis on the major poets (Tennyson, Browning, and Arnold), on the more important novelists (e.g., Dickens, Thackeray, Eliot) and on writers of general and critical prose works of lasting significance (e.g., Newman, Ruskin, Mill, Huxley). 3 hours a week.

**460. Twentieth-Century British Literature.** A critical study of works by Shaw, Yeats, Eliot, James, Conrad, Joyce, D. H. Lawrence, and others of the modern period. 3 hours a week.

**470. History of Literary Criticism.** A study in seminars of the literary criticism of the four great ancients and of English writers from the Elizabethans to the present day. 2 hours a week.

**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. 3 hours a week.

**480. Senior Seminar.** Designed for fourth-year students in the Honours English program or in programs combining Honours English with a fraternal discipline, this course provides a study in depth of a selected author or group of authors. Open also to superior third-year General students. 3 hours a week.

**495. Supervision of Senior Honours Essay.** 3 hours a week.
Graduate Course Descriptions

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 1967-68.


†603. Practical Criticism (Half course). Instruction and supervised practice in the art of reading closely, interpreting, and evaluating. (No letter grade).

605. Beowulf (Half course). A study of Beowulf as a work of literature. A knowledge of Old English is a prerequisite for admission to this course.

607. Chaucer (Full course). A study of the works of Chaucer, with emphasis on The Canterbury Tales and Troilus and Criseyde.

†610. Spenser (Half course). A study of the works of Spenser, with emphasis on The Faerie Queene.

†615. Shakespeare I (Full course). A study of the comedies, problem plays, and poems.

616. Shakespeare II (Full course). A study of the histories and tragedies.


†622. Metaphysical and Cavalier Poets (Half course). A study of their theory and practice.

625. Milton (Full course). A study of the poetry of Milton. Some attention will be given to selected prose works.

627. Drama of the Restoration (Half course). The chief comedies and tragedies of the period 1660-1707.

†630. Satire (Full course). 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 (Half course). 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 (Half course). 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.

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Department of English

636. **Johnson and his Circle** (Half course). A study of the literary theories, writings, and relations of Johnson, Boswell, and their circle.

638. **Sterne and Smollett** (Half course). A study of a selection of their writings.

639. **Blake** (Half course). A study of his theories and practice.

640. **Wordsworth and Coleridge** (Full course). A study of the poetry and prose of Wordsworth and Coleridge, with emphasis on the period of close association of the two poets.

642. **Shelley** (Half course). A study of the poetry and prose of Shelley.


645. **Byron** (Half course). A study of the poetry of Byron, with emphasis on *Don Juan*.

647. **Jane Austen: Novelist** (Half course). Her place in the development of the novel; her work in relation to the Romantic Revival; an analysis of Jane Austen criticism.

650. **Studies in Victorian Poetry** (Full course). A complete survey of the poetry of Tennyson, Browning, and Arnold, in relation to the thought of the Victorian Age.

652. **Expository Prose of the Victorian Age** (Full course). Reading, study, and discussion of the major prose works of Carlyle, Newman, Ruskin, Arnold, Mill, and Huxley, with selected readings from Macaulay, Pater, and Stevenson.

654. **Late Victorian Poets** (Full course.) A study of the poetry of Swinburne, D. G. Rossetti, Meredith, Morris, Clough, and the poets of the 1890's.

656. **The Victorian Novel** (Full course). A study of the principal works of such novelists as Dickens, Thackeray, Eliot, Meredith, and Hardy.

660. **Antebellum American Literature** (Full course). 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** (Full course). A study of the works of such authors as Dickinson, Howells, Crane, Twain, and James.

670. **The Twentieth-Century British Novel** (Full course). A study of the works of such novelists as James, Conrad, Lawrence, Joyce, Forster, and Woolf.

672. **Twentieth-Century British Poetry** (Full course). A study of the works of such poets as Hopkins, Yeats, Eliot, Lawrence, Owen, and Auden.

673. **Yeats** (Half course). A study of his poetry, drama, and prose.

677. **Twentieth-Century Drama** (Full course). A study of the major drama of the twentieth century.
*680. Twentieth-Century American Fiction* (Half course). A study of the works of such authors as Hemingway, Faulkner, Dos Passos, and Steinbeck.


*685. Studies in Canadian History and Letters* (Full course, given in conjunction with the History Department.) A study of the major works and movements in Canadian literature, seen in the context of social and political developments.

*687. Studies in Australian Poetry* (Half course). 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.


*696. Special Studies* (Full course). Studies in a specific author, genre, or period.

*697. M.A. Thesis.*

*698. M.Phil. Thesis.*

*Preparation for a Student Production in the Theatre of the Arts*
Department of French

F. K. Montgomery (Miss), B.A., M.A. (Western),
D. de l'U. de Paris  
Professor and Chairman of Department

M. I. Kieffer, C.R., B.A. (St. Louis), M.A. (McGill),
J.C.D. (Gregorian)  
Professor

R. L. Myers, B.A. (Western), M.A., Ph.D. (Johns Hopkins)  
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. R. Finn, C.R., B.A. (Western), M.A. (Toronto),
Ph.D. (Illinois)  
Associate Professor

Z. T. Ralston, C.R., B.A. (Western), M.A. (Laval),
Ph.D. (Catholic U. of America)  
Associate Professor

J. J. Binamé, L. en Phil. rom., Agrégé (Brussels)  
Assistant Professor

J. Lafrance (Miss), B.Paed., M.A. (Laval)  
Assistant Professor

J. B. Bullbrook, C.R., B.A. (Western), M.A. (Laval)  
Lecturer

R. J. Fournier, B.A., M.A. (Western)  
Lecturer

P. Gaudet, B.A. (Ottawa)  
Lecturer

C. E. Jose, B.A. (Western), M.A. (Toronto)  
Lecturer

A General Arts student majoring in French will complete French 160, 200 and 300 (or 220J and 310J or 320J) and any two courses chosen in consultation with the departmental chairman.

Note: The number of hours or lectures shown after the course description is an attempt to indicate the "normal;" each instructor determines how often his particular class will meet.

50J. Preliminary Year French. Authors and Composition. The Ontario Grade 13 curriculum will be followed. 4 lectures.

100. Selected Works of the Twentieth Century. Oral practice in the language laboratory.

160. Selected Works of the Nineteenth and Twentieth Centuries. Lectures and written reports. Intensive grammar review with the use of the language laboratory. Prerequisite: Grade 13 French. (This course is open to any qualified student not honouring or majoring in French). 3 lectures.

Prerequisite: French 100 or 160.

250. Grammar and Prose Composition; Phonetics and Oral Practice.
Prerequisite: French 100 or French 160.
2 hours of lectures and 1 hour of phonetics and oral practice.

260. French Literature and Culture of the Seventeenth Century. Lectures, reports, discussions in French.
Prerequisite: French 160.
3 lectures.

300. Survey of the French Drama. A study of typical examples of French drama from the 17th century to the present.
Prerequisite: French 160.
3 lectures.

310J. Survey of Twentieth Century French Literature.
Prerequisite: French 100 or 160.
3 lectures.

320J. Survey of Nineteenth Century French Literature.
Prerequisite: French 100 or 160.
3 lectures.

3 lectures.
Prerequisite: French 160.

350. Grammar and Prose Composition.
Prerequisite: French 250.
2 lectures.

360. French Literature of the Eighteenth Century. Lectures, readings, reports in French.
Prerequisite: French 260.
3 lectures.

370. French Literature from Balzac to 1900. Lectures, readings, reports in French.
Prerequisite: French 160.
3 lectures.

450. Advanced Composition and Oral Practice. The language laboratory will be used.
Prerequisite: French 350.
2 lectures.

460. Sixteenth Century French Literature. Lectures and seminars in French.
Prerequisite: French 360.
2 lectures.
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470. **Medieval French.** Reading of Old French; survey of Medieval French literature, beginning with La Chanson de Roland. Lectures, reports.
Prerequisite: French 360.
2 lectures.

480. **French Literature since 1900.** Lectures and seminars in French.
Prerequisite: French 370.
2 lectures.

**Graduate Courses**

All graduate courses with the exception of the Thesis are one term courses.

600. **Literary Criticism in French (Problems and Methods)**

601. **History of the French Language**

602. **Medieval French Literature**

603. **Literature of the Renaissance in France**

604. **Reading Course in approved topics**

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 Novel**

620. **Twentieth Century French Literature**

625. **The Literature of French Canada**

699. **Thesis.**
General Engineering

11. Engineering Synthesis. Principles of problem statement, analysis, and concept creation in the design process. Discussion of planning, the flow of information, physical, economic and financial feasibility, and concept selection as related to project design. Discussion of social and economic conditions affecting value and utility, and their relationship with the design process in the solution of engineering problems. The application of simulation, modelling and optimization to the above: three term projects.

2 hour lectures, 1 hour problems, first term.

12. Introduction to Engineering Systems. Introduction to basic methods of analysis through mathematical models for components and processes. Systematic formulation of terminal representations and of system equations or linear systems, utilizing terminal and system graph concepts in conjunction with matrix notation. Solutions through Laplace transforms and by computer methods. Examples are drawn from the various engineering disciplines.

13. Management Science I. Applications of economic performance indices in choosing between engineering alternatives and choosing optimum operating levels. Topics: the planning process; generation and classification of cash flows; accounting concepts; methods for tangible evaluation of alternatives; capital resources and allocation principles; determination of minimum costs and maximum profit; elements of economic measurement, analysis, and forecasting: competition.

3 hours per week.

1 term.


2 hours, one term.


4 hours alternate weeks, one term.

22. Graphics II. The application of graphics to the solution of Vector problems, both co-planar and non-co-planar. Graphic calculus both integration and
differentiation, design of all types of nomographs: design of special slide rules: continuation of free hand sketching.

4 hours, week, one term.

23. Measurement. (First term) Nature of measurement, scales and measurement units. Complementary variables and postulates of measurement. Concepts of accuracy, precision, systematic and random errors. Probability, normal distribution function, elementary sampling. Propagation of errors in calculations, formation of measurement specifications. 2 lectures. Measurement Laboratory. (Second Term) Use of design morphology in development of measurement techniques for specific problems illustrating other Year I courses. 3 hours laboratory, alternate weeks.

24 Tutorial. Students will meet in very small groups with a faculty member designated as their tutor. Performance in problem assignments and conceptual difficulties with other courses will be discussed, along with interrelation of present coursework, later work and engineering practice. The student will be responsible to his tutor for undertaking of certain assignments in the other courses. 1 hour per week, both terms. (Consultation periods with teaching assistants regarding specific course problems as and if required at the initiative of the student or his tutor, will be available).


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, one term.


2 lectures, 1 hour tutorial, one term.
51. **Micro Structure of Materials.** Crystal structure and lattice, X-ray and electron diffraction analysis, chemical binding, Bloch waves and band model, quantum statistics, imperfections and their interactions, diffusion.

52. **Physical Properties of Materials.** Lattice vibrations, phonon and electronic specific heats, thermal conduction, phases, elasticity, plasticity, mechanical properties, electric conduction in metals, semiconductors and superconductors. 2 hours lectures, 3 hours laboratory.

53. **Structure and Properties of Matter I.** Gases; condensed states of matter; origin of interatomic forces; structure of crystals and non-crystalline solids; free electron theory of metals; semiconductors; physical electronics; optical processes; magnetic properties; nuclear processes. 2 hours lectures, 1½ hours laboratory, 1 term.

54. **Structure and Properties of Matter II.** Properties associated with primary forces, waves and vibrations, theory of systematic reactions; properties associated with defect structures, plasticity, viscosity, hardness, creep, brittle fracture, ductile fracture fatigue; stability under service environment.

61. **History and Philosophy of Science.** The nature of science; science and technology in Egypt and Babylon. The development of science in Greece; the Orphic mysteries and the Ionian philosophers, Plato and Aristotle; Archimedes. The Alexandrian school and the separation of science and philosophy. Technology under the Roman Empire. The 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, one term.

*Chemical Engineering Experiment in the Purification of Polluted Water by Running it Through Coal*
Department of Geography and Planning

R. R. Kuruger, M.A. (Western), Ph.D. (Indiana)  
Professor and Chairman of Department

A. de Vos, M.Sc. (Wisconsin), Ph.D. (Wisconsin)  
Professor (Psychology and Geography)

A. Diem, B.A. (Wayne State), M.A. (Clark),  
Ph.D. (Michigan)  
Professor

L. O. Gertler, B.A. (Queen's), M.A. (Toronto), Planning (McGill)  
Professor

D. K. Erb, B.Sc. (Western), M.A. (Toronto),  
Ph.D. (McGill)  
Associate Professor

J. T. Horton, B.A. (Wheaton), M.A. (Northwestern)  
Associate Professor and Associate Chairman of Department

R. M. Irving, B.A. (Toronto), M.A. (Toronto),  
Ph.D. (Minnesota)  
Associate Professor

R. A. Murdie, B.A. (Waterloo), M.A. (Chicago)  
Assistant Professor

E. R. Officer, B.A. (British Columbia), M.A. (Wisconsin)  
Assistant Professor

N. Pearson, B.A. (Dunelm)  
Assistant Professor

H. J. Stolle, Kart. Ing. (Berlin)  
Lecturer (Part-time)

Notes:
1. General Geography Course. Students majoring in Geography will be required to take Geography 100*, 101*, 220, 210*, 211* and may select additional courses from Geography 320, 330, 341 and 345 to complete their programmes. Students desiring a course in planning will be permitted to take Planning 340* and/or 341* as one of their options outside Geography. Only in exceptional cases will a student be considered for a fourth year make-up programme beyond the General Degree.

2. Honours Geography Course. The Honours 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 Planning 340* and/or 341*. The programme for each student must be arranged in consultation with the Department.

3. Honours Urban and Regional Planning Course. 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. Students in other disciplines, having taken Geography 101°-100° and desiring additional courses may select from Geography 320, 330, 341 and 345 and Planning 340° and/or 341°. Entrance to other courses requires consent of instructor.

7. Not all the courses listed below are offered each year. Students should consult the Department prior to registration.

8. Course numbers followed by an asterisk (eg. 101°) indicate a half-course.

9. 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.

A. Geography Courses

15°. Survey of Geography. This one term course presents a general review of the field of geography, its scope, approach, and basic concepts. The primary aim is to provide the student with background material, readings, 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 nature 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. (Given in spring term — normally this course will 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. (Given in fall term).

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 spring 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 occupancy and utilization of urban and rural land, and the effects of man's tools, techniques, and institutions on the earth's surface. 2 lectures, 2 hours 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.

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 term).

275*. Introductory Air Photo Interpretation. The technique of air photo interpretation as applied primarily in the field of geography and resources inventory. Interpretation of landforms, geological features, soils, natural vegetation, drainage patterns, and rural and urban land use. Prerequisite: Honours Geography or Planning students only. 3 hours laboratory, seminar and field work (Given in spring term — normally this course will follow 260*).

300*. Geomorphology. A study of landforms and their origins. Basic geomorphic 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 full term).

301*. Climatology and Meteorology. Advanced study of the elements of climate and weather. Analysis of world climatic and weather patterns. Effects of climate on man's activities and on the distribution of natural vegetation and soils. Weather forecasting. Applied climatology. Prerequisite: Honours Geography students, or consent of instructor. 2 lectures, 2 hours lab. (Given in spring term — normally this course will follow Geography 300*).

320. Regional Geography of Anglo-America. A study of the physical, cultural, economic and political geography of Canada and the United States.
Note: Geography 320 is designed particularly for students majoring in Geography (General Course) and for students in other disciplines.
3 lectures.

330. Cultural Geography. 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 330 is designed particularly for students majoring in Geography (General Course) and for students in other disciplines.
3 lectures.

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.
Prerequisite: Geography 100°-101°, or consent of instructor.
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.

3 lectures (Given in fall term).

375. Geographical Research Methods. The nature of geographical research; selected field research methods; student field projects; 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.

380. 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.

400. Advanced Geomorphology. Advanced Geomorphology. Advanced study of geomorphologic processes, morphometric analysis, and applied geomorphology. Specific problem areas will be subject to field and laboratory investigation.
Prerequisites: Geography 275°, 300° and Earth Sc. 130.
3 hours seminar and/or lab.
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401. Advanced Air Photo Interpretation. Basic photogrammetric principles including measurement, 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 275º, 300º and Earth Sc. 130.
3 hours seminar and/or lab.

Prerequisite: Geography 260º.
2 hours seminar and/or tutorial.

Prerequisite: Geography 375, or equivalent, and consent of instructor.
3 hours seminar and/or tutorial.

420-429. Geographic Analysis of Selected World Regions. Detailed study of physical, cultural, economic and political geography; geographic basis of current problems.
Prerequisite: Honours Geography students, or consent of instructor.
3 lectures.

420. Canada (offered in 1967-68).
421. Europe and the Mediterranean.
423. Middle East.
425. Africa.
427. Latin America.
428. United States of America.
429. Polar Lands.

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.
475a. 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.

490. Senior Honours Essay.
3 hours seminar.

491a. 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).

B. Planning Courses

156a. Introductory Urban and Regional Planning. Planning concepts and prin-
ciples; the nature, purpose, and scope of land-use planning; elements of econ-
omic 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.
Prerequisite: Honours Planning students, or consent of instructor.
2 lectures, 2 hours studio. (Given in spring term — normally this course will
follow Geography 101c).

255a. Land-Use Survey and Analysis. Methods of land-use mapping in urban
and rural area; development of land-use capability classification; land-use clas-
sification for special purposes; regional and national resource inventory; use
of census data, government documents, soils reports, engineering and trans-
portation studies; guidelines for preparing pre-planning reports.
Prerequisite: Honours Planning students only, or consent of instructor.
2 lectures, 2 hours studio. (Given in fall term).

256a. Principles of Environmental Design. Goals, objectives, standards of de-
sign; principles of aesthetics as applied to urban and regional planning;
architectural composition, civic and landscape design; the functional require-
ments 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 spring term — normally this course will follow Planning 255*).

340*. Urban, Regional and Resource Planning: A Survey of the Field (Part I). An overview of the urban and regional planning field; planning theories; different urban and regional planning frameworks.

Note: Planning 340* is designed particularly for students in disciplines other than Planning.
3 lectures. (Given in fall term).


Note: Planning 341* is designed particularly for students in disciplines other than Planning.
3 lectures. (Given in spring term — normally this course will follow Planning 340*).

357*. Conservation and Resource Development. History of the conservation movement; principles of conservation, management and development of resources. Prerequisite: Honours Planning and Geography students, or consent of instructor.
3 lectures. (Given in spring 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.

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

A. Geography Courses

600. Geomorphology. Advanced studies of geomorphologic processes with associated research. Geomorphology applied to resources survey, regional planning, and developmental studies.


602. Air Photo Interpretation. Advanced studies involving air photo interpretation, use of stereo-plotting instruments, mosaic construction, map production, and applied research.

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.

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
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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.


B. Planning Courses

603. Planning and Resource Survey Techniques.

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. Urban and Regional Planning. Advanced study and handling of projects and problems in actual situations reflecting contemporary practice; examination of methodology of planning and its principles.

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 and Chairman of the Department

E. Heier, B.A., M.A. (British Columbia), Ph.D. (Michigan)
Professor (Germ./Russ.)

H. Hennecke - - - Visiting Professor
H. Nicolai, Ph.D. (Leipzig) - - Visiting Professor
S. Hoefert, B.A., M.A., Ph.D. (Toronto) - Associate Professor (German)
W. Klaassen, B.A. (McMaster), B.D. (McMaster Divinity School), D.Phil. (Oxford) - Associate Professor (German) (Part-time)
I. Levitsky, A.B. (Rochester), M.A. (Buffalo), Ph.D. (Duke) Associate Professor (Germ./Russ.)
M. Richter, Staatsexamen (Berlin and Bonn), M.A. (Toronto) Assistant Professor (Germ./Russ.)
W. Shelest, Diploma (Munich), M.A. (Ottawa), Ph.D. (Munich) Assistant Professor (Russian)
M. A. Davies (Mrs.), B.A. (Washington), A.M. (Radcliffe) - Lecturer
H. Marsden (Mrs.), B.A. (Randolph-Macon), M.A. (Waterloo) - Lecturer
H. Panthel, B.A. (Waterloo), M.A. (Cincinnati) - Lecturer

A. Undergraduate Course Descriptions

Notes:

1. All courses with the exception of German 10 are one term (half) courses.

2. To obtain credit for a full course, students must follow up: 1-51 with 1-52; 51-52; 101 with 102; 251 with 252; 271 with 272; 351 with 352; 451 with 452. Any other two half (one term) courses constitute one full course.

3. German 271 plus 272 meets the requirement otherwise (see: The General Course; Honours Courses) referred to in the calendar as Culture and Civilization Courses.

4. 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. Scientific German. 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. 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. 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 the 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. Prerequisite: German 101.

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: First Class Honours in Grade 13 or German 1-52, 102.

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 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 “Blütezeit” 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, Hoffmannswaldau, Angelus Silesius, Opitz, etc.).
One term. 3 lectures.
Prerequisite: German 101 and 102.

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495-498. Reading Course in Approved Topics.
One term each. 3 lectures.
Open for fourth year students only.

Graduate Courses

600*. German Literary Criticism. Research techniques, source material, bibliography.
601*. Intellectual Foundations of German Classicism.
620*. Studies of a Modern Author.
621*. Recent German Literature.
630*. The German Novel.
631*. The German Novelle.
640*. Lessing.
641*. Schiller.
650*. Goethe.
651*. Kleist.
660*. The German Drama to 1889.
661*. Twentieth Century German Drama.
670*. Medieval German Literature.
671*. History of the German Language.
680*. Andreas Gryphius and his Time.
681*. Heine and Young Germany.
690*. Gothic.
691*. Old High German.
692*. The History of German Literary Criticism.
695-698. Reading Course in Approved Topics.

All the courses with the exception of the Thesis are one term courses.
Russian

Notes:

1. All courses with the exception of Russian 10 are one term (half) courses.

2. To obtain credit for a full course, 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. Any other two half (one term) courses constitute one full course.

3. Russian 271 plus 272 meets the requirement otherwise (see: The General Course; Honours Courses) referred to in the calendar as Culture and Civilization Courses.

4. Except for those numbered below 101, all the following courses are Honours courses, but are also open to students enrolled in General programmes.

10. Scientific Russian. 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. 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. One term. 3 lectures. Prerequisite: Russian 1-51 or equivalent. Permission of instructor.

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.

52. Intermediate Scientific Russian. Course description as in 51. One term. 3 lectures. Prerequisite: Russian 51 or equivalent. Permission of instructor.
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101. Second Year Russian. Reading in selected texts of major Russian authors. Oral practice, grammar review, composition. One term. 3 lectures. Prerequisite: open to all students.

102. Second Year Russian. Course description as in 101. One term. 3 lectures. Prerequisite: Russian 101 or permission of instructor.

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. One term. 3 lectures (mostly in Lang. Lab.) Prerequisite: First Class Honours in Grade 13 or Russian 1-52, 102.

252. Conversation, Composition, Grammar and Phonetics. As 251. One term. 3 lectures (mostly in Lang. Lab.) Prerequisite: Russian 251 or equivalent.

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. One term. 3 lectures. Prerequisite: Russian 102 or permission of instructor.

262. Introduction to Russian Literary Movements. As 261. One term. 3 lectures. Prerequisite: Russian 261.

271. Russian Thought and Culture. A study of the major thought movements and masterpieces of philosophy, literature, history, music, art, etc. up to 1861. This course is taught in English. One term. 3 lectures. Prerequisite: none.

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 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: Russian 252 or equivalent.

352. Intermediate Conversation and Composition. As 351. One term. 3 lectures. Prerequisite: Russian 351.
361. Russian Realism. (Aksakov, Gogol, Goncharov, Turgenev, Chernyshevsky, Ostrovsky) Reading, interpretation and critical analysis of prescribed prose and drama.
One term. 3 lectures.
Prerequisite: Russian 101 and 102.

362. Russian Realism. (Tolstoy, Leskov, Dostoevsky, Saltykov-Shchedrin, Chekhov) Reading, interpretation and critical analysis of prescribed prose and drama.
One term. 3 lectures.
Prerequisite: Russian 101 and 102.

371. The Golden Age of Russian Literature. Reading and interpretation of prescribed prose, drama and poetry from Lomonosov to Pushkin.
One term. 3 lectures.
Prerequisite: Russian 101 and 102.

372. The Golden Age of Russian Literature. Reading and interpretation of prescribed prose, drama and poetry from Pushkin to the 1860's.
One term. 3 lectures.
Prerequisite: Russian 101 and 102.

381. The Peoples of the Soviet Union. Especially emphasized will be the study of non-Slav peoples of the Caucasus and Central Asia; the peoples of 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.
One term. 3 lectures.
Prerequisite: none.

382. The Peoples of the Soviet Union. As 381.
One term. 3 lectures.
Prerequisite: Russian 381.

391. 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.
One term. 3 lectures.
Prerequisite: none.

392. The Image of Russia and the Russians in Western Thought and Writings. As 391.
One term. 3 lectures.
Prerequisite: none.

451. Advanced Conversation, Grammar and Composition. This course is conducted in Russian and provides intensive practice in spoken Russian on the advanced level.
One term. 3 lectures.
Prerequisite: Russian 352 or equivalent.
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452. Advanced Conversation, Grammar and Composition. As 451.
One term. 3 lectures.
Prerequisite: Russian 451.

461. Twentieth Century Russian Literature. (Gorky, Mayakovsky, Olesha, Kataev, Leonov, Zoshchenko) Reading, interpretation and critical analysis of prescribed prose and drama.
One term. 3 lectures.
Prerequisite: Russian 101, 102.

One term. 3 lectures.
Prerequisite: Russian 101, 102, and 461.

471. Russian Literature in Translation. From Pushkin to Dostoevsky.
One term. 3 lectures.
Prerequisite: At least one course in any other literature.

472. Russian Literature in Translation. From Chekhov to Pasternak.
One term. 3 lectures.
Prerequisite: At least one course in any other literature.

481. Russian Poetry. A study of themes and forms of representative authors of Classicism, Romantisism and Realism (Lomonosov, Derzhavin, Pushkin, Lermontov, Nekrasov, Fet, Tiutchev, etc.).
One term. 3 lectures.
Prerequisite: Russian 101 and 102.

482. Russian Poetry. A study of themes and forms of representative authors from Symbolism to the present (Blokh, Esenin, Mayakovksy, Akhmatova, etc.).
One term. 3 lectures.
Prerequisite: Russian 101 and 102.

495-498. Reading Course in Approved Topics.
One term each. 3 lectures.
Open for fourth year students only.

Graduate Courses

600*. Russian Literary Criticism. (Problems and Methods)

601*. Pushkin or Lermontov.

620. Old Church Slavonic.

621. History of the Russian Language.

630*. Tolstoy.

631*. Dostoevsky.

640*. The Russian Drama.

641-546. Reading Course in Approved Topics.

650*. Contemporary Soviet Literature.
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, Kotliarevsky, Franko, L. Ukraineka, Rylsky).
One term. 3 lectures.
Prerequisite: Admission by consent of the instructor.

202. Introduction to Ukrainian Literature. A critical survey of Ukrainian literature from Kotliarevsky to the present.
One term. 3 lectures.
Prerequisite: Admission by consent of the instructor.

301. Taras Shevchenko and his Age. 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.).
One term. 3 lectures.
Prerequisite: Admission by consent of the instructor.

302. Taras Shevchenko and his Age. 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).
One term. 3 lectures.
Prerequisite: Admission by consent of the instructor.
Department of History

P. G. Cornell, E.D., M.A., Ph.D. (Toronto)  
Professor and 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)  -  -  -  -  Professor R

M. T. Cherniavsky, M.A. (Oxon)  -  -  -  Assistant Professor

Ph.D. (Washington)  -  -  -  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

L. A. Juliuson, B.A. (Waterloo), M.A. (Toronto)  -  -  -  Assistant Professor

R. C. MacGillivray, B.A. (Queen’s), M.A., Ph.D. (Harvard)  Assistant Professor

E. P. Patterson, B.A. (Baylor), M.A. (Kansas),  
Ph.D. (Washington)  -  -  -  -  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. (Minneapolis)  -  -  -  Assistant Professor

T. H. Wilson, B.A., LL.B. (Toronto)  -  -  -  Assistant Professor

Z. Rosenberg (Miss), B.A. (New Brunswick), M.A. (Toronto),  
M.S.L. (St. Michaels)  -  -  -  -  Lecturer J

J. M. Wahl, C.R., B.A. (Western), M.A. (St. Louis)  -  Lecturer J

1. General Course. Students majoring in History will normally choose their courses from History 100, 201/202, 211/212, 221/222, 231/232, 301/302, 303/304, 311/312. They will fulfill the requirement History 349.

Students in the General Course in any field with a standing of at least B average in their previous year may, with the permission of the department, be admitted to any History course.

2. Honours Course. The Honours History programme recommended on page 34 is the standard prescription. The programme for each student must be arranged in consultation with the department.

A student in Honours in any discipline other than History can be admitted to any History course with the permission of the department.

3. Master of Arts. In History there are two programmes leading to the degree of Master of Arts.

In proceeding to the degree by courses alone the candidate will offer: (a) History 600, and (b) three other graduate courses selected in consultation with the staff. Subject to departmental approval, one of the courses may be selected from graduate courses in another department. The candidate will also be re-
required to have a reading knowledge of an appropriate second language.

In proceeding to the degree by courses and a thesis the candidate will offer:

(a) History 600, (b) a minor field (a second graduate course) and (c) a major
field (a thesis and a comprehensive examination in the period). The candidate
will also be required to have a reading knowledge of an appropriate second
language.

4. Not all the courses listed below are offered each year.

5. The number of hours or lectures shown after the course description is an
attempt to indicate the "normal"; each instructor determines how often his
particular class will meet.

Undergraduate Course Descriptions

100. An Historical Introduction to the Ideas of Western Civilization. Designed
especially for freshmen.
2 lectures, 1 hour discussion groups.

110. An Introduction to Historical Method. This course is designed to intro-
duce the gifted freshman student to the concepts, methods and materials of
historical study. One significant theme or limited historical period will be
dealt with in some depth.
3 hours, lectures and seminars.

201. Expansion of Europe since 1400 - The American Phase
3 hours

202. Expansion of Europe since 1400 - The Afro-Asian Phase. Surveys the
course of Portuguese, Spanish, Dutch and French colonial expansion as com-
pared to the historical development of British overseas institutions (1400 to
the 20th century).
3 hours

211. British History, 800 A.D. to 1714.
3 hours

212. British History, 1715 to the present.
3 hours

221. Modern European History: Central Europe from the Peace of West-
phalia to the Revolutions of 1848. Political, social and economic problems
will be stressed.
3 hours

222. Modern European History: Eastern Europe with an Emphasis on Rus-
sian History from the Seventeenth Century. Political, social and economic
problems will be stressed.
3 hours

236
231.* European History 1815-1867.
3 hours

232.* European History 1867 to World War I. Select problems in the political, industrial and cultural development of Western Europe.

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 hours

249.* Administrative Law. Discusses the issues raised by delegation of legislative and executive authority and the proliferation of administrative boards. 3 hours

250. History of Medieval Europe.
3 hours, lectures and seminars.

3 lectures

3 hours, lectures and seminars.

270. Asian History.
3 hours, lectures and seminars.

274.* Modern Russian History. The course will focus on selected themes in the development of the Russian state and society from the founding of the Romanov dynasty, with special emphasis on the 19th century and the Russian Revolution.
3 hours

276.* Modern German History. The course will cover in some depth selected topics during the period 1600 to 1850. (a) The Thirty Year's War; its causes and consequences. (b) The rise of Brandenburg-Prussia. (c) The Habsburg realm and Prussia in the early 19th century. (d) 1848 and its aftermath in Central Europe.

277. History of France.
3 hours, lectures and seminars.

280. History of French Canada.
3 hours, lectures and seminars.

3 hours, lectures and seminars.

3 hours
3 hours

296. * History of the United States since 1865. The growth of a new nation; the territorial and economic expansion of the United States from the Revolution to the Second World War; inter-relationship of economic, social, political, and intellectual developments.
3 hours

301. * Canadian History to 1867.
3 hours

302. * Canadian History since 1867.
3 hours

303. * American History to 1865.
3 hours

304. * American History since 1865.
3 hours

3 hours

3 hours

313 R. War and Revolution in Twentieth Century World History.
3 hours

321. * Medieval History 476-1100 A.D. A consideration of the main political, social, economic, and religious themes of the Medieval period.
3 hours

322. * Medieval History 1100-1500 A.D. 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

3 hours, lectures and seminars.

361. Modern British History to 1660.
3 hours, lectures and seminars.

362. Modern British History since 1660.
3 hours, lectures and seminars.

3 hours, lectures and seminars.
380. Canadian History.  
3 hours, lectures and seminars.

382. Regional Approach to Canadian History. The historical development of a selected region will be examined in relation to that of the rest of Canada and of neighbouring areas in the United States.  
3 hours, lectures and seminars.

450. History of the United States. Selected periods in the history of the United States of America (History 295/296, normally a prerequisite).  
2 hours

460. History of the Far East in the Nineteenth and Twentieth Centuries.  
3 hours, lectures and seminars.

463. Modern International History, Mainly since 1900.  
3 hours, lectures and seminars.

465. Historiography and the History of Historical Writing.  
3 hours, lectures and seminars.

470. Senior Tutorial in English History.  
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).
Graduate Courses

600. Historiography and the History 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.
620. Modern English History.
621. German History.
622. Medieval History.
623. French History.
624. Russian History.
691. Directed Studies in Special Topics.
Management and Systems Engineering Programme

D. E. Coates, B.A.Sc. (Toronto), M.S. (Illinois)

Assistant Professor and Chairman
(Mechanical Engineering and Management and Systems)

J. B. Ellis, B.A.Sc. (Toronto), D.I.C., M.Sc. (Imperial College, London),
Ph.D. (Michigan State) - - - - Associate Professor
(Electrical Engineering and Management and Systems)

P. T. FitzRoy, B.E. (Melbourne), M.S.I.E. (Purdue),
Ph.D. (Purdue) - - - - Assistant Professor

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.

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.

Students in the Management programme, or in any of the above fields, may select a major or minor field of methodology, functional operations such as production, marketing, etc., or in integrative activities such as corporate planning. 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 four units from the Management and Systems Engineering curriculum, two units from Mathematics, and two units from any Department. 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 Operations Research or 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. Full-time students will choose such a problem with the help of faculty. The candidate has, of course, full access to the Library, the computational and consultational facilities of the University and its faculty members, for the project.

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, and hence require a minimum of two terms (not necessarily consecutive) to complete the course requirements. The project requirement will probably but not necessarily extend beyond the course-study period. 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.

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).

Where it appears appropriate candidates may be admitted to the programme with the requirement that prerequisite courses be taken.

In view of the requirement for a project study, co-operative programme candidates must assure themselves of support from their employers, and the Management and Systems Engineering Committee will require some evidence that such support is forthcoming.

Application for admission should be made as early as possible on forms provided by the Office of the Registrar. Academic transcripts and other supporting documents should be forwarded to the Registrar as soon as they become available. It is preferred that at least one reference from an applicant's employer be submitted.

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 are not eligible for University financial support who are employed off-campus.

Course Descriptions

Undergraduate Course Descriptions

13. Management Science I. Applications of economic performance indices in choosing between engineering alternatives and choosing optimum operating levels. Topics: the planning process; generation and classification of cash flows; accounting concepts; methods for tangible evaluation of alternatives; capital resources and allocation principles; determination of minimum costs and maximum profit; elements of economic measurement, analysis, and forecasting; competition.
3 hours per week.
1 term.

2 hours.
1 term.

Graduate Course Descriptions

All 600-level courses carry 1 unit of graduate credit and are completed in one term unless otherwise noted.

Basic Methodology

600. Mathematical Foundations of Management Science I. A special review course in advanced calculus, numerical analysis, basic statistics, and computer programming to the level required for entry to the Management Science programme. Degree credit is not given for this course.
1 term.

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.
2 hours per week.
1 term.

618. 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. 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.
Management and Systems Engineering

652. Advanced Information Processing. The nature of a system; system elements and relationships; structuring a business system; management objectives, organizational concepts; the information system; integrated systems—a "personnel" case in depth; organizing a data processing centre; task force selection 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 organization, contracts, securities, marketing, and patents. Court administration and procedure. Information retrieval and O.R. applications in legal and legislative procedures.

Advanced Methodology

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.


Advanced Integrative Courses


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.

Research Activities in Management and Systems Engineering

I. Industrial Systems Engineering.
II. University Planning and Systems Studies.
III. Accident Occurrence and Prevention.
IV. Methodology in Quantitative Methods.
V. Socio-Economic Systems.
VI. Educational Development.
VII. Studies of Research and Development (as a process; as a sector of society).

VIII. People, machines, and organizations (human behavioural and mechanical factors in systems design, operation, evolution).
Faculty of Mathematics

Department of Applied Analysis and Computer Science

D. D. Cowan, B.A.Sc. (Toronto), Ph.D. (Waterloo)
Associate Professor and Chairman of the Department

J. Aczel, Ph.D. (Budapest), Habil. D.Sc. (Hung. Ac. of Science) Professor
S. Golab, Ph.D., D. Habil. (Krakow) Visiting Professor
J. W. Graham, M.A. (Toronto) Professor and Director of Computing Centre
H. Harnik, 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) Associate Professor (Psychology and Mathematics)

Department of Applied Mathematics

P. J. Ponzo, M.A. (Toronto), Ph.D. (Illinois) Associate Professor and Chairman of the Department

H. F. Davis, Ph.D. (Massachusetts Institute of Technology) Professor
K. Maruhn, Ph.D. (Leipzig), D. Habil. (Berlin) Visiting 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

Department of Combinatorics and Optimization

G. Berman, Ph.D. (Toronto) Professor and Chairman of the Department
C. A. B. Smith, Ph.D. (Cambridge) Visiting Professor
W. T. Tutte, Ph.D. (Cambridge) Professor
R. C. Mullin, B.A. (Western), Ph.D. (Waterloo) Associate Professor
J. W. Dodd, B.A.Sc. (Toronto), M.Sc. (Waterloo) Lecturer
G. B. Faulkner, B.Sc. (Toronto), M.Sc. Waterloo) Lecturer
R. A. Honsberger, B.A. (Toronto) Lecturer
E. Koch, M.A. (Waterloo) Lecturer
P. J. Schellenberg, M.A. (Waterloo) - - - - Lecturer
H. I. McIntosh, B.A. (Toronto), F.S.A. (American Society of Actuaries) - - - - Adjunct Professor
G. N. Robertson, M.A. (Manitoba) - - - - Lecturer (part-time)

Department of Pure Mathematics

D. G. Wertheim, B.A. (McMaster), Ph.D. (Toronto)
Professor and Chairman of the Department

G. E. Cross, M.A. (Dalhousie), Ph.D. (British Columbia) - Professor
K. D. Fryer, B.A. (Western), Ph.D. (Toronto) - Professor
and Associate Dean of the Faculty of Mathematics

L. J. Mordell, M.Sc., M.A. (St. John’s College, Cambridge), F.R.S. (London) - Visiting Professor

H. H. Crapo, A.B. (Michigan), Ph.D. (Massachusetts Institute of Technology) - Associate Professor
P. de Witte, Ph.D. (Brussels), Logic & Foundations - Associate Professor
A. Kerr-Lawson, B.A. (Toronto), S.M. (Chicago), Ph.D. (McMaster) - 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
E. R. Bishop, B.Sc. (Acadia), M.Sc. (Queen’s) - Assistant Professor
D. Higgs, B.Sc. Hou. (Rand), M.A. (Cantab.) - Assistant Professor
P. Hoffman, B.A. (Toronto), Ph.D. (Manchester) - Assistant Professor
D. J. Miller, B.Sc. (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
J. Wilkinson, Ph.D. (California Institute of Technology) - Assistant Professor
S. Aczel (Mrs.), M.A. (Szeged) - Assistant Professor (part-time)
J. Malzan, M.A. (Toronto) - - - - - - Lecturer
J. P. McClure, M.Sc. (Waterloo) - - - - - - Lecturer
B. S. Thomson, B.Sc. (Toronto), M.Sc. (Waterloo) - - - - Lecturer
J. K. Vranch, M.Sc. (Waterloo) - - - - - - Lecturer

Department of Statistics

D. A. Sprott, Ph.D. (Toronto) Professor and Chairman of the Department and Dean of the Faculty of Mathematics
W. F. Forbes, D.I.C., Ph.D., D.Sc. (London) Professor (Chemistry and Mathematics)
J. S. Minas, B.A. (Wayne), Ph.D. (Illinois) Professor (Philosophy and Mathematics)
G. W. Bennett, Ph.D. (Adelaide) - - - - - - Associate Professor
M. D. Vogel-Sprott, B.A. (McMaster), Ph.D. (Toronto) Associate Professor (Psychology and Mathematics)
Undergraduate Course Descriptions

Note: The number of hours or lectures shown after the course description is an attempt to indicate the "normal"; each instructor determines how often his particular class will meet.

12. Calculus I. Functions and limits, the derivative. Differentiation formulae. Applications to tangents, rates, extremes. The indefinite and definite integrals, fundamental theorem of integral calculus. Applications to area, volume, centroids, moments of inertia, fluid pressure, work, potential. Introduction to the trigonometric, inverse trigonometric, exponential, logarithmic functions. Transcendental functions. Parametric and polar equations. Formal integration and applications to physical problems. Students will work selected problems under supervision. A certain proportion of the problems will include mathematical formulation of physical problems.
3 lectures, 2 hours problems.

2 lectures, 1 hour problems.

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.

33. **Differential Calculus.** Real numbers, sequences, limits, continuity. The derivative. General Theorem of Mean Value. Functions of several variables. Implicit functions, Jacobians. Power series with complex terms, the Taylor series for functions of several variables, constrained extrema. The elementary functions for a complex variable.
Prerequisites: Math 22, 31.
3 lectures, one term.

Prerequisites: Math 21, 31.
3 lectures, one term.

3 lectures, one term.

42. **Vector Methods.** Scalar and vector products; curl, divergence, and gradient. Use of vectors and matrices in discussion of physical problems in mechanics, fluid flow, and electromagnetism. Introduction to tensors.
Prerequisites: Math 22, 31, and consent of instructor.
2 lectures, 1 hour problems, one term.

44. **Complex Variable.** Cauchy-Riemann equations, the Cauchy integral theorems, conformal mapping, the Taylor and Laurent series, contour integration.
2 lectures, 1 hour problems, one term.

45. **Applied Analysis II.** A continuation of some topics listed in Math. 41, complex variables, calculus of variations.
2 lectures, one term.

Prerequisite: Math 22.
2 lectures, 3 hours problems, one term.

52. **Mathematical Probability.** Probability distributions, recurrent events,
stochastic processes, with applications to Brownian movement, diffusion, and noise.
3 lectures, one term.

Prerequisites: Math 22, 31, and consent of instructor.
2 lectures, 1 hour problems, one term.

Prerequisites: Math 22, 31, and consent of instructor.
2 lectures, 1 hour problems, one term.

Prerequisite: Math 32.
3 lectures, one term.

Prerequisite: Math 21.
3 lectures, one term.

3 lectures.

100. Fundamental Concepts of Mathematics. A terminal course designed for Arts students who wish to learn something of the fundamental ideas of mathematics but who will not be encountering technical problems of application. The course will include discussion of the fundamental concepts involved in a selection of topics chosen from mathematical areas such as Calculus, Statistics, Probability, Projective Geometry, Non-Euclidean Geometry, Set Theory, Group Theory, Field Theory, Boolean Algebra, Mathematical Logic, Vector Spaces, Matrices, Numerical Analysis.
3 lectures.
3 lectures.

2 lectures, one hour problems.

1 lecture, 2 hours problems.

140. Calculus. The topics of Mathematics 130, presented with a view to the special needs of Social Science students. Emphasis will be on basic concepts rather than on the more difficult manipulative techniques.
3 lectures.

3 lectures.

2 lectures.

3 lectures.

2 lectures, 1 hour problems.

2 lectures.


243. **Statistics for the Social Sciences.** The topics of Mathematics 233 presented with a view to the special needs of Social Science students. Emphasis will be on basic concepts rather than on the more difficult manipulative techniques. Prerequisite: Mathematics 140 or equivalent. 3 lectures.

253. **Concepts of Statistics.** The topics of Mathematics 243 treated without the use of Calculus. In addition to the basic statistical methods, emphasis will be placed on the nature of evidence and inference. 3 lectures.


331. **Abstract Algebra II.** Vectors and vector spaces; transformations and matrices; quadratic and Hermitian forms. Algebraic structures, rings and ideals. Matrices with entries from a ring. Canonical forms and eigenvalues; the orthogonal group. 2 lectures.


335. Finite Differences. A theoretical course in the calculus of finite differences to include summation, the differences of zero, numerical integration, the relation between integration and summation. An introduction to difference equations. 2 lectures.

336. Life Contingencies. An advanced course on problems of single lives and on the death and survival of multiple lives. 3 lectures.


425. Introduction to the Theory of Numbers. 2 lectures.

427. **Graph Theory.** Introduction to basic concepts and theorems, connectivity, planarity, arboricity, directed graphs, partial orderings, girth and regularity, the four-colour problem.
2 lectures.

428. **Lattice Theory.** Ordered sets, lattices, Galois connections. Special attention is given to geometric lattices (matroid theory).
Prerequisite: Mathematics 230.
2 lectures, one term.

Prerequisite: Mathematics 230.
2 lectures, one term.

2 lectures.

431. **Algebra III.** A continuation of course 331.
2 lectures.

2 lectures.

433. **Metric Spaces and Integration.** Theory of metric spaces, completeness and compactness, measure in Euclidean n-space, the Lebesgue integral, convergence theorems, the Fubini theorem, differentiability, absolute continuity. A study of Banach spaces.
2 lectures.

2 lectures, 1 hour problems.

435. **Laboratory.** Numerical problems arising in actuarial science and statistics.
2 hours laboratory.

436. **Mathematical Logic.** An informal introduction to the logic of sentences and predicates, with emphasis on analogies with familiar mathematical structures. Syllogisms and the algebra of sets related to predicate logic. Simplification, logical deduction, duality, consistency and completeness. The concepts of constant, variable, function, and set. Axiomatics.
2 lectures.
437. Graduation and Morality. Methods of constructing and graduating mortality tables. 2 lectures.


440. Advanced Probability. Recurrent events. Markov processes and applications to Physics and Biology, including diffusion processes and epidemics. 2 lectures.


443. Electromagnetism II. Applications of the Maxwell equations. Reflection and refraction. Introduction to wave guides and antennae. 2 lectures.


446. History of Mathematics. The development of Mathematics from ancient to modern times, including study of prominent mathematicians and their works. Problems will be worked using both modern and historical approaches. 2 lectures.

447. Statistical Mechanics. Applications of probability theory to theoretical Physics. 2 lectures.


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Faculty of Mathematics

2 lectures.

2 lectures.

**Graduate and Research Programmes**


The University of Waterloo's computing facilities presently include four computer systems, namely, IBM 1620, IBM 1710, IBM 7040 and IBM SYSTEMS/360 MODEL 40. The Department of Electrical Engineering operates an analogue computer in conjunction with the 1710 to give a hybrid system.

The IBM 1620 computer is available to undergraduate students at all times. The IBM 1710 is used by undergraduates, graduates, faculty and staff according to schedules made up one week in advance. Both the 7040 and the Systems/360 are run on a closed shop basis, but all members of the University can get programmes processed within a reasonably short time.

Systems planned for the future include an IBM System/360, Model 44, and, at a later date, an even more powerful Systems/360 Computer.

Extensive opportunities for fellowship assistance are available through National Research Council Fellowships and Province of Ontario Graduate Fellowships. In addition, the Faculty of Mathematics offers a number of Teaching Fellowships which may be held singly, or in conjunction with other Fellowships. For details, correspondence should be addressed to the Department Chairman.

Candidates for the degrees of M. 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.

**PURE MATHEMATICS:** Current research in pure mathematics includes studies in functional equations for analytic functions, categories of incidence geometries, theory of integration and measure, the enumeration of planar maps, matrix-like representations of infinite groups, homotopy theory, contact manifolds, theory of generalized decompositions of groups, logic and foundations of set-theory, and general functional equations.

Functional equations — that is, roughly speaking, the theory of determining
functions from elementary equations containing them — is a field of mathematics looking back into a history of more than two centuries. The somewhat general theory of which has been developed however only in the last two decades and it has applications in and is connected with such modern disciplines as the theory of information, mathematical psychology and universal algebra.

At the University of Waterloo we work on these problems, on general methods and uniqueness theorems, and also on applications to and relations with differential geometry, homological algebra, functional analysis, theories of continuous groups of nets and of complex functions, etc.

COMPUTER SCIENCE: Research in compiler construction has produced the WATFOR fast FORTRAN IV compiler, completed in 1965 and currently used by over seventy 7040-7044 computing centres throughout the world. Research and development work on similar compilers for the 360 series machines is progressing well.

A graphic display unit will permit research in new techniques in computer-aided design, computer graphics, graphic programming and simulation. Also, a process control computer is currently used to perform and analyze complex experiments, some of which would be difficult to handle by conventional methods.

In numerical analysis, algorithms for two-point boundary problems, stiff systems of differential equations, unilateral matrix equations and optimization problems are under investigation.

In addition, many computer-oriented research projects by faculty and graduate students in science, engineering and the humanities are pursued with the assistance of the Computer Science department. It is this wide variety of problems which makes the department environment so stimulating to faculty and students alike.

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.

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.


Graduate Course Descriptions


601. A series of courses in Numerical Analysis.
(a) Introduction to Numerical Analysis
   1 term.
(b) Solution of Ordinary Differential Equations
   1 term.
(c) Constructive Theory of Functions (Approximation Theory)
   1 term.
(d) Numerical Methods in Linear Algebra
   1 term.
(e) Solution of Partial Differential Equations
   1 term.
(f) Problems in Numerical Integration
   1 term.


604. Special Functions. Elliptic functions. The hypergeometric function. The gamma and beta functions. The functions of Laplace, Legendre, Lamé, Mathieu,
and Bessel. Orthogonal functions; the functions of Laguerre, Hermite, Chebyshev.

605. Groups and Matrices.

611. A series of courses in Probability.
(a) Introduction to Random Variables. Probability, random variables, distribution functions, expectation, discrete transform methods. 1 term.
(b) Theory of Probability. Measures on a sample space, types of convergence, limit theorems, laws of large numbers. 1 term.
(c) Stochastic Processes I. Discrete space — discrete time processes. Discrete space — continuous time processes. Applications in Physics, Biology, Queuing Theory, etc. 1 term.
(d) Stochastic Processes II. Mathematical foundations of stochastic processes, continuous space processes. Time-series analysis.
(e) Special Topics in Probability. 1 term.

614. Integral Equations.

615. Group Characters and Representation Theory.

617. A series of courses in the Application of Analysis.
(a) Integral Transforms 1 term.
(b) Complex Variable Techniques 1 term.
(c) Fourier Series and Orthogonal Functions 1 term.
(d) Group Theory in Physical Problems 1 term.


(a) The Theory and Construction of Compilers. Some theoretical aspects of mechanical language translation with references to compilers and compiling techniques both past and present, including general compiler organization, statement decomposition, syntax analysis, code optimization and compiler compilation. One term.
(b) Computer Systems. A discussion of the hardware and software required in a computer system. Including overlapped channels, interrupt facilities, memory protection, buffers, input-output control systems, macro-programming, multi-processing, dynamic memory allocation, time-sharing. One term.
621. **Computer Programming.** General concepts of computer types, the stored program, computers with different addressing schemes. Machine language and assembly language coding. Input and output devices and their uses. Number representations. Number systems. Automatic programming and universal computer languages, the recursive definition of a programming language, the design of compilers for algebraic languages, the use of algebraic languages (FORTRAN and ALGOL) in matrix and other calculations in numerical analysis, other special purpose languages for mathematical calculations, list processing, inductive inference. Mathematical theory of automata.


624. **Advanced Statistics.**

625. **Galois Theory.**

626. **Data Processing For Behavioral Scientists.** This course is intended for behavioral scientists who wish to use computers in their research. Introduction to computer systems and their components. Algorithms and flow charts. Programming in a procedure oriented language (Fortran IV) and machine and assembly languages. An application of computers to areas in behavioral science including statistical analysis, linear programming, simulation and file processing.


632. **Topics in Variational Theory.**

634. **Topics in Ordinary Differential Equations.**

635. **Algebraic Numbers.**

638. **Functional Equations for Analytic Functions.**

639. **Functional Equations.**

640. **Seminar on Functional Equations.**

641. **Mathematical Methods for Operations Research.** A selection of topics with emphasis on mathematical techniques having direct application to business, industrial, military, and scientific problems.

(a) **Special Methods.** Algebra of probability distributions; Monte Carlo Methods; application to queuing theory, replacement theory and inventory control.

(b) **Linear Programming.** Simplex method; flows in networks; application to transportation problem, assignment problem and project cost curves.

(c) **Competitive Models.** Game theory; gaming; decision theory.

(d) **Model Analysis.** Partially ordered models; stochastic models; general models; general model logic; examples from business, industry and the military, including PERT* CPM, and the Leontiev model; construction of models,
simulation, optimization, computational methods.

642. Optimization Techniques.

(a) Analytic Methods. Review of classical methods; optimization of discrete functions; convex functions.

(b) Sequential Optimization. Methods including Fibonacci search, steepest descent, conjugate gradients and successive approximations; application to the solution of equations, curve fitting, likelihood estimates.

(c) Programming. Non-linear programming; stochastic programming; linear integer programming; dynamic programming; applications, including optimal digital control.

643. Literature and Research Studies in Operations Research and Optimization. Prerequisite: 641, 642 or equivalent.

644. Mathematical Genetics.

645. Rings and Ideals.

646. Topics in the History of Mathematics.

649. Functional Analysis.


651. Seminar on Matroid Theory. 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.

652. Topics in Differential Geometry.

653. Differentiable Manifolds. Manifolds, tangent bundles, differential forms, deRham cohomology, deRham's theorems. Whitney's embedding theorem, existence of differentiable structures, obstructions to differentiable structures, characteristic classes, almost-complete manifolds.


(a) Partial Differential Equations. 1 term.

(b) Hyperbolic Partial Differential Equations. 1 term.

(c) Elliptic Partial Differential Equations. 1 term.

(d) Parabolic Partial Differential Equations. 1 term.
655. Combinatorial Analysis.
656. Seminar in Mathematics Education.
659. Linear Operators.
660. Theory of Nets and Quasigroups.
663. Mathematical Logic.
665. Topics in Number Theory.
666. Universal Algebra.
667. Extrema in Graphs.
668. Seminar in Number Theory.
669. Harmonic Analysis.
670. Seminar in Graph Theory.
672. Statistical Information Theory.
673. Transfinite Arithmetic.
674. Statistical Decision Theory.
675. Linear Graphs. Definitions and basic theorems. Planar graphs and Kuratowski’s theorem. Selected topics from advanced graph theory.
676. Analytic Graph Theory.
677. Measurement of Information.
678. Potential Theory.
679. Abstract Measure Theory.
680. Infinite Groups.
682. Topics in the Calculus of Variations.
684. Topics in Decision Theory.
685. Topics in Graph Theory.
688. Special Topics in Algebra.
695. Lie Groups.
697. Thesis (M. Phil.)
698. Special Topics in Analysis.
699. Thesis (Ph.D.)
Department of Mechanical Engineering

G. T. Csanady, Dipl. Ing. (Munich), Ph.D. (New South Wales)

Professor and Chairman of the Department

S. A. Alpay, Dipl. Ing., Dr. Ing. (Berlin) - - - Professor
T. A. Raszutowski, B.A.Sc. (Toronto), A.M., Ph.D.
(Princeton) - - - - - 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)

Professor and Associate Dean of the Faculty of Engineering

G. F. Pearce, B.A.Sc. (British Columbia), M.A.Sc. (Toronto)

Professor and 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
A. A. Bruneau, B.A.Sc. (Toronto), D.I.C., Ph.D.
(London) - - - - - Associate Professor
D. J. Burns, B.Sc., Ph.D. (Bristol) - - Associate Professor
D. E. Coates, B.A.Sc. (Toronto), M.S. (Illinois) - 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.), Engineer
(Stanford) - - - - - Associate Professor
K. R. Piekarski, Dipl. Ing. (London) - Associate Professor (on leave of absence 1956-67)
R. F. Scrutton, B.Sc., M.Sc. (Melbourne) - Associate Professor
G. M. Bragg, B.A.Sc. (Toronto), Ph.D. (Cambridge) - Assistant Professor
A. M. Hale, B.Sc., M.A. (New Brunswick), B.A.Sc. (Toronto),
M.A.Sc. (Waterloo) - - - Assistant Professor
P. Niessen, B.Sc. (McMaster), M.A.Sc., Ph.D.
(Toronto) - - - - - Assistant Professor
P. T. FitzRoy, B.E. (Melbourne), M.S.I.E., Ph.D.
(Purdue) - - - - - Assistant Professor
A. Plumtree, B.Sc., Ph.D. (Nottingham) - - Assistant Professor
C. J. Beingessner, 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. Kuwalski, B.Sc. (Glasgow), M.S. (Stevens Institute) - - Lecturer
T. A. Ledwell, B.Eng., M.Eng. (Nova Scotia) - - Lecturer
W. K. Luk, D.I.C. (Imperial College, London), Dipl. of Hong Kong
Tech. College) - - - - - 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
Undergraduate Programmes

Details of the undergraduate programme in Mechanical Engineering are to be found on page 72. All courses extend over one semester only.

Undergraduate Course Descriptions

13. **Kinematics.** A basic course in kinematics emphasizing the creative approach. Uniform rotary motion including rolling cylinders, gears and the synthesis of gear trains including planetaries. Non-uniform motion including cams, gears and linkages. Programming non-uniform motion and the synthesis of cam mechanisms, non-circular gear trains and linkages.

3 lectures, 3 hours laboratory.

21. **Mechanics of Machinery.** The effects of dynamic forces in machines; introduction to mechanical vibrations. Transient forces. Static force analysis, dynamic force analysis, balancing, cam dynamics, dynamics of feedback systems.

Prerequisite: ME 13.

2 lectures, 3 hours laboratory.

22. **Mechanical Design I:** Analysis and synthesis of machine elements. Factors affecting working stresses, fatigue, creep and impact considerations. Design of shafting, springs, screws, clutches, brakes and gears.

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.

3 lectures.

24. **Advanced Dynamics.** A second course in engineering dynamics. Topics: rocket and space dynamics, inertia tensor and Euler's Equations, energy methods, gyroscopic motion, generalized co-ordinates and Lagrange Equations, vibrations.

3 lectures, one term.

Prerequisite: GE 42.


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.

2 lectures.


2 lectures.


35. **Introduction to Nuclear Engineering.** An introductory course in nuclear reactions and their engineering applications, including neutron/fission chain reactors, and nuclear radiation uses. Topics covered will include kinds and characteristics of nuclear reactions and radiations, principles of fission and decay chain reactions, elementary nuclear reactor design, radiation detection, effects of radiation, hazards and shielding.

Prerequisite: Physics 15 or equivalent, at least 3B standing.

3 hours lecture per week, 2 hours laboratory every second week.

37. **Ceramics.** The crystallography of ionic and co-valent compounds. A study of the mechanical properties of single crystals and polycrystals. Properties of special ceramic materials.

3 lectures.

38. **Materials in Nuclear Technology.** Mechanical and physical requirements of materials used as fuels, moderators, shields and structural components in reactors. Special problems related to corrosion, radiation damage and high temperatures. Materials selection. Radioactive waste disposal.

2 lectures.


43. **Manufacturing Science IV.** Moulding from the liquid state. Review of applicable heat transfer and fluid flow theory. Influence of time in casting. Solidification time, freezing waves and riser design. Pouring time, fluidity,
gating and running. Hot tears, distortion, shrinkage and residual stresses. Die casting: thermal balance, thermal stability, pressure pulse effects. Other casting methods.

Prerequisite: ME 53, GE 32.


49. Metrology. Theory and practice of high precision mechanical measurements under strict control conditions — super micrometry; measurements by comparators; profilometry; surface profilography; environmental effects on measurements accuracy; theodolite techniques in the measurements of large structures; collimator applications in machine installation; photography as a mensuration tool for moving (dynamics) conditions, stroboscopic measurements for frequency drift in rotating machinery.


3 lectures, 3 hours laboratory, alternative weeks.

54. Thermodynamics II. Review of the basic concepts and postulates of thermodynamics and the conditions for equilibrium. Reactive systems. An introduction to irreversible thermodynamics. Applications to selected engineering systems including direct conversion devices, gas turbines, other heat engines.

Prerequisite: GE 31.

2 lectures, 3 hours laboratory.


Prerequisite: GE 31.

3 lectures.
Prerequisite: ME 53.
3 lectures.

60. **Fluid Control Systems I.** Theory of fluid power and fluid process control. 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. Energy transducers in fluid control systems: performance characteristics of various types of pump and fluid motor units and actuators.
3 lectures.

62. **Fluid Dynamics. Ideal Fluids:** Equations of motion of non-viscous fluid; sample solutions of two and three-dimensional problems; Fourier analysis; conformal mapping in two-dimensional flow; shortcomings of ideal fluid models. **Real Fluids:** viscosity, the Navier-Stokes equations, flows at low Reynolds number; laminar boundary layers; short introduction to turbulent flow.
3 lectures.

63. **Turbomachines I.** Performance characteristics, laws of modelling, classification and selection of turbomachines. Cavitation, suction specific speed. Reynolds number and Mach number effects, small stage efficiency. Dynamic analysis of the energy transfer in the turbomachine, application to the principal types of pumps, compressors and turbines. Cascade mechanics.
3 lectures.

3 lectures.

3 lectures.

81. **Seminar.** Designed to give the student personal experience in oral presentation of technical information. Also provides an opportunity for students to attend seminars on topics of interest presented by recognized workers in the
Department of Mechanical Engineering

field.
1 hour.

82. Mechanical Engineering Projects. Engineering assignments requiring the student to demonstrate initiative and assume responsibility. Student activity is guided and co-ordinated by faculty supervisor. In selecting and assigning projects, particular account is taken of the student's field of specialization. Projects, in general, involve technical disciplines beyond the strictly mechanical engineering field.
9 hours laboratory.

90. Nuclear Engineering I. Engineering problems arising from utilization of nuclear reactions. Topics covered include multi-group diffusion theory, kinetics and stability, heat removal and materials problems in nuclear power reactors, direct conversion of nuclear energy to electricity, accelerator design and shielding, and process applications of nuclear radiations.
Prerequisite: Math 55 or equivalent; ME 35 or equivalent and 4B standing.
Two hours lecture per week, 2 hours laboratory every second week.

Graduate and Research Programmes
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 usually appointed from outside the university, another one from outside the department (often from Mathematics or Physics.)

Comprehensive Examination: A comprehensive examination is normally held approximately 12 months after the candidate has embarked on his Ph.D. programme. It is an oral examination administered by the supervising committee, except that the external assessor may be replaced by a member of the university faculty. On the basis of the examination, the committee decides whether:

a) The scholarly competence of the candidate in his chosen field of specialization and in closely related fields is adequate,

b) The candidate should be instructed through his supervisor to extend his reading of specified fields or even to take further specific courses,

c) The candidate is so lacking in competence in his chosen field that his registration as a Ph.D. candidate should be terminated.

Language Requirements: The candidate must have an adequate knowledge of
at least one foreign language as specified by the department. This requirement may be fulfilled either by direct language examination or by the completion of an approved language course with a final grade considered to be satisfactory. When the native tongue of a student is not English, its knowledge is not normally acceptable as satisfying the foreign language requirements, except when the native tongue is French, German or Russian.

Examination of the Thesis: Upon completion of the research the candidate is required to submit four typed copies of the final draft of his thesis to the supervising committee. The thesis is read by each of the members of the Committee. One copy of the four is filed with the Graduate Studies Office for three weeks and is available for all members of the faculty of the University to review. Recommendations of the readers of the thesis may be in one of four categories:

a) Acceptance as submitted.

b) Acceptance with minor modifications as noted.

c) Conditional acceptance with major modifications usually requiring a re-submission.

d) Complete rejection.

Public Presentation: The candidate is required to give a public presentation of his thesis before a colloquium held by his major department. This public delivery will be well advertised in advance throughout the University and possibly at neighbouring institutions. Although this is not construed as an examination, an adequate time is allowed for questions from the floor.

**Graduate Course Descriptions**

*(All one semester courses)*


**622. Evaluation of Mechanical Systems and Design.** The testing and evaluation of mechanical systems. Product characteristics, reliability and long-life design. Hazards and safety considerations. Shock and vibration, environmental testing. Value engineering.


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.

637. Phase Transformations. Phase diagrams, homogeneous and heterogeneous, nucleation, diffusion, phase changes in metals and alloys. Diffusional growth processes, diffusional and shear transformations. 3 hours.

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. 3 hours.

639. 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. 3 hours.

640. Thermodynamics of Solids. This course will deal with the atomistic and thermodynamic interpretation of the fundamental properties of solids such as diffusion, solidification, surface properties and equilibrium in multicomponent systems.


Department of Mechanical Engineering

effects. Mechanical properties of special single crystal polycrystals and polyphase materials.


645. Machinery of Manufacture - Design and Utilization. Modular design vs. composite design; multiple purpose design vs. special function design; tooling design as a parameter in machine tool design; machine tool efficiency analysis by percentage time of cutter contact; effect of climb compensation on tooling costs; three dimensional development by selective etching and tape control. Discussions of actual problems in machine tool applications in Canadian industry.


3 lectures.

Prerequisites: ME 53, GE 32.


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662. Viscous Laminar Flows. Survey of experimental results. Equations of motions in tensor form; Navier-Stokes equations; some exact solutions of Navier-Stokes equations in steady and unsteady flows; limiting cases of small and large Reynolds numbers; two-dimensional boundary layers, exact and approximate solutions; three-dimensional axisymmetric boundary layers; boundary layer control, free jets.


664. Theory of Turbulence. Instability of laminar flows and transition to turbulence; stochastic properties of turbulent flows; measurement methods; homogeneous turbulence models; theories of local isotropy; structure of turbulence in shear flows.


672. Turbulent Boundary Layers with Heat Transfer. The velocity boundary layer. Velocity profile from a Couette flow analysis. Reasons for preferring the power law and the logarithmic law to express universal velocity profile. Local and mean drag laws for pipe flows and for boundary layers.


690. Nuclear Engineering II. Advanced topics in nuclear reactor design and analysis: elementary transport theory applications in core design and shielding, coupled nuclear/thermal systems kinetics, fuel and poison management optimisation.

Prerequisite: consent of instructor.

2 hours lecture per week.

698. Specially Directed Studies. Directed study of a special topic of interest to an individual student or group of students. May consist of a series of lectures, assigned reading, and a report.


Active Research Projects

Fluid Mechanics. Studies of non-viscous and viscous fluid mechanics; Incompressible and compressible flows; Heat and mass transfer in problems of forced and free convection; Wave phenomena in fluids; Surface and internal waves in the Great Lakes; Fluid power control systems; Fluid mechanics of turbo-machinery components; secondary flow in impeller passages, flow in annuli and annular diffusers, radial flow with swirl; Problems of Cavitation. Fluid flow studies by photoelastic methods.

Mechanics of Turbulent Flows. Stability of laminar flows and its effects on
transition to a turbulent regime; Turbulent diffusion and its application to studies of diffusion in the atmosphere and in the Great Lakes; Free turbulence in jets, wakes, and plumes; Air pollution; Aerodynamic Noise; Mechanics governing turbulent flow near rigid and flexible surfaces; Turbulent boundary layers with heat and mass transfer; Advanced topics in turbulence.

Materials. Theoretical and experimental studies of dislocations in both single and polycrystalline solids; Physical and mechanical behaviour of materials in reactive environments; Investigation of internal stresses in plastically-deformed solids; The design and properties of composite materials; Microstructural aspects of fatigue; Atomistic growth processes occurring on solidification of metals; Mechanical properties of bones. Hysteretic damping of materials.

Nuclear Engineering. Economics of reactor operation using digital computer models; Heat removal, experimental studies; Fuel and structural materials, experimental and theoretical studies.

Combustion and Heat Transfer from Flames. Combustion of liquid fuels above the critical pressure; Heat transfer from metal-powder flames; Electrical properties of metal-powder flames; Flame spread in fires; Ignition and combustion of solid propellants; Combustion instability of solid propellants.

Manufacturing Science. Plasticity applied to forming processes; Instability problems and limiting conditions in forming operations; Bulging, deep drawing, strip buckling in cold rolling; Electromagnetic forming.
For further details the faculty research brochure may be consulted.

Music

100. Music of the 18th, 19th, and 20th Centuries and its relationship to the Arts.
Prerequisite: Gr. XIII Music or the equivalent, and consent of the instructor.
3 lectures.

110. History of Music. A critical survey of the history of music from the Greek period to the present: Special emphasis will be given to basic rudiments, form and style.
3 lectures.

310. Music and Literature. A study of music that is either inspired by, or makes use of literary texts, or serves as incidental music to drama. Special emphasis will be placed on music related to Greek Drama, the Bible, and German literature of the Romantic period, but also included will be music related to Spanish, English, French, Russian and Chinese writings.
3 lectures.

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Department of Philosophy

J. S. Minas, B.A. (Wayne), Ph.D. (Illinois)

Professor and Chairman of Department.

Dean of Graduate Studies:

L. L. Haworth, B.A. (Rollins), M.A., Ph.D. (Illinois)

Professor

Z. Adamczewski, B.A. (London), M.A. (Columbia), Ph.D.

( Harvard)

- - -

Professor

R. J. Butler, B.A., M.A. (New Zealand)

- - -

Professor

R. H. Walters, B.A., Dip.Ed., M.A. (Bristol), B.Phil. (Oxford),

Ph.D. (Stanford), F.B.Ps.S. - Professor (Psychology and Philosophy)

L. Armour, B.A. (British Columbia), Ph.D. (London) - Associate Professor and Deputy Chairman

R. J. C. Burgener, M.A., Ph.D. (Toronto)

- -

Associate Professor

R. A. George, M.A., Ph.D. (Michigan State)

- -

Associate Professor


Associate Professor

D. D. Roberts, B.A. (Roosevelt), M.A., Ph.D. (Illinois)

Associate Professor

P. Seligman, B.A., Ph.D. (London)

- -

Associate Professor


Associate Professor

W. R. Abbot, B.A. (Kenyon), Ph.D. (Ohio State)

- -

Assistant Professor

B. P. Hendley, B.A. (Marquette), M.A., Ph.D. (Yale)

- -

Assistant Professor


( Huron), Ph.D. (Columbia)

- -

Assistant Professor

D. M. Lochhead, B.Sc., B.D., S.T.M., Ph.D. (McGill)

- -

Assistant Professor

J. W. Van Evra, B.A. (Valparaiso), M.A., Ph.D. (Michigan State)

Assistant Professor and Executive Secretary

J. Wubnig (Miss), B.A. (Swarthmore), M.A., Ph.D. (Yale)

Assistant Professor

A. C. Narveson (Mrs.), B.A. (Radcliffe), M.A. (Harvard)

- -

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 con-
templating further study in Philosophy. (See recommended Honours Pro-
grammes, pp. 37).

(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 design-
ated by an asterisk (*) after the course number.

(5) Courses suffixed with a '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: Phi-

Undergraduate Course Descriptions

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 any-
thing is right or wrong? How can we know about things we cannot directly
observe? Can we know whether there is a God? Is mind in any sense distinct
from matter? Original texts of both classical and contemporary thinkers are
employed. No prerequisite.
3 hours.

100J. Introduction to Philosophy. A study of St. Thomas and his writings;
fundamental Thomistic principles.
3 hours.

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 selections. No prerequisite.
3 hours.

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.
125.* Fundamentals of Social and Political Philosophy. The central question of the course is: What reasons can I have for acting on the issues which will face me as a member of society? Such problems as divorce, democracy, socialism, the Bomb, and international politics will be critically discussed in the light of readings from both classical and contemporary philosophers. No prerequisite. 3 hours.

135.* Fundamentals of the Philosophy of Religion. Basic ideas common to all religious beliefs will be discussed from a non-denominational viewpoint. What do we mean by revelation, sin, redemption? Can the existence of a supreme being be proved to the satisfaction of man's reason? Both classical and contemporary readings will be used. No prerequisite. 3 hours.

140.* Fundamentals of Logic. Basic types of reasoning will be analyzed. The reasons for using symbols in logic will be explored, and some simple systems considered. Attention will also be devoted to informal arguments and scientific method. No prerequisite. 3 hours.

140J. Logic and Epistemology. Nature and division of Philosophy; nature of logic; the term; the proposition; argumentation; induction and deduction; scientific demonstration. Truth; certitude; evidence; sense and intellectual knowledge; criterion of truth; contemporary theories. 3 hours.

150.* Fundamentals of Epistemology and Metaphysics. Discussion of the nature of reality. Rival theories concerning mind, matter, freedom, the existence of God, and the place of experience and reason in human knowledge. No prerequisite. 3 hours.

200J. Cosmology and Philosophy of Science. Corporeal bodies and change; quantitative and qualitative characteristics; motion; time, space; hylomorphic theory. Nature of science; abstraction; necessity; foundation and object of science; scientific method; hypothesis and theory. 3 hours.

210P.* 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.

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 from 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.

238J. History of Ancient and Medieval Philosophy. From the Presocratics to the decline of Scholasticism. 3 lectures.

240. Logic. A systematic development of the propositional calculus and of the first-order predicate calculus, including the theory of identity and of definite descriptions and some attention to the theory of relations. Considerable attention will be devoted to formalization of various applied theories in, e.g., economics, measurement, utility theory, etc. Prerequisites: None for second-year, and above, students; consent of instructor for others. 3 hours.

240J. Ethics. End of Man; the human act; law, conscience; morality; rights and duties; duties of a man as an individual and as a member of society. 3 hours.

280.* History of Ancient Philosophy I. From the beginnings to Plato. Prerequisite: Consent of instructor for students not taking philosophy as their main subject. 3 hours.

281.* History of Ancient Philosophy II. From Aristotle to the close of classical antiquity. Prerequisite: Philosophy 280. 3 hours.

282.* History of Modern Philosophy I. Earlier period beginning with Descartes. Prerequisite: One full or two half Philosophy courses, preferably 280/1, 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. 3 hours.

300J. Metaphysics and Natural Theology. The notion and analogy of being; the primary principles of being; the properties, division, and causes of being. Demonstration of existence of God: His nature and attributes; the divine intelligence and will; creation and providence. 3 hours.
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.

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.

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.

345.* Philosophy of History. Consideration of various possible views about the ultimate nature of history and historical knowledge. Both classical and contemporary views will be examined. Prerequisite: One full or two half Philosophy courses.
3 hours.

348J. Seminar in Philosophy. A special study of the principal philosophers of the modern and contemporary eras.
3 hours.

350. Epistemology. A systematic course in the analysis of human knowledge. Phenomenalism and various kinds of realism will be considered, as well as other main topics such as the a priori, our knowledge of other minds, and our knowledge of abstract entities. Prerequisite: One full or two half courses in Philosophy. Students not taking Philosophy as their main subject should consult the instructor.
3 hours.

361. Philosophy of Science. 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 or two half Philosophy courses, or consent of instructor.
3 hours.

363. Analytic Philosophy. Contemporary philosophical literature is employed in the exploration of both formal and "ordinary language" analysis. This course should be especially useful for persons contemplating graduate study in Philosophy. Prerequisite: Consent of instructor, or Honours status in Philosophy.
3 hours.

365.* - 366.* Oriental Philosophy. Studies of a selected area of non-western Philosophy (e.g. Indian or Chinese). Parallels will be drawn between modes of Eastern thinking and European conceptions with emphasis on essential differences as well as similarities. Prerequisite: Consent of instructor.
3 hours.

370* - 372.* Special Subjects. One or more half courses will be offered at different times as announced by the Department. Prerequisite: Consent of instructor.
3 hours.

380* - 389.* Studies in the History of Philosophy. Various half courses dealing with a particular philosopher, a selected work or period; one or more of these will be offered each year as announced by the Department. Prerequisite: Philosophy 280/281 and 282/283.
3 hours.

390.* Medieval Philosophy I. The early period to the thirteenth century. Prerequisite: Philosophy 280/281.
3 hours.
Department of Philosophy

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.

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, mainly of the last hundred years. Prerequisite: Two full courses (or equivalent) in Philosophy. 3 hours.

465. Existential Philosophy. A study of selected readings. Prerequisite: Consent of instructor. 3 hours.

471* - 473.* Problems. One or more half courses will be offered at different times, as announced by the Department. Prerequisite: Consent of instructor. 3 hours.

480* - 489.* Advanced Studies in the History of Philosophy. Various half courses dealing with a particular philosopher, a selected work or period; one or more of these will be offered each year as announced by the Department. Prerequisite: Consent of instructor. 3 hours.

498* (a-b). Directed Reading in Special Areas.

499. Tutorial and Honours Essay. Students wishing to enrol in 499 should consult the Department.

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.

698.*(a) - (n). Pre-Thesis Graduate Research in Special Areas.

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, one term.

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, one term.

Prerequisite: Biology 131.
3 lectures, 2 hours lab. - one term.

210. Anatomy and Kinesiology (Part II). An intensive study of the locomotor apparatus. Kinesiological principles are applied in the analysis of simple and complex human movements. Laboratory work will include cinematographical analysis of movement.
Prerequisite: P.E. 200.
3 lectures, 2 hours lab. - one term.
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, one term.

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, one term.

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. - one term.

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. - one term.

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 the endocrine system.
3 lectures, 2 hours lab. - one term.

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. - one term.

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. - one term.

2 lectures, 1 hour lab. - one term.

340. 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. Field trips will be an integral part of the course.
3 lectures, one term.
Department of Physical and Health Education

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, one term.

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, one term.

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 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 one.

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. - one term.

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. - one term.

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, one term.

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, one term.

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, one term.

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, one term.

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

I. A. Cowan, B.Sc. (Manitoba), M.A., Ph.D. (Toronto)

Professor and 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
D. J. Henderson, B.A. (U.B.C.), Ph.D. (Utah), F. Inst. P. - Professor
G. E. Reesor, B.A., M.A. (McMaster), Ph.D. (Toronto) - 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
D. F. Brodie, B.Sc., M.Sc., Ph.D. (McMaster) - Associate Professor
I. R. Dagg, B.Sc. (Manitoba), M.S. (Penn. State), Ph.D. (Toronto) - Associate Professor
P. C. Eastman, B.Sc., M.Sc (McMaster), Ph.D. (U.B.C.) - Associate Professor
H. K. Ellenton, B.Sc. (Western), M.A. (Toronto) - Associate Professor
J. Grindlay, B.Sc. (Glasgow), 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
M. G. Rochester, B.A., M.A. (Toronto), Ph.D. (Utah) - Associate Professor
S. F. Wang, B.E. (Port Arthur, China), D.Sc. (Nagoya) - Associate Professor
S. H. Chen, B.Sc. (Taiwan), M.S. (Michigan), Ph.D. (McMaster) - Assistant Professor
J. M. Corbett, B.A.Sc. (Toronto), M.Sc., Ph.D. (Waterloo) - Assistant Professor
S. G. Davison, B.Sc., M.Sc., Ph.D. (Manchester) - Assistant Professor
A. Dixon, B.Sc. (Mt. Allison), M.Sc. (Dalhousie), Ph.D (McMaster) - Assistant Professor
D. Hemming, B.Sc., Ph.D. (Bristol) - Assistant Professor
H. M. Morrison, B.Sc., Ph.D. (Edinburgh) - Assistant Professor
H. J. T. Smith, B.S., Ph.D. (London) - Assistant Professor
B. H. Torrie, B.A.Sc. (Toronto), Ph.D. (McMaster) - Assistant Professor
K. A. Woolner, B.Sc. (London) - Assistant Professor

Undergraduate Course Descriptions

Details of the undergraduate programmes offered by the Faculty of Science are to be found on page 99.

11. 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, heat and elementary thermodynamics.
3 lectures, 3 hours laboratory.

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.

3 lectures, one term.

3 lectures, one term.

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.

3 lectures, 3 hours laboratory.

200. General Physics II. Electromagnetism. A.C. circuits, geometrical and physical optics, introduction to atomic and nuclear physics.
3 lectures, 3 hours laboratory.

290
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.


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.

242. Electricity and Magnetism. Electrostatics, D.C. circuits, magnetic fields, electromagnetic induction, A.C. circuits, electrical measurements, introductory electronics. 2 lectures, 3 hours laboratory and 2 hours problems on alternate weeks.

243. Electricity and Magnetism. Electrostatics, D.C. circuits, magnetic fields, electromagnetic induction, A.C. circuits, electrical measurements. 3 lectures, 3 hours laboratory alternate weeks, one term.

245. Structure of Solids 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).

331. Classical Mechanics I. Foundations of Newtonian mechanics. Dynamics of a particle; harmonic oscillator; central force motion; conservative force; potential energy. Dynamics of a system of particles; conservation laws; trans-
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; eigenfunctions.
2 lectures.

337. Astronomy II. Selected topics in astrophysics, cosmogony, and radioastronomy.
2 lectures.

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, molecular and solid state physics.
3 lectures.

292
431. Classical Mechanics II. Review of Lagrangian formulation of mechanics. Rotation of a rigid body; the inereia tensor; Hamilton’s principle; Hamilton’s equations. Classical theory of small vibrations. Dynamics of deformable matter; elasticity; hydrodynamics. 2 lectures.


433A Advanced Laboratory. Selected experiments in atomic and nuclear physics, solid state physics, thermodynamics. Electrical and electronic measurements, vacuum techniques. 6 hours laboratory, first term.

433B Advanced Laboratory. A short Research Problem. 6 hours laboratory, second term.

434. Atomic and Nuclear Physics II. Applications of wave mechanics; the harmonic oscillator, the hydrogen atom. Angular momentum. Scattering. Perturbation theory, transitions, The multi-electron atom. 2 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 elec-
trosstatics; 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.

3 lectures, second term.

3 lectures, second term.

447. Astronomy III. Spherical astronomy and celestial mechanics.
2 lectures.

Graduate and Research Programmes
See page 132 for general information.
There are at present several major areas of study in the Department in which graduate students may specialize. These include:

Low temperature physics: experimental studies of condensed inert gases, liquid helium, superconductivity, energy gap and Fermi surface determinations.

Physics of lattice defects: layer structures, properties of vacancies and impurities.

Thin film physics: epitaxial, anodic oxide, and semi-conducting films - active thin film devices.

Laser Research: ruby laser research, solid state injection lasers.

Microwave research: dielectric constant measurements, field induced adsorptions, microwave spectrometry.

Theoretical Physics: geophysics, theory of liquids, theoretical solid state physics

Graduate Course Descriptions

Three lectures, first term.

622. Group Theory and Quantum Mechanics. Introduction to group theory; groups, representations of groups, character tables. Group theory and quantum mechanics, the permutation and rotation groups. Applications of the theory to atomic spectra, the theory of angular momentum. Molecular symmetry and solid state physics. 3 lectures, one term.

623. Advanced Quantum Mechanics. Dirac theory; the single particle description of relativistic quantum mechanics; bound state and scattering problems—the need for a many-particle (field) approach. Classical relativistic field theory, Feynman-Schwinger quantization of this theory. The radiation field, the electron field. Interaction of these fields. The S-matrix; Compton scattering, Coulomb scattering. The magnetic moment of the electron, the Lamb shift. Renormalization. 3 lectures, one term.

627. Atomic Spectra. The fine and hyperfine structure of one-electron and many-electron atoms, the Zeeman and Stark effects. 3 lectures, one term.

628. Molecular Spectra. The electronic, vibrational, and rotational spectra of diatomic and polyatomic molecules and the Raman effect. 3 lectures, one term.


634. Advanced Classical Mechanics. Review of elementary mechanics, Lagrangian formulation, variational principles, Hamiltonian formulations; rigid body kinematics and dynamics, special relativity, transformation theory, Hamilton-Jacobi theory. 3 lectures, one term.

635. Electromagnetic Theory I. The electrostatic and the magnetic field; energy, force and momentum relations in the electromagnetic field; Maxwell's equations, solutions of the wave equation; radiation. 3 lectures, first term.

636. Electromagnetic Theory II. The special theory of relativity; the electromagnetic tensor; the field of moving charges; magnetohydrodynamics; selected topics. 3 lectures, second term.
640. Electron Optics and Electron Microscopy. Electrons in electrostatic fields, the electrostatic lens, the magnetic lens, aberrations, the electron microscope, theory of image contrast, Fresnel diffraction and image contour phenomena, electron diffraction and dark-field microscopy, experimental methods in electron microscopy.
3 lectures, one term.

3 lectures, one term.

645. Statistical Mechanics. Review of essential classical and quantum mechanics; microcanonical, canonical and grand canonical ensembles; quantum statistical mechanics, theory of the density matrix; fluctuations, noise, irreversible thermodynamics; transport theory; application to gases, liquids, solids.
3 lectures, one term.

3 lectures, one term.

650. Solid State Physics. An introductory undergraduate course in classical solid state physics, or equivalent, is assumed. The free electron model in metals, band theory of solids, application of Brillouin zone theory, semiconductors, optical properties of solids and devices of current interest are some of the topics which are covered.
Three lectures, second term.

651. Imperfections in Crystals. Perfect and imperfect crystals, general properties and origins of point defects and dislocations, stacking faults, interactions of imperfections, influence of lattice imperfections on physical properties and their role in deformation of crystals and phase transformations, experimental detection and observation of imperfections.
3 lectures, one term.

3 lectures, one term.

3 lectures, one term.
654. Advanced Quantum Theory of Solids. Theoretical and experimental techniques for determination of the band structure of metals and semiconductors; electrical and thermal conduction processes and electron-lattice interactions. 3 lectures, one term.

655. Optical Properties of Semiconductors. Reflection and refraction of electromagnetic waves at dielectric and conducting interfaces. Dispersion, absorption processes, photo effects, magneto-optical effects, emission of radiation. 3 lectures, one term.

656. Magnetism. Introduction to the theory of magnetic phenomena in metals and non-metals. Relevant experimental work will also be discussed. 3 hours per week, one term.

660. Selected Topics in Physics. 3 lectures, one term.

667. Molecular Biology. Selected topics of interest to biologists, biochemists and biophysicists will be presented at the advanced level with the aim of evaluating recent work and development in each area. Each will be developed from basic concepts and interrelationships emphasized. Topics will include: the structure of proteins and their properties in solution, transport through biological membranes, cell morphology and physiology, structure and function of selected organelles, biosynthesis of macromolecules, and the chemistry of enzyme action. This graduate course is to be presented by members of the Biology, Chemistry, and Physics Departments and is intended to cover those areas common to these disciplines (identical to Biology 667 and Chemistry 667).

670. Physics of the Earth's Interior. Selected topics in theoretical geophysics; seismology, rheology of the Earth, geomagnetism, the Earth's rotation. 3 lectures, one term.


Department of Political Science

T. H. Qualter, B.A. (New Zealand), Ph.D. (London)
Professor and Chairman of Department

D. R. Gordon, B.A. (Queen's), M.A. (Toronto) - - Associate Professor
A. D. Nelson, A.B., A.M., Ph.D. (Chicago) - - Associate Professor
J. E. Anderson, B.A. (Manitoba), M.A. (Princeton) - Assistant Professor
S. Andracki, LL.M. (Poznan), M.Sc. (London), Ph.D. (McGill) - Assistant Professor

L. G. E. Edmondson, B.Soc.Sc. (Birmingham), M.A. (Queen's) - Assistant Professor
W. D. K. Kernaghan, B.A. (McMaster), M.A., Ph.D. (Duke) - Assistant Professor
J. M. Wilson, B.A., M.A. (Toronto) - - Assistant Professor
K. P. Watson, B.A., M.A. (Toronto) - - Adjunct Professor
T. H. Wilson, B.A., LL.B. (Toronto) - - Lecturer (Political Science & History)

Notes: (1) Students electing an Honours Programme or a Major in Political Science, or an Honours Programme in such related subjects as History, Economics, Sociology or Psychology are encouraged to register in Political Science 110 in their first year. Other students are encouraged to register in Political Science 100. Either of these courses will serve as a prerequisite for senior courses in Political Science.

(2) Courses designated "Full course, half year" are comparable to a normal year course in their content. They are, however, offered, on a more concentrated basis during one term only. In drawing up a programme a student would regard such a course as two courses during the term in which it is offered and would combine it with another such course, or two half-courses during the remaining term. The advantage of such a combination of courses is that it allows a more concentrated study of a more limited number of subjects at any given time.

(3) The number of hours or lectures shown after the course description is an attempt to indicate the "normal"; each instructor determines how often his particular class will meet.

General Course

Students majoring in Political Science are referred to the General Course Requirements commencing on page 21. All students majoring in Political Science shall complete Political Science 250 and 280. Other courses will be selected in consultation with the Department.

Honours Course

The Honours Political Science Programme recommended on page 42 is the standard prescription. The programme for each student must be arranged in consultation with the Department.
A student in Honours in any discipline other than Political Science may, with the permission of the Department and the instructor concerned, be admitted to any Political Science course.

**Graduate Programme**

The Department of Political Science offers courses of study leading to the degree of Master of Arts. The principal areas of the discipline in which graduate students may specialize include, at present, political theory, political behaviour, parties, interest groups, public opinion and propaganda and the electoral process.

The candidate for a Master's degree will select one of these areas as a major field and will submit a thesis in that field. In addition, each candidate will select two graduate courses in consultation with the Department which may, at the discretion of the Department, be closely related to his major (thesis) field, or may be drawn from quite different areas of Political Science.

At the discretion of the Department a candidate may be required, or permitted, to select additional courses at either the graduate or undergraduate level in Political Science, or in another Department.

Each candidate will be required to write a comprehensive examination dealing with his major field and areas related to it.

**Undergraduate Course Descriptions**

15. **Government and Politics.** An introduction to liberal democratic ideals and a comparative treatment of the institutions and practices of modern democratic government with particular reference to Canada, the United States and Great Britain. **Note:** This course is restricted to students in the Co-operative Engineering programme.

100. **Introduction to Political Science.** A study of the origin, nature and impact of contemporary political doctrines including Communism, Fascism, Democratic Socialism and Democratic Capitalism, together with a study of the institutions and practices of modern government, with particular reference to the governments of Canada, the United States and Great Britain. 3 lectures.

101. **Introductory Politics.** (a) A study of some of the leading political ideas of the contemporary world. (b) A comparative treatment of the institutions and practices of modern government with particular reference to Canada. **Note:** This course is restricted to students in the Co-operative Mathematics programme. Parts (a) and (b) will be offered in alternate terms.

102. **Politics in Mass Society.** An examination of the methods and problems of contemporary government.

Current attempts to deal with the challenges of numbers, size and technology, and their political consequences will be studied together with a consideration of needs and proposals for reform.
110. Democratic Government. An examination of the theory and practice of constitutional democracy in modern industrial "mass" society. The relationship between basic political objectives and general features of organization, procedure and practice will be emphasized, with primary reference to Canada, Great Britain and the United States. 
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 only.

249.* Administrative Law. Discusses the issues raised by delegation of legislative and executive authority and the proliferation of administrative boards. 3 lectures. Winter term only.

250. The History of Political Theory. An examination of the theories of some of the major figures in the history of western political thought, from ancient Greece to the present day. 
3 lectures.

261.* Contemporary International Politics. A study of the main political developments and issues in the relations of nations since World War II. 
3 lectures. Fall term only.

270. Public Administration. A comparative analysis of the public services of the major democracies with particular reference to the legal basis, organization and political and judicial control of the administrative processes. 
3 lectures.

280. Canadian Government and Politics. A critical examination of the institutions and practices of the Canadian political system. 
3 lectures.

Full course, half year. Fall term only.

Full course, half year. Winter term only.

283. Soviet Government and Politics. A survey of both the theoretical and practical aspects of political life in the Soviet Union, emphasizing Soviet domestic politics and political institutions. 
3 lectures.

284.* Government and Politics in Western Europe. A comparative study of the government and politics of France, Italy and the Federal German Republic in the post-war world. 
3 lectures. Winter term only.
364. **Theory and Practice of International Relations.** An examination of the concepts of international relations and the study of International Relations as a discipline. A treatment of foreign policy analysis with special emphasis on components of national power and methods and trends in the pursuit of national and collective interests.
Prerequisite: Political Science 261 or consent of instructor.
3 lectures.

371.* **Local Government.** A study of the development, structure, functions, machinery and finances of Canadian local government.
3 lectures. Winter term only.

372.* **Provincial Governments.** A study of the history, structure and operation of government and politics at the provincial level in Canada, with special emphasis on the particular problems of special provinces.
3 lectures. Fall term only.

381.* **The State and Economic Life.** An analytical and comparative study of the growth of government intervention in the economic process, and of the development of the welfare state.
3 lectures. Fall term only. Admission by consent of instructor.

382.* **Federalism - Classical and Co-operative.** A study of the evolution, structure and functions of modern federalism in selected countries.
3 lectures. Winter term only. Admission by consent of instructor.

390.* **Political Parties.** An analytical and comparative study of the development, organization, activity and function of political parties, and the nature of contemporary party systems.
3 lectures. Fall term only. Admission by consent of instructor.

391.* **The Electoral Process.** An analytical and comparative treatment of electoral machinery and law, voting systems, and redistribution problems.
3 lectures. Fall term only. Admission by consent of instructor.

392.* **Interest Group Politics.** A study of interest group theory and comparative analysis of the internal politics of interest groups and their role in the political process.
3 lectures. Winter term only. Admission by consent of instructor.

3 lectures. Winter term only. Admission by consent of instructor.

450* - 455.* **Advanced Theory Seminars.** A series of half courses providing for a detailed study of the political theory of one selected period or school. One or more of these courses will be offered in each year.
3 lectures. Admission by consent of instructor.

460. **International Law and International Institutions.** An examination of concepts and rules of international law relevant to the development of international institutions. An evaluation of the United Nations system and of regional
systems with special reference to common institutional problems.
Prerequisite: Political Science 364 or consent of instructor.
3 lectures.

480. The Politics of the Developing Areas. An analysis of political systems and processes in the transitional societies of Africa, Asia and Latin America. 3 lectures. Admission by consent of instructor.

3 lectures. Fall term only. Admission by consent of instructor.

482 - 485.* Comparative Government Seminars. A series of half courses on the government and politics of selected countries, regions or systems.
3 lectures. Admission by consent of instructor.

490.* Public Opinion and Propaganda. A detailed study of the nature of public opinion and the attempt to control it through propaganda.
3 lectures. Winter term only. Admission by consent of instructor.

491. Political Behaviour. An examination of the objectives, characteristics, and problems of contemporary research on political behaviour, with emphasis on democratic electoral behaviour.
3 lectures. Admission by consent of instructor.

498. Senior Research Seminar.
3 lectures. Admission by consent of instructor.

Graduate Course Descriptions

630. Administrative Law. A study of the powers and procedures of administrative agencies in Canada and in other selected countries. The nature of the powers delegated to administrative bodies; the problems of administrative procedure; questions of responsibility to the legislative and executive branches of government; the methods and degree of judicial control over administrative action.
Full course.

650. Select Period of Political Theory. An intensive study of the genesis, nature and implications of the political theories of one selected period or school. The actual period or school chosen will vary from year to year. Candidates wishing to take this course are advised to consult the Department well in advance.
This may be offered as either a full course or as a half course.

651.* Contemporary Democratic Theory. An examination of recent and contemporary theories of democratic government.
Half course.

660. International Relations Seminar. A study of the development of international relations as a discipline and an analysis of contemporary theoretical and empirical approaches in the field.
Full course.

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Department of Political Science

661. *International Migrations.* A comparative survey of the migration policies of immigration countries with special reference to Canada, Australia and the United States. Concepts and techniques developed in the various countries in the matter of selection, admission and exclusion of immigrants will be analyzed systematically against the background of immigration policies and laws.
Half course.

662. *Canadian Foreign Policy.* A critical examination of the sources, challenges and methods of Canadian foreign policy together with case studies of major contemporary issues.
Full course.

670. *Comparative Public Administration.* An examination of the theory of public administration and a comparative analysis of the actual operation of the public service in Canada, Great Britain, the United States and selected other countries.
Full course.

680. *Problems in Canadian Government and Politics.* A critical study, at the advanced level, of selected aspects of the Canadian political system.
Full course.

Full course.

682. *Comparative Federalism.* A comparative examination of federalism in Canada, the United States, Australia, Switzerland, and selected developing nations. The concept of federalism; the characteristics of a federal society, its constitution and its government; the formation and operation of federal governments; the transition from classical to cooperative federalism; the prospects for federalism.
Full course.

690. *Problems in the Study of Propaganda and Psychological Warfare.* A detailed examination of specific problems including testing the effectiveness of propaganda campaigns, the techniques and media of propaganda in different political systems and the internal and international uses of propaganda.
Full or half course.

Full or half course.

692. *The Communication Media.* A study of the impact of the mass communication media on political processes.
Full course.
693. The Political Process. The seminar will be devoted primarily to the study of special problems relating to the structure and functioning of the political process in selected countries, with emphasis on parties, interested groups and electoral behaviour. Members of the federal and provincial parliaments and officials of the various party organizations will be invited from time to time to participate.
Full course.
Department of Psychology

Professor (Philosophy and Psychology) and Chairman of Department

R. K. Penney, B.Sci. (Wayne State), Ph.D. (Iowa)
Professor and Associate Chairman of Department

G. T. Barrett-Lennard, B.Sc., B.A. (Western Australia), Ph.D. (Chicago)
Professor

M. P. Bryden, S.B. (Massachusetts Institute of Technology), M.Sc., Ph.D. (McGill)
Professor

A. de Vos, M.Sc., Ph.D. (Wisconsin) - Professor (Geography and Psychology)

J. S. Minas, A.B., M.A. (Wayne State), Ph.D. (Illinois)
Professor (Philosophy and Psychology)

E. A. Salzen, B.Sc., Ph.D. (Edinburgh)
Professor

D. A. Sprott, B.A., M.A., Ph.D. (Toronto), F.S.S.
Professor (Mathematics and Psychology)

R. K. Banks, B.A., M.A., Ph.D. (Toronto)
Associate Professor

T. E. Cadell, B.A. (British Columbia), M.A. (Massachusetts), Ph.D. (Wisconsin)
Associate Professor

W. D. Fenz, B.A. (Southern Missionary), M.A., B.D. (St. Andrew's), M.Sc. (Hawaii), Ph.D. (Massachusetts)
Associate Professor

J. B. Gilmore, B.A. (Stanford), M.S., Ph.D. (Yale)
Associate Professor

G. V. Goddard, B.A., M.A. (Saskatchewan), Ph.D. (Illinois)
Associate Professor

H. M. Lefcourt, B.A. (Antioch), M.A., Ph.D. (Ohio State)
Associate Professor

C. F. Preston, B.A. (Toronto), B.D. (Wycliffe), M.A., Ph.D. (Toronto)
Associate Professor and Director of Counselling Services

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 (Mathematics and Psychology)

M. D. Vogel-Sprott, B.A. (McMaster), M.A., Ph.D. (Toronto)
Associate Professor (Mathematics and Psychology)

D. M. Amoroso, B.A., M.A. (Toronto), Ph.D. (Waterloo)
Assistant Professor

K. S. Bowers, A.B., Ph.D. (Illinois)
Assistant Professor

P. E. Bowers, B.A. (Rosemont), M.A., Ph.D. (Illinois)
Assistant Professor (part-time)

M. Breidenbaugh, B.A. (Wittenburg), Ph.D. (Vicma)
Assistant Professor (part-time)

M. Brown, B.A., M.S. (McGill), Ph.D. (Michigan)
Assistant Professor

J. M. Cornell, B.S., M.S., Ph.D. (Washington)
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
<table>
<thead>
<tr>
<th>Name</th>
<th>Degree &amp; University</th>
<th>Position/Role</th>
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<tbody>
<tr>
<td>J. E. Grusec (Mrs.)</td>
<td>B.A. (Toronto), M.A., Ph.D. (Stanford)</td>
<td>Assistant Professor</td>
</tr>
<tr>
<td>T. Grusec</td>
<td>B.A. (Toronto), Ph.D. (Stanford)</td>
<td>Assistant Professor</td>
</tr>
<tr>
<td>W. C. Horne</td>
<td>B.A., M.A., Ph.D. (Iowa)</td>
<td>Assistant Professor</td>
</tr>
<tr>
<td>P. C. Jennings</td>
<td>B.A. (Utah), M.A., Ph.D. (Texas)</td>
<td>Assistant Professor (Computer Science and Psychology)</td>
</tr>
<tr>
<td>M. Krampen</td>
<td>Diploma in Visual Communication</td>
<td>Assistant Professor (Design and Psychology)</td>
</tr>
<tr>
<td>R. D. Lambert</td>
<td>B.A., M.A. (McMaster), Ph.D. (Michigan)</td>
<td>Assistant Professor (Psychology and Sociology)</td>
</tr>
<tr>
<td>J. B. Kalbfleisch</td>
<td>B.Sc. (Toronto), M.Sc., Ph.D. (Waterloo)</td>
<td>Assistant Professor (Mathematics and Psychology)</td>
</tr>
<tr>
<td>G. E. MacKinnon</td>
<td>B.A. (Queen's), Ph.D. (Johns Hopkins)</td>
<td>Assistant Professor</td>
</tr>
<tr>
<td>D. Meichenbaum</td>
<td>A.B. (City College of New York)</td>
<td>Assistant Professor</td>
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<tr>
<td>M. A., Ph.D. (Illinois)</td>
<td></td>
<td>Assistant Professor</td>
</tr>
<tr>
<td>P. M. Merikle</td>
<td>B.A. (Knox), M.A., Ph.D. (Virginia)</td>
<td>Assistant Professor</td>
</tr>
<tr>
<td>J. C. Naidoo</td>
<td>B.Sc. (Witwatersrand), B.Sc. (South Africa), M.A., Ph.D. (Illinois)</td>
<td>Assistant Professor, J</td>
</tr>
<tr>
<td>I. W. Silverman</td>
<td>B.A. (Brooklyn), M.S., Ph.D. (Purdue)</td>
<td>Assistant Professor</td>
</tr>
<tr>
<td>J. A. Van Evra</td>
<td>B.A. (Valparaiso), M.A., Ph.D. (Michigan State)</td>
<td>Assistant Professor (part-time)</td>
</tr>
<tr>
<td>D. S. Barnes</td>
<td>M.D. (Western Ontario)</td>
<td>Adjunct Professor</td>
</tr>
<tr>
<td>A. J. Cawley</td>
<td>D.V.M., D.V.Sc (Toronto)</td>
<td>Adjunct Professor</td>
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<tr>
<td>J. J. Hartford</td>
<td>M.D. (Toronto)</td>
<td>Adjunct Professor</td>
</tr>
<tr>
<td>D. J. Torney</td>
<td>B.A., M.A. (Western Ontario)</td>
<td>Adjunct Professor</td>
</tr>
<tr>
<td>K. Carlson</td>
<td>B.A., M.A., Ph.D. (McGill)</td>
<td>Research Fellow and Special Lecturer</td>
</tr>
<tr>
<td>R. D. Seim</td>
<td>B.A. (Queen's)</td>
<td>Special Lecturer</td>
</tr>
<tr>
<td>R. G. Setterington</td>
<td>B.A., M.A. (Toronto)</td>
<td>Research Fellow and Special Lecturer</td>
</tr>
</tbody>
</table>

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 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 200, and at least one other full-year or two half-year Psychology courses. Psychology 280 is strongly recommended in the second year. During Year III the student must complete two full-year or four half-year Psychology courses at either the 200 or 300 level, including Psychology 280 if it has not been taken previously.
Department of Psychology

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 233, Philosophy 220.

An introductory course (Psychology 110, 111-112, 150) is a prerequisite for all subsequent courses in Psychology.

Note on numbering: Courses numbered 250-299, 350-399 are Honours courses. Ordinarily, General Course students will take the courses numbered 200-249 or 300-349. Honours students may take a limited number of 200-249 and 300-349 courses but Honours standing will be required. Undergraduate courses ending in 0 and 99 are full-year courses. Courses ending in odd numbers are half-year courses offered in the fall term, while courses ending in even numbers are half-year courses offered in the winter term, with the exception of those courses offered to students in co-operative programmes. Courses numbered 250-299 and 350-399 are intended primarily for honours students.

Graduate Offerings: Courses numbered 600-650 are offered on a half-year basis. Courses numbered 699 and above are full-year courses.

Candidates for a graduate degree in psychology who possess an ordinary bachelor's degree must take at least one preliminary year of work in psychology to ensure that their preparation is equivalent to that of a graduate of an honours course in psychology.

Candidates with an honours bachelor's degree or equivalent preparation may select either a research-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 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.

155. Introductory Psychology. A short introduction to the methodology and basic principles of some of the major areas of modern psychology such as learning, emotion, and perception. (For engineering students only.)
3 lectures.

110. Introductory Psychology. This course is designed to provide the students with an understanding of the basic concepts and techniques of modern psychology as a behavioural science. The development of behaviour, learning, motivation, emotion, sensation and perception, and individual differences will be studied with reference to physiological correlates and to environmental factors.
3 lectures.

111. Introductory Psychology I. This course, together with Introductory Psychology II, is equivalent to Psychology 110, but is given in two self-contained units. (For Co-operative Mathematics students only).

112. Introductory Psychology II. (For Co-operative Mathematics students only.)
Prerequisite: Psychology III.
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.

200. General Experimental Psychology. An introduction to the methods of experimental psychology. Laboratory experience will be used to introduce the student to the data and theories of learning and perception. (This course is required of all general B.A. students in Psychology unless both Psychology 290 and Psychology 360 are substituted.)
2 lectures, 2 hours laboratory.

211. Developmental Psychology. The genesis and development of behaviour will be traced from conception to maturity.
3 lectures, fall term.

212. Social Learning and Motivation. An analysis of the motivational aspects of human behaviour from a developmental point of view.
3 lectures, winter term.

2 lectures, 2 hours laboratory, fall term.
2 lectures, 2 hours laboratory, winter term.

253.* (Sociology 210). Introductory Social Psychology. The contribution of psychological processes to social interaction. Analysis of selected interpersonal events, such as the self, communication, and bonds, with special attention to the problem of social influence and social control. Fall.

254.* (Sociology 212). Interpersonal Relations. The contribution of social organization to interpersonal processes. Consideration of some "theories" of social interaction at the small group level. The social system approach to the problem of personal and interpersonal control. Winter.

280. Statistical Methods in Psychology. An introduction to the logical and theoretical bases 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.

290. Principles of Learning. This course is designed to introduce the student to learning theory and to provide an understanding of experimental techniques in this area. Required of all Honours Psychology students.  
2 lectures, 2 hour laboratory.

300. Social Psychology. Several topics in social psychology will be covered in depth. Prerequisite: 253 or Sociology 210.

331.* Individual Differences. The basic problems in measuring individual differences in intelligence, personality, and other characteristics will be studied.  
3 lectures, fall term.

332.* Applied Psychology. An introduction to the methods and problems of such applied areas as counselling, educational, and industrial psychology.  
3 lectures, winter term.

351.* Personality Theory. An examination and evaluation of some of the outstanding theories of personality 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: 351.  
3 lectures, winter term.
360. **Sensation and Perception.** The characteristics of sensation and perception will be studied in relation to the physics of the stimuli and physiology of the sensory apparatus. Required of all Honours Psychology students. 2 lectures, 3 hours laboratory, alternate weeks.

370. **Animal Learning.** More advanced study of learning principles, together with a presentation of, and practice in, the techniques of experiments with animals. 2 hours lectures, 2 hours laboratory.

380. **Advanced Physiological Psychology.** More advanced study of the physiological basis of behaviour, with particular reference to the functioning of the nervous system. Prerequisite: 252. 2 hours lectures, 2 hours laboratory.

390. **Motivation and Emotion.** Past experience, the social environment, and physiological responses as determinants of motivated behaviour. 2 hours lectures, 2 hours laboratory.

410. **History and Systems.** An examination of current theoretical approaches to psychological problems presented in a historical context. 3 hours lectures.

430. **Problems in Contemporary Psychology.** Conducted, for the most part, as a seminar class, the purpose of this course will be to examine the latest developments in psychology, chiefly through journal publications, in order to evaluate contemporary trends in research and theory. Required of all Honours students in Psychology. 2 lectures.


499. **Senior Honours Essay.** Each student will work under the direction of a member of the department on an experimental study. The result of this investigation will be presented in the form of a thesis, which will be critically examined by members of the department and also, where pertinent, by members of other departments. Required of all Honours Students in Psychology. 5 hours supervised research. Seminar.

**Graduate Course Descriptions**

**A. Courses for Credit Toward the Ph.D. Degree**

611. **Human Factors Engineering I.** The human being as an element in an engineering system; his physical and mental capabilities and limitations; his assets and liabilities as compared to automatic elements; his physical and mental requirements for optimum functioning as an element in a system.
612. **Human Factors Engineering II.** More advanced study of selected problems presented in Psychology 611, together with laboratory demonstrations.

621. **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 behavior 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 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.

635, 636. Social and Personality Development. Two half-year courses designed for students who are interested in a developmental approach to theory and research in social and personality psychology. 635 will be given in the Fall term, 636 in the Winter term, but 635 is not a prerequisite for 636.

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.

640. Selected Topics in Psychology.

698. Internship.


702, 722, 742. Learning I, II, III. A series of seminars devoted to critical reviews of basic theoretical issues and recent advances in selected topics in learning.

703. Physiological and Comparative Psychology. A seminar series dealing with the physiological aspects of human behaviour and with relevant animal physiological and behavioural studies. Open only to students obtaining minor credit in comparative and physiological psychology.

704, 724, 744. Social Psychology, I, II, III. A series of seminars dealing with theoretical issues and research findings in the area of social psychology.

705, 725, 745. Child Psychology I, II, III. A series of seminars dealing with recent experimental advances in the area of child psychology and with theoretical issues and research in the areas of child development and behaviour.

706. Biological Basis of Behaviour. A seminar on aspects of cytology, histology, anatomy, embryology, phylogeny and genetics in relation to the behaviour of organisms.

708. Comparative and Human Neuroanatomy. Comparative study of the vertebrate nervous system; detailed study of the central nervous system of mammals including man.

709. Physiological Mechanisms in Behavior. An examination of aspects of physiology and physiological chemistry that are related to the behaviour of organisms.


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.

B. Courses Principally for M.A.Sc. Candidates

801. Tests and Measurements. An examination of methods and issues in the evaluation, selection and construction of psychological tests. General procedures for evaluating tests (various kinds of reliability estimation and validation) will be considered in detail. Principles of test construction will be examined.

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 Intelligence. Theories of intelligence and the nature of tests derived from these theories. Criteria for the selection of tests. Review of relevant research. Practice in test administration and evaluation of results.

813. Assessment of Personality Aptitudes and Interests. The development and use of non-projective personality tests. A brief introduction to the role of projective techniques. Theoretical and research foundations of tests used in career planning. Practice in test administration and evaluation of results.

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.
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 communication 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 consisting 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.

843. Research Essay. A formal paper which may either:
(a) report a research study carried out under supervision during work terms;
or
Department of Psychology

(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. Personnel Psychology. An examination of various areas of personnel psychology, with special reference to job analysis, personnel selection and evaluation, and psychological testing in industry.

848. Industrial Social Psychology. An application of the principles of social psychology to industry, including such areas as motivation and morale, union-management relations, and organizational problems and theories.

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 Knowledge

<table>
<thead>
<tr>
<th>Professor/G</th>
<th>Lecturer/L</th>
<th>Course Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>J. W. Fretz, A.B. (Bluffton), B.D. (Chicago Theol. Seminary), M.A., Ph.D. (Chicago)</td>
<td>-</td>
<td>50J. Grace and the Sacraments</td>
<td>Grace: concepts pertaining to all the sacraments; the meaning of sacramental life to the individual and to society. 3 lectures.</td>
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<tr>
<td>A. M. McLachlin, M.A. (Toronto), B.D. (Emmanuel)</td>
<td>-</td>
<td>100J. Christian Apologetics</td>
<td>Establishment of the claims of Christianity; the divinity of Christ; the Church: sources of dogma: faith. God and His nature the divine attributes: the Trinity: Incarnation: Redemption: Mariology. 3 lectures.</td>
</tr>
<tr>
<td>E. B. Gamble (Miss), B.A. (Victoria), M.A. (Columbia), B.R.E. (Emmanuel)</td>
<td>-</td>
<td>100P. New Testament Greek</td>
<td>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.</td>
</tr>
<tr>
<td>J. R. Horne, M.A. (Western), B.Th. (Huron), Ph.D. (Columbia)</td>
<td>-</td>
<td>105P. Introductory Hebrew</td>
<td>An introduction to Hebrew grammar. Translation and exegesis of selected passages from the Old Testament. 3 hours.</td>
</tr>
<tr>
<td>N. L. Medley, B.A. (St. Mary's)</td>
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<tr>
<td>D. M. Lochhead, B.Sc., B.D., S.T.M., Ph.D. (McGill)</td>
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<tr>
<td>L. J. Siess, Ph.D., S.T.L. (Gregorian, Rome)</td>
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<tr>
<td>P. F. Pigott, B.A. (Western), S.T.L. (Laval)</td>
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</tr>
<tr>
<td>L. J. Grace</td>
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</tbody>
</table>

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Religious Knowledge

200G. The Left Wing of the Reformation. The history and philosophy of the sixteenth century sectarians contrasted with the major reformers and evaluation of their place in modern Christianity.
3 lectures.

200J. Sacred Scriptures. Inspiration; origin; the canon of the Scriptures; manuscripts and versions; Biblical history of the Old and New Testaments.
3 lectures.

3 lectures.

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.

300J. Catholic Social Doctrines. 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.

Science

400. The History and Philosophy of Science. The nature of science; science and technology in Egypt and Babylon. The development of science in Greece; the Orphic mysteries and the Ionian philosophers. Plato and Aristotle; Archimedes. The Alexandrian school and the separation of science and philosophy.

2 lectures.
Department of Sociology and Anthropology

H. J. Fallding, B.A., B.Sc., M.A. (Sydney), Ph.D. (Australian National University) - Professor and Chairman of Department
J. W. Fretz, A.B. (Bluffton), B.D. (Chicago Theol. Seminary), M.A., Ph.D. (Chicago) - Professor
N. H. High, B.S.A. (Toronto), M.S., Ph.D. (Cornell) - Professor and Dean of the Faculty of Arts
H. D. Kirk, B.S. (City College, New York), M.A., Ph.D. (Cornell) - Professor
W. L. Sauer, B.A. (Wayne State), M.A., Ph.D. (Michigan State) - 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
M. Kurokawa, B.A. (Tokyo Women's Christian College), M.A. (California) - Associate Professor
R. D. Lambert, B.A., M.A. (McMaster), Ph.D. (Michigan) - Assistant Professor
A. J. Muntean, B.A. (Youngstown), M.A. (Michigan State) - Assistant Professor
Wm. B. Roosa, B.A. (Texas Christian), M.A. (New Mexico) - Assistant Professor
J. M. Spina, B.A., M.A. (Chicago) - Assistant Professor
S. M. Weaver, B.A., M.A. (Toronto) - Assistant Professor
A. Wipper, B.A., M.A. (McGill) - Assistant Professor
D. R. Badir, B.Sc. (Manitoba), M.Sc. (Syracuse), M.Sc. (London) - Lecturer
N. L. Choate, C.R., B.A. (St. Mary's, Kentucky), M.A. (St. Louis) - Lecturer

Undergraduate Course Descriptions

Notes:

(1) Students electing an Honours programme or a major in Sociology should register in Sociology 100. Students electing to major in Anthropology should register in Anthropology 101 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 210, 320, 325, and one other full or two half courses in Sociology. Courses listed under Anthropology are accepted as credit in Sociology, with the exception of Anthropology 444.

(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.

(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.

**Anthropology**

**101*. Origins of Man and Culture.** An introductory course in Physical Anthropology and Archaeology. Lectures on living and fossil primates, the fossil evidence for the origins and development of man, modern races, and archaeological evidence for the origins and development of culture.
3 lectures.

**102*. Cultural and Social Anthropology.** An introductory course on the nature of culture. Data are presented on several primitive cultures.
3 lectures.

**222. North American Archaeology.** A survey of North American archaeology from the earliest known cultures to the time of European contact. Data on the Great Lakes area will be emphasized.
Prerequisites: 101 and 102, or permission of the instructor.
3 lectures.

**223. Old World Archaeology.** A survey of Old World archaeology from the beginning of culture up to the advent of history.
Prerequisites: 101 and 102, or permission of the instructor.
3 lectures.

**225. North American Indians.** A survey of North American Indian cultures as they were at the time of European contact. Data on the present-day status of several selected groups will be included.
Prerequisites: 101 and 102, or permission of the instructor.
3 lectures.

**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: 101 and 102.
3 lectures.

**350. Culture Theory.** A survey of the historical development of the concepts of culture, cultural evolution, and acculturation.
Prerequisites: 101 and 102.
3 lectures.

**353*. Primitive Social Organization.** A study of primitive social structure with primary emphasis on kinship systems.
Prerequisites: 101 and 102.
3 lectures.

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356*. **Primitive Economics.** A study of economic systems of bands, tribes, and chiefdoms as contrasted with those of primitive states. Prerequisites: 101 and 102. 3 lectures.

357*. **Hunting and Gathering Cultures of North America.** Archaeological and ethnological data on various prehistoric and historic groups are presented. Emphasis is on hunting and gathering cultures as a distinct type. Prerequisites: 101 and 102, or permission of the instructor. 3 lectures, alternate years.

444*. **Method and Theory in Archaeology.** An advanced course in archaeology with emphasis on method and theory. Prerequisites: 101, 102, 222, or permission of instructor. 3 lectures, alternate years.

**Sociology**

15*. **Sociology.** A general introduction to the subject covering the main concepts, theories and ideas and how they relate to study of groups in society.

100. **Introductory Sociology.** The sociological approach to social phenomena emphasizing analytical concepts and tools of investigation. 3 lectures.

202*. **Sociological Statistics.** A first course in sociological statistics; sampling, central tendency, probability, co-variance, as illustrated in specifically sociological data. 3 lectures.

205*. **Social Problems.** An 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 contribution of psychological processes to social interaction. Analysis of selected interpersonal events, such as the self, communication, and bonds, with special attention to the problem of social influence and social control. 3 lectures. Fall.

211*. **Social Structure and Character.** The relationship between social organization and modal as well as deviant personality types. Differential processes of socialization, and the effects of personality types on social organization. Social structures considered will include occupational, fraternal, and kinship groupings. 3 lectures.

212*. (Psychology 254*) **Interpersonal Relations.** The contribution of social organization to interpersonal processes. Consideration of some "theories" of
social interaction at the small group level. The social system approach to the problem of personal and interpersonal control. 3 lectures. Winter.

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.

248*. (History 248*, Political Science 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 only.

249*. (History 249*, Political Science 249*) Administrative Law. Discusses the issues raised by delegation of legislative and executive authority and the proliferation of administrative boards. 3 lectures. Winter term only.

250*. Crime and Society. An analysis and criticism of the major theories of criminal behaviour. Emphasis is given to the relationship between social structure and criminal behaviour; types of criminal behaviour such as drug addiction; statistics and contemporary research. A sound knowledge of sociological concepts is advisable. 3 lectures.

251*. Ethnic and Racial Relations. Relations between different racial and cultural groups; analysis of majority-minority group status. 3 lectures.

252*. Juvenile Delinquency. A systematic analysis and criticism is presented of biological, psychological, psychoanalytical and sociological theories of juvenile delinquency. Attention is given to statistics and contemporary research with special emphasis on the distribution and types of delinquent subcultures. Students should possess a sound knowledge of basic sociological concepts. 3 lectures.

260*. Population. The study of population as an area of sociological investigation; population size, composition, and distribution; population trends and problems. 3 lectures.

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Department of Sociology and Anthropology

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.

271*. The Functions and Effects of Mass Communication. The study of mass communication is viewed as embedded in a social context. The role of the larger social system in shaping systems of mass communication is considered, and the place of groups in mediating the impact of mass communicators on individuals in society.
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.

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.

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.

320. Sociological Research. A systematic treatment of the logic and practice of methods basic to social research. Examination of problems of experimental design, sampling, data gathering, and analysis in the context of case studies of research. Students will be given laboratory experience in several techniques of research.
3 lectures.
325. Sociological Theory. Major European and American sociologists and “schools” from Comte to the present. Emphasis will be less on history and biography than on the ideas, and their application to an understanding of major issues generated in human societies.
3 lectures.

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 with particular attention to evolutionism, historicism and functionalism. Theoretical problems are then examined within a specific context, such as social organization, social stratification, economic institutions, urban structures, etc.
3 lectures.

332*. Oriental Societies. Most sociological theories have been developed based on studies of Western societies. This course deals with the application of these theories to the analysis of Oriental social structures and social processes.
3 lectures.

335*. Sociology of Science. The study of science as an institution; its historical development and contemporary relationships with other institutions including government, education, and industry.
3 lectures.

339*. Industrial Sociology. Sociological analysis of industry, including relationships between labour and management and industry and society.
3 lectures.

340*. Formal Organizations. A survey of theory and research on formal organizations making use of selected contributions from the scientific management and human relations approaches, but with emphasis on the structure and functions of large scale organizations. The nature and types of formal organizations; control techniques and leadership; relations of the organization to its clients and publics; informal aspects of the organization; organizational tensions and pathologies of bureaucratic systems; how the organization adjusts to change.
3 lectures.

341*. Sociology of Occupations. The sociological study of occupations as an aid to understanding the social structure; social and demographic aspects of the labour force: the meaning of work; the relation of work and leisure; career and occupational mobility patterns; occupation and status; professionalization; trends in occupations.
3 lectures.

355*. 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.
Department of Sociology and Anthropology

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.


465. Readings. Selected readings and essay assignments under the direction of a staff member. 3 - 4 hours.

470. Seminar: Practicum in Theory and Methodology. A preparation for advanced undergraduate students for an independent, sophisticated orientation to graduate study. The practicum provides opportunities for:
(1) developing research designs on the basis of extant theory, and
(2) theorizing on the basis of the reanalysis and reinterpretation of extant data. 1 - 3 hours.

499. Senior Honours Essay. Required of all honours students in Sociology or Psychology-Sociology in their fourth year.

Graduate Courses

601. 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.
602. **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.

610. **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.

615. **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.

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.** Relationship between social structure and the process of socialization. The course is focused on comparing family structures in Gemeinschaft and Gesellschaft; and on examining the possible effects of differential socialization process on child's behaviour patterns.

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.
Department of Sociology and Anthropology

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.

Department of Spanish and Italian

J. C. McKegney, B.A. (Western), M.A. (Oregon), Ph.D. (Washington), Diploma (Santander)

Associate Professor and Chairman of the Department

M. I. Kieffer, C.R., B.A. (St. Louis), M.A. (McGill), J.C.D. (Gregorian)

Professor

C. M. Fernandez, Lic. en Arq. (Madrid), M.A. (Tulane) - Assistant Professor

E. Grey, B.A. (Texas Western), M.A. (Colorado), Ph.D. (Harvard)

Assistant Professor

M. Adelstein, Doctorado en Pedagogía (Havana)

Lecturer

E. Montoya, Bachillerato (Málaga)

Lecturer

Undergraduate Course Descriptions

General Arts students who wish to major in Spanish will take Spanish 100, 200, 300 and any two Honours Spanish courses chosen in consultation with the department chairman.

Note: The number of hours or lectures shown after the course description is an attempt to indicate the “normal”; each instructor determines how often his particular class will meet.

1-50. Introductory to Spanish. Intensive drill in the fundamentals of grammar and composition. The language laboratory will be used regularly. No prerequisite, though the student should have Grade 13 French.

5 lectures.

100. Survey of Spanish Literature. Intensive review of grammar and composition. Survey of Spanish literature. The language laboratory will be used regularly.

Prerequisite: Spanish 1-50 or Grade 13 Spanish.

4 lectures.

200. Survey of the Spanish Novel. For students in General Arts only. Critical survey of representative Spanish novels, from Lazarillo de Tormes to the mid-twentieth century. Lectures, readings, reports.

Prerequisite: Spanish 100.

3 lectures.

210. Spanish Civilization. A study in English of the main historical and cultural currents in Spain and Spanish America. (Honours Spanish students may not take this course for credit.)

3 lectures.


Prerequisite: Spanish 100.

3 lectures.
Department of Spanish and Italian

260. Prose and Drama of the 18th and 19th Centuries. Critical reading of the principal authors and playwrights of the period. Lectures in Spanish, readings, reports.
Prerequisite: Spanish 100.
3 lectures.

300. Survey of the Spanish Drama. For students in General Arts only. Critical survey of representative Spanish plays, from Juan del Encina to the mid-twentieth century. Lectures, readings, reports.
Prerequisite: Spanish 200.
3 lectures.

350. Advanced Composition. Writing of essays based on critical examination of selected plays and novels; discussion, in Spanish, of these works; practice in the language laboratory.
Prerequisite: Spanish 250.
2 lectures.

360. Spanish Prose and Drama of the 16th and 17th Centuries. Critical study of the literature of the Spanish Golden Age.
Prerequisite: Spanish 260.
2 lectures.

2 hours.

370. Survey of Spanish American Literature. A critical study of Spanish American literature from the Cortés letters to the present.
Prerequisite: Spanish 100.
3 lectures.

375. Individual Playwrights of the Golden Age.
3 hours seminar.

450. Senior Spanish Composition and Oral Practice. The language laboratory will be used regularly.
Prerequisite: Spanish 350.
2 lectures.

455. Individual Writers of the Twentieth Century.
3 hours seminar.

460. Spanish Literature of the 20th Century. Critical examination of the works of the most significant writers of this Century.
Prerequisite: Spanish 360.
2 lectures.

465. Cervantes and His Age.
3 lectures.
470. Mediaeval Spanish. Study of the literature from the beginnings to 1500 A.D.; introduction to Old Spanish grammar; elementary Portuguese. Prerequisite: Spanish 370. 2 lectures.

475. The Modernista Movement. 3 lectures.

476. The Novel in Mexico. 3 lectures.

480. Survey of Spanish Poetry. From the Poema del Cid to the present. Lectures, reports. Prerequisite: Spanish 300 or 360. 2 lectures.

Ukrainian — See page 234

Student Research
IX

Department of Co-ordination and Placement
Functions of Department of 
Co-ordination and Placement

The Department of Co-ordination and Placement is responsible for the successful operation of the industrial periods of the Co-operative Programmes. In addition, the department provides assistance to undergraduate and graduating students in all faculties in obtaining full-time or summer employment.

The staff of the department is comprised of professional personnel having extensive industrial experience. Each co-ordinator is responsible for a designated area and is the liaison officer between the University and the employers of students in his territory. Each acts as a counsellor and advisor to these students.

Director
A. S. Barber, P.Eng.

Associate Director
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, R. A. Sc. (Toronto), P.Eng.
A. L. Lind, B.Sc. (Queen's), P.Eng.
R. D. Mumford, B.Sc. (Queen's), P.Eng.
M. M. Smith, B.Sc. (Queen's), P.Eng.
M. S. Stevens, B.Sc. (Queen's), P.Eng.

Co-operative Mathematics

Assistant Director

Co-ordinators
D. V. Deverall, B.A. (Bishop's)
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-ordinator
J. D. Pearse, B.A. (Toronto)

Career Planning and Placement
C. F. Burk, M.A.Sc. (Toronto), P.Eng.
Miss E. McTavish, B.A. (Toronto), M.A. (Colorado State)

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.

All year I students enrol in September and spend the first term together at the University. As indicated on the diagram, they rejoin as a class for the last term to complete their course, and graduate together. Between the first and last terms, the diagram shows that each class is split into two approximately equal groups (streams) for continuity of employment opportunity on the co-operative programme. Both groups, of course, have the same total time on campus and in industry; one group having a double academic term at the start of the course and the other having a double academic term at the end of the course. The division at the end of the first term of study is based upon student preference, financial considerations of students, etc. Precise dates for the beginning and end of various terms are shown in the Academic Calendar.
The Work-Study Sequence

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

<table>
<thead>
<tr>
<th>1967</th>
<th>1968</th>
<th>1969</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Winter</td>
<td>Spring</td>
</tr>
<tr>
<td>Stream “A”</td>
<td>First Term</td>
<td>Second Term</td>
</tr>
<tr>
<td>Stream “B”</td>
<td>First Term</td>
<td>Work Period</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Winter</th>
<th>1970</th>
<th>Spring</th>
<th>Fall</th>
<th>1971</th>
<th>Spring</th>
<th>Fall</th>
<th>1972</th>
<th>Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stream “A”</td>
<td>Fifth Term</td>
<td>Work Period</td>
<td>Sixth Term</td>
<td>Work Period</td>
<td>Seventh Term</td>
<td>Work Period</td>
<td>Eighth Term</td>
<td></td>
</tr>
<tr>
<td>Stream “B”</td>
<td>Work Period</td>
<td>Fifth Term</td>
<td>Work Period</td>
<td>Sixth Term</td>
<td>Work Period</td>
<td>Seventh Term</td>
<td>Eighth Term</td>
<td></td>
</tr>
</tbody>
</table>

Co-operative Work Assignments

A basic requirement of the Co-operative Programmes at the University of Waterloo is satisfactory performance during co-operative work assignments.

Registration in a co-operative course implies that students will accept work assignments either through the regular interview procedure or where their best interests are served on an assignment that the Department may determine. All positions held by students must be approved by the Co-ordination Department in order to be considered as part of the required work assignments.

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 process. Copies of examination reports received by students while on work assignments are provided for the information of cooperating 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 ordinarily expect the income from his work periods to make him completely self-supporting.

Although the Co-ordination Department does not guarantee placement of students in industry, every effort is made to ensure that appropriate employment is made available.
Job notices are posted on the bulletin boards and students are asked to examine the notices and indicate their interest by applying for an interview appointment. An interview schedule is prepared and the company representatives interview the students on campus. The experience obtained in dealing with industry is a fundamental part of the student's education.

It is inevitable that some students will not be successful in being selected for employment on an assignment of their choice, and likewise that some companies will not obtain the students they have selected. Consequently, the Department will make every effort to place these students and satisfy the companies where the best interests of each can be served. On the other hand, the Department is not responsible for assisting in the placement of students required to repeat an academic term, until evidence of the successful completion of such term has been received.

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 companies 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 industry 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 periods in industry he carries a
responsibility to build and maintain his own good reputation as well as that
of the University. Poor performance, unexcused absence from work, consistent
lack of punctuality, inability to work with supervisors or fellow workers, lack
of interest in the job, will be interpreted as an indication that he is not accept-
able for professional training. A student who fails to honour an agreement to
work with a company or who leaves his co-operative employment without
prior approval from the Co-ordination Department, or who conducts himself
while on the job so as to purposely cause his discharge, may be suspended
immediately from the University for breach of discipline.

Co-operative education is a synthesis of two educational themes — the academ-
ic theme and the theme of organized practical training in the area of career
interest. These two themes, when carried on concurrently, give depth and
meaning to the formative years of learning. The numerous industrial and busi-
ness firms, as well as many other institutions and organizations that co-operate
with the University in providing an opportunity for students at Waterloo, have
entered a most serious undertaking to help prepare young men and women for
fruitful careers. These companies and institutions exemplify an enlightened
view of society's responsibility for preparing the coming generations of leaders.
Students feel that industry and society are indeed interested in their develop-
ment 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 numer-
ous institutions, co-operate to produce a richer educational experience for
university undergraduates. The task of the University is to engage their minds
in demanding and fundamental studies, while the role of those who co-operate
with the University is to engage their minds and youthful enthusiasm in the
complementary discipline of well-ordered work experience.

It is this concept that forms the basic philosophy and underlying principle of
co-operative education.

It is the Department of Co-ordination and Placement that provides the student
with assistance and counselling necessary to ensure proper integration of the
academic and industrial phases of his education.

**Industrial Advisory Council for the Co-operative Engineering Programme**

The Industrial Advisory Council is composed of delegates from companies
interested in engineering education. The Council acts in an advisory capacity
presenting industry's viewpoint to the University on the programming of the
co-operative course at Waterloo as it affects the relations of the University
and its students with industry. A list of members follows:
Northern Electric Company Limited
Union Carbide Canada Limited
Anthes Eastern Limited
C. C. Parker and Associates
Shell Canada Limited
Air Canada
Aluminum Company of Canada Limited
Ball Brothers Limited
The Bell Telephone Co. of Canada
Canadian General Electric Co. Ltd.
Canadian Westinghouse Co. Ltd.
Coulter Copper & Brass Co. Ltd.
Cyanamid of Canada Limited
Dominion Textile Company Limited
Dupont of Canada Limited
Fiberglas Canada Limited
City of Hamilton
Hawker Siddceley Canada Limited
International Harvester of Canada Ltd.
Kaufman Footwear Limited
Kimberly-Clark Pulp & Paper Co. Ltd.
Noranda Mines Limited
Pigott Construction Company Ltd.
Proctor & Redfern
The Steel Company of Canada Limited
Woods, Gordon and Company

Mr. J. B. Hutchinson
Chairman
Mr. G. O. Loach
Past-Chairman
Mr. C. H. Watson
Vice-Chairman
Mr. C. C. Parker
Vice-Chairman
Mr. H. L. Hinchcliffe
Secretary
Mr. J. T. Dyment
Mr. H. J. Baker
Mr. L. J. Eskritt
Mr. J. T. Fisher
Mr. W. F. McMullen
Mr. H. J. Simmons
Mr. W. R. Coulter
Mr. H. B. Van Hartesveldt
Mr. K. C. F. Mills
Dr. H. R. L. Streight
Mr. A. J. Fisher
Mr. W. A. Wheten
Mr. W. D. Walker
Mr. H. F. Schnell
Mr. W. H. Bechtel
Mr. C. C. Wright
Mr. R. P. Riggin
Mr. D. H. Stevens
Mr. A. Staig
Mr. C. P. Layard
Mr. H. P. Connor

Companies Employing Co-operative Honours Mathematics Students

A.G.T. Management Systems Consultants
Aluminum Company of Canada, Limited
Automatic Electric (Canada) Limited

Bata International Centre
The Bell Telephone Company of Canada
The British American Oil Company Limited

Canadair Limited
The Canada Life Assurance Company
Canadian Canners Limited
Canadian General Electric Company Limited
Canadian General-Tower Limited
Canadian Ingersoll-Rand Company Limited
Canadian Kodak Co., Limited
Canadian National Railways
Canadian Tire Corporation Limited
Canadian Westinghouse Company Limited
Cockshutt Farm Equipment of Canada Limited
Colgate-Palmolive Limited
Confederation Life Assurance Association
The Consumers' Gas Company
Co-operators Insurance Association
Crown Life Insurance Co.

DCF Systems Limited
The Dehavilland Aircraft of Canada Ltd.
Dominion Life Assurance Company
Dominion Stores Limited
Dominion Textile Company Limited
Domtar Consumer Products Ltd.
Dunlop Canada Limited

Electric Reduction Company of Canada, Ltd.
The Empire Life Insurance Company
The Excelsior Life Insurance Company

Firestone Tire & Rubber Company of Canada, Ltd.
Ford Motor Company of Canada, Limited

Galt Metal Industries Limited
General Foods Limited
General Motors of Canada, Limited
Global Life Insurance Company
B. F. Goodrich Canada Limited

Government of Canada:
   Central Data Processing
   Dept. of Agriculture
   Dept. of Finance
   Dept. of Forestry
   Dept. of Mines & Technical Surveys
   Dept. of National Defense
   Dept. of Northern Affairs
   Dept. of Transport
   Dominion Bureau of Statistics
   National Energy Board
   Canada Post Office
W. R. Grace & Co. of Canada Limited

Honeywell Controls Limited
The Hydro-Electric Power Commission of Ontario
The Imperial Life Assurance Company of Canada Limited
Imperial Oil Limited
International Business Machines Company Limited
International Harvester Company of Canada, Limited
John Labatt Limited
London Life Insurance Company
The Manufacturers Life Insurance Company

McKinnon Industries Limited
Montreal, Bank of
The Mercantile and General Reinsurance Company, Limited
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 Telephone Limited
Nova Scotia, The Bank of

Ontario, Province of
   Dept. of Highways
   Treasury Board

Pan American Petroleum Corporation
Polymer Corporation Limited
H. K. Porter Company Canada Limited
The Proctor & Gamble Company of Canada, Limited
The Prudential Assurance Company Limited
Pulp & Paper Research Institute of Canada
Shell Canada Limited
Simpsons-Sears Limited
The Robert Simpson Company Limited
Sklar Furniture Company
The Sovereign Life Assurance Company of Canada
The Steel Co. of Canada, Limited
Sun Life Assurance Company of Canada
Sun Oil Company Limited

Texaco Canada Limited
Toronto, City of - Finance Dept.
The Toronto Stock Exchange

Union Gas Co. of Canada, Limited
United Aircraft of Canada Limited
United Co-operatives of Ontario
Univac-Canada, Division of Sperry-Rand Limited

Wabush Mines
Westmount Life Insurance Company
Workmen's Compensation Board
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
Hamilton General Hospital, Department of Psychiatry
Jewish Vocational Service, Toronto
The Kitchener Separate School Board
Kitchener-Waterloo Hospital, Department of Psychiatric Services
Northern Electric Co. Ltd., Department of Manpower Requirements
Ontario, Province of
   Department of Civil Service, Personnel Research Branch
   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
Sutherland Educational Clinic, Toronto
Windsor Board of Education
The Workmen's Compensation Board, Hospital & Rehabilitation Centre
Toronto Metropolitan Separate School Board
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Companies Employing Co-operative Engineering, Applied Physics and Applied Chemistry Students

Abex Industries of Canada Limited
Abitibi Power and Paper Company Limited
Aerovox Canada Limited
Aiken & MacLachlan Limited
Ainley & Associates
Air Canada
The Algoma Steel Corporation, Limited
Alleu-Bradley Canada Limited
Allied Chemical (Canada) Limited, Brunner Mond Division
Aluminum Company of Canada, Limited
Aluminum Laboratories Limited
American-Standard Products (Canada) Limited
Anaconda American Brass Limited
R. V. Anderson & Associates Limited
Angelstone Limited
H. H. Angus & Associates Ltd.
Anthes Eastern Limited
Atomic Energy of Canada Limited
Aunor Gold Mines Limited
Automatic Electric (Canada) Limited
Automotive Hardware Limited
Aviation Electric Limited
Babcock-Wilcox and Goldie-McCulloch Limited
Bailey Meter Company Limited
Ball Brothers Limited
Barnes Electric Company Limited
Bata Shoe Company of Canada Limited
Beatty Bros. Limited
Beer Precast Concrete Limited
The Beaver Wood Fibre Company, Limited
Bell-Camp Corporation Limited
The Bell Telephone Company of Canada
Bendix-Eclipse of Canada Limited
Black Clawson-Kennedy Ltd.
Black & McDonald Limited
Blackstone Industrial Products Limited
Black, Shoemaker & Robinson
Blacktop Paving Company Limited
W. H. Bonus & Associates Ltd.
The Borden Chemical Company (Canada) Ltd.
Bowmar, Canada Limited
S. F. Bowser Company Limited
Brampton, Town of
Brant, County of
Brantford, The Corporation of the City of
Brantford, Public Utilities Commission
The British American Oil Company Limited
British American Research & Development Company
British Motor Corporation of Canada Limited
Brown & Root Limited
Building Products of Canada Limited
Burlington, Corporation of the Town of
Burlington, Public Utilities Commission of
Butts, Ross & Associates, Ltd.

CAE Industries Limited
Calvert Distillers Limited
Campbell Red Lake Mines Limited
Canbar Wood Tank Company—Division of Canada Barrels & Kegs Limited

Canada and Dominion Sugar Company Limited
Canada Foundries & Forgings, Limited
Canada Iron Foundries, Limited—Electrical Division
Canada Machinery Corporation, Limited
The Canada Metal Co., Limited
Canada Packers Limited
Canada Sand Papers Limited
Canada Starch Company Limited
Canada Vitrified Products Limited
Canadair Limited
Canadian Admiral Corporation, Ltd.
The Canadian Blower & Forge Company Limited
Canadian Broadcasting Corporation
The Canadian Coleman Company, Limited
Canadian Copper Refiners Limited
Canadian Electrolytic Zinc Company Limited
Canadian Filters Limited
Canadian General Electric Company Limited
Canadian General-Tower Limited
Canadian Hanson & Van Winkle Company Ltd.
Canadian Industries Limited
Canadian Ingersoll-Rand Company Limited
Canadian International Paper Company
Canadian Johns-Manville Co., Limited
Canadian Kodak Co., Limited
Canadian Marconi Company
Canadian National Railways
Canadian National Telecommunications
Canadian Pacific Railway Company
Canadian Pacific Telecommunications
Canadian Refractories Limited

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The Canadian Salt Company Limited
Canadian SKF Company Limited
Canadian Vickers Limited
Canadian Westinghouse Company Limited
Carter Bros. (Waterloo) Ltd.
Catalytic Construction of Canada Limited
Chatham, City of
Chemcell Limited
Chicago Rawhide Products Canada Limited
Chinook Chemicals Corporation Limited
Chrysler Canada Ltd.
Clare Brothers 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
Concrete Pipe Limited
Consolidated Paper Corporation Limited
Consolidated Sand & Gravel Limited
The Consumers' Gas Company
Continental Can Company of Canada Limited
Cooper-Bessemer of Canada Ltd.
Coulter Copper & Brass Co., Limited
Crowe Foundry Limited
CSA Testing Laboratories
CTS of Canada, Ltd.
Cutler-Hammer Canada Limited
Cyanamid of Canada Limited

Dahmer Steel Limited
Damas & Smith Limited
Daystrom, Limited
Dearborn Chemical Company Ltd.
Decca Radar (Canada) Limited
John Deere Welland Works
The De Havilland Aircraft of Canada, Limited
De Laval Company Limited
De Leuw, Cather & Company of Canada, Limited
M. M. Dillon & Company Limited
P. D. Dirksen Limited
Dodge Construction Company Limited
Dominion Bridge Company Limited
Dominion Die Casting Limited
Dominion Electrohome Industries Limited
Dominion Foundries and Steel, Limited
Dominion Road Machinery Co., Limited
Domtar Chemicals Limited
Domtar Construction Materials Ltd.
Domtar Limited
Domtar Newsprint Limited
Domtar Pulp & Paper Limited
P. R. Donahue Ltd.
Donald Inspection Limited
Dosco Steel Limited
Dravo Corporation
Dryden Chemicals Limited
Dryden Paper Company Limited
Dufresne Engineering Company Limited
Dunker Construction Limited
Dunlop Research Centre
Du Pont of Canada Limited

Eastern Steel Products Company—Div. of Turnbull Elevator Limited
Eaton Automotive Canada Limited
T. Eaton Company Limited
The E. B. Eddy Company
Eldorado Mining and Refining Limited
Electrical Bureau of Canada
Emco Limited
Enelco Limited
Erie Technological Products of Canada, Ltd.
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
Fisher & Porter (Canada) Limited
Fisher Governor Company of Canada Limited
Ford Motor Company of Canada, Limited
Foster Wheeler Limited
The Foundation Company of Canada, Limited
Foxboro Company, Limited
Frankel Structural Steel Limited
Fraser-Brace Engineering Company, Limited
The Frontier College
Fruehauf Trailer Company of Canada Limited

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John Gaffney Construction Company Limited
W. J. Gage Limited
Galt, City of
Gamma Engineering Ltd.
Gaspé Copper Mines Limited
Genaire (1961) Limited
General Concrete Ltd.
General Foods Limited
General Motors of Canada, Limited
Giffels Associates Limited
B. F. Goodrich Canada Limited
The Goodyear Tire & Rubber Company of Canada, Limited
Gorc & Storrie Limited

Government of Canada:
Department of National Defence
Department of National Health & Welfare
Department of Public Works
Department of Transport

W. R. Grace & Co. of Canada Ltd.
A. P. Green Refractories (Canada) Ltd.
Grey, County of
Gummed Papers Limited

Hahn Brass Limited
Hallnor Mines, Limited
Hamilton, City of
Hamilton Gear and Machinery Company—Division of Turnbull Elevator Ltd.
J. Harris & Sons Limited
Hawker Siddeley Canada Limited
Hayes Steel Products Limited
H. J. Heinz Company of Canada Ltd.
R. R. Higgins & Associates Limited
Hilroy Envelopes & Stationery Limited
Honeywell Controls Limited
The Hoover Company Limited
Horton Steel Works Limited
James Howden & Parsons of Canada Limited
Hussman Refrigerator Company Limited
The Hydro-Electric Power Commission of Ontario

Imperial Oil Enterprises Ltd.
Indesco Limited
Interchem Canada Limited—Ault & Wiborg Division
International Business Machines Company Limited
International Cellulose Research Limited
International Harvester Company of Canada, Limited

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International Nickel Company of Canada, Limited
International Systcoms Limited
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
Kayson Plastics & Chemicals Limited
Kellogg Company of Canada, Limited
The Kendall Company (Canada) Limited
Kilborn Engineering Limited
Kimberly-Clark of Canada Limited
Kimberly-Clark Pulp & Paper Company Limited
Kitchener, City of
Kitchener Electronic Industries Limited
Konvey Construction Company Limited
Kruschen & Dailey
Kuntz Electroplating Limited
The KVP Company Limited

John Labatt Limited
Lake Ontario Steel Company
J. Edward Lanthier
Leeds & Northrup, Canada, Ltd.
Legatt Aircraft Limited
Leigh Instruments Limited
Lennox Industries (Canada) Limited
Link-Belt Limited
Link-Belt Speeder (Canada) Limited
Liquid Carbonic Canadian Corporation Limited
Litton Systems (Canada) Limited
Logan Contracting Limited
London, City of
Looby Construction Ltd.

McCavour Developments Limited
McCormick & Raukin Limited
W. A. McDougall Limited
McGrath Engineering Limited
Mcnulty Porcupine Mines, Limited
A. M. MacKay & Associates Limited
Arthur G. McKee & Company of Canada Ltd.
McKinnon Industries Limited

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James F. MacLaren Limited
MacLeod Cockshutt Gold Mines Limited
McNamara Marine Limited
Mansfield-Denman General Limited
Marshall Macklin Monaghan Limited
Marsland Engineering Limited
Massey-Ferguson Brantford Limited
Mathews Conveyor Company Limited
Mattagami Lake Mines Limited
Minnesota Mining & Manufacturing of Canada Limited
O. G. Moffat Limited
Molson’s Brewery (Ontario) Limited
Montreal Engineering Company Limited
Murray Printing & Gravure Limited
National Sewer Pipe Limited
National Sound Services Limited
National Steel Car Corporation Limited
Niagara Falls, City of
R. H. Nichols Co. Limited
A. C. Nielsen Co. of Canada Ltd.
Noranda Mines, Limited
North Bay, City of
Northern Electric Company Limited
Northern Telephone Limited
Norton Company

Oakville, Town of
Oakville, Public Utilities Commission of
W. H. Olsen Manufacturing Company Limited
Ontario Northland Communications
The Ontario Paper Company Limited
Ontario, Province of
    Department of Health
    Department of Highways
    Department of Mines
Ontario Water Resources Commission
Orchan Mines Limited

Pamour Porcupine Mines, Limited
C. C. Parker and Associates Limited
John B. Parkin Associates
Peterborough, City of
W. R. Petri, P.Eng.
Phelps Dodge Corporation of Canada Limited
Philips & Roberts Limited
Pigott Construction Company Limited
Pioneer Electric Eastern Limited
Pioneer Saws Ltd.
Ios. F. M. Poelman & Associates Limited
Polymer Corporation Limited
Potter & Brumfield—Division of AMF Canada Limited
The Powers Regulator Company of Canada, Limited
Powertronic Equipment Limited
Pre-Con Murray Limited
Prestolite Limited—Battery Division
Preston, Town of
Price Brothers & Company, Limited
Procor Limited
The Proctor & Gamble Company of Canada, Limited
Proctor & Redfern
Pro-Eco Limited
Provincial Gas Company Limited
Provincial Paper, Limited
Purolator Products (Canada) Limited
Pye Electronics Limited
Quebec North Shore Paper Company
Quemont Mining Corporation, Limited
Quist & Associates

Ralston-Purina Company of Canada Limited
Raytheon Canada Limited
RCA Victor Company, Ltd.
Read Voorhees & Associates, Ltd.
Red-D-Mix Concrete Limited
Redfern Construction Company Limited
Richards-Wilcox Company—Division of General Products Mfg., Corp
Ltd.
Rio Algom Mines Limited
P. L. Robertson Manufacturing Co. Limited
E. S. & A. Robinson (Canada) Limited
Roelofson Elevator Company—Div. of Montgomery Elevator Co. Ltd.
B. M. Ross and Associates Limited
Ross Division—Midland-Ross of Canada Limited
Royal Military College of Canada
Rubbermaid (Canada) Limited
R. W. D. Tool Industries Ltd.

St. Anne Paper Co. Ltd.
St. Lawrence Cement Co.
The St. Lawrence Seaway Authority
St. Mary's Cement Co., Limited
Salter & Allison
Samsonite of Canada Limited
L. J. R. Sanders Company Limited

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Sandwell and Company Limited
F. Schaeffer & Associates Limited
Schell Industries Ltd.
Schlumberger of Canada
J. M. Schneider Limited
Joseph E. Seagram & Sons Limited
Sehl Engineering Limited
Shawinigan Chemicals Limited
Sheldons Engineering Limited
Shell Canada Limited
M. V. Shore & Associates
Shore & Moffat and Partners
Sick Children's Hospital
A. C. Simmonds & Sons Ltd.
Sinclair Radio Laboratories Ltd.
Smith & Stone Limited
S. N. C. Filer, Limited
Spruce Falls Power & Paper Co., Limited
Standard Paving & Materials Ltd.
Standard Tube & T. I. Limited
The Steel Company of Canada, 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
Sutcliffe Company
Swansea Construction Company Limited
Swift Canadian Co. Limited

Teck Corporation Limited
Tele-Radio Systems Limited
Texaco Canada Limited
Texas Instruments Inc.
Thompson Products Limited
Timberland-Ellicott Limited
T M C (Canada) Limited
Toronto, City of—Board of Education
Toronto, The Corporation of the Township of
Toronto Foundry Limited
Toronto, Municipality of the Metropolitan—Dept. of Works
Toronto Transit Commission
Trans-Canada Pipe Lines Limited
W. A. Trow & Associates Limited
Union Carbide Canada Limited
Union Gas Company of Canada, Limited
UniRoyal (1966) Limited
United Aircraft of Canada Limited
Unitel Limited
Universal Plumbing & Heating Company (1961) Limited
Ure & Smith

Versafood Services Limited
Vickers-Sperry of Canada Ltd.

Wabush Mines
Walter, Eull & Elliott Ltd.
Warnock-Hersey Company Ltd.
Waterloo, City of
Waterloo, County of
Waterloo Public Utilities Commission
The Weatherhead Co. of Canada, Ltd.
Jervis B. Webb Company of Canada, Ltd.
Welland, County of
Willroy Mines Limited
The W. C. Wood Company Limited

Yolles & Rotenberg Limited
X

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.

Retiring Chancellor, The Hon. Dura H. Porter receiving an Honourary Degree at the Fall Convocation 1966.
Residence, Housing Service, Bookstore

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 colleges federated and affiliated with the University. These diverse elements together form a crown, and the points of the crown, while tending toward a union do not quite touch but remain as individuals suspended in tension and yet engaged in a deep harmony. This creative process is focussed not on the traditional spherical orb of static perfection but rather on an elliptical silver ovum — the egg-shaped symbol of creativity — the marvelous potential of a new individual life.

Residence

Students in all faculties are eligible to apply for residence in Conrad Grebel College, Renison College, St. Jerome's College, St. Paul's College or the University Residence Village.

Conrad Grebel College (Mennonite) offers residence accommodation for sixty-five men and forty women.

Renison College (Anglican) offers residence accommodation for ninety-eight men and eighty women.

St. Jerome's College (Roman Catholic) have available a men's residence with accommodation for one hundred students and a women's residence with accommodation for fifty-five students under the supervision of the School Sisters of Notre Dame.

St. Paul's United College offers accommodation for one hundred men and fifty women.

The University of Waterloo Residence Village (non-denominational) offers accommodation for 1,024 men and 235 women. Approximately forty-five residents are accommodated in each of twenty-six houses surrounding the Village Square and Dining Hall complex. Each house is supervised by a Resident Don, and each six houses by a Tutor. A house contains three floors. In addition to the usual facilities, each floor has a lounge and a kitchenette.

Application forms may be obtained from the Registrar, University of Waterloo.

Housing Service

The Housing Office provides addresses of private homes to students wishing to live off-campus. These are not inspected or supervised by the University. Freshman students must bring with them proof of University admission when they apply for assistance. All inquiries must be made in person between the hours of 9:00 a.m. and 5:00 p.m., Monday to Friday. The Housing Office observes all legal holidays.

Bookstore

University of Waterloo students may purchase textbooks, stationery and engineering supplies at the University's modern bookstore, located on the ground
floor of the Engineering Building. The bookstore 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 bookstore is also open from 7:00 p.m. to 9 p.m. In addition to textbooks, reference materials, paper supplies and drawing materials, the University of Waterloo bookstore also features the largest display of quality paperbacks in Kitchener-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, conferences, workshops, intensive short courses and University orientation programmes.

The Department does not offer correspondence courses. Courses not fully developed at the time of the publication of the Calendar are advertised in sufficient time to acquaint 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

All courses and seminars in the Centre for Continuing Studies in Marketing program 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 forty lecture hours. No such “Acknowledgement” is granted for short-term seminars.

In the five years in which marketing courses have been offered over four hundred national marketers from coast to coast have enrolled one or more of their executives at all levels of line and staff responsibility. Over twelve hundred marketing people have participated in the various courses and seminars which have comprised the “Centre’s” total program.

Although the program has grown by the end of 1966-67 academic year from the original Advanced Course in Marketing and Sales Management instituted in 1962 to fourteen courses, 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.

Timetable of Courses 1967-68

September 13, 14 & 15 and November 15 & 16—1967
Sales Management Course

October 11, 12 & 13
New Product Development Seminar

November 22, 23 & 24
Product Management Seminar

December 6, 7 & 8
Sales Management Seminar (Advanced Studies)

January 2, 3, 4 & 5—1968
Field Sales Management Seminar

January 17, 18, & 19 and March 6 & 7
Marketing Management Course

January 31 & February 1 & 2
Marketing Planning Seminar

February 14 & 15
Sales Office Management Seminar

March 13, 14 & 15
Sales Manpower Development Seminar

March 27 & 28 and May 22 & 23
Sales Promotion Management Course

April 10 & 11
Marketing Research Course

April 24, 25 & 26
Marketing Management Seminar (Advanced Studies)

May 8, 9 & 10
Physical Distribution Management Seminar

June 4, 5, 6 & 7
Field Sales Management Seminar

June 19, 20 & 21
Management of Advertising Seminar
Student Discipline

The University of Waterloo is a community of men and women who have come together to enjoy the privileges and to accept the responsibilities of University life. The traditional privileges of a University are freedom of inquiry and freedom of expression. To maintain these freedoms it is the obligation of all students to adhere to a standard of responsible social behaviour that shall not reflect discredit upon the University. All students are reminded that they are bound to live in accordance with the laws of the community. Specifically this means respect for University regulations, personal liberty and civil law.

Students are subject to University regulations governing their behaviour at all times while remaining members of the University. Regulations and infractions thereof may be reviewed by a President’s Committee on Student Discipline and University Regulations. The members of this committee include University officers, faculty and students.

International Student’s Association

The organization is open to all students including Canadians, both graduate and undergraduate. The purpose: to promote intellectual, cultural and social activities; foster international co-operation and understanding; and assist in the orientation of students from other countries. Monthly meetings are held. International Cuisine Dinners and International Song and Dance Evening are part of the Association’s program. Trips of interest to the members are organized. Membership fee is $1.00 per year.

Health Services

Health Centre - The Health Services offer a first-aid and medical care centre on campus with Registered Nurses in attendance Monday through Friday from eight-thirty to five. The University Physician is available for consultation on campus at regular hours daily.

Health Insurance—Undergraduate students are covered from the date of registration by a University Health 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 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.

Further information about the University’s Health Insurance Plan may be obtained from the insurance clerk in the Federation Office. 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 Constitution of the Federation of Students which guarantees certain rights and privileges to students was approved by the Board of Governors of the University on the recommendation of the Student's Council after a campus-wide referendum.

**Objects and Purpose.** The "Objects and Purpose" of the Federation are:

1. "The promotion of the welfare and interests of the students of the University of Waterloo.
2. The promotion and co-ordination of student participation in athletic, cultural and social activities.
3. The maintenance of communication between the student body and the authorities of the University.
4. To represent members of the Federation in matters affecting the common interest.
5. To encourage inter-university co-operation and communication."

**The Students' Council.** Twenty-five elected members and officers make up the Students’ Council which is the governing body of the Federation. Members representing all faculties, societies and colleges are included.

The functions of the Students’ Council include: upholding the "Objects and Purpose" of the Federation, administration and control of finances, and operation and control of all Boards and Committees of the Council. Almost all of the social, cultural and athletic activities of the student body are managed by the Students’ Council as well as off-campus representation of the student body.

**Organization.** The activities of the Students' Council are carried out by its various boards and committees which are directed by a student chairman.

**The Executive Board.** The Executive Board is composed of the principal officers of the Students’ Council including the President, Vice-President, Treasurer, and all Board Chairmen. The Board controls day-to-day administration, finance, and recommends policy to the Students’ Council. It also co-ordinates the activities and programmes of all other Boards and provides liaison between them.

**The Creative Arts Board.** The Creative Arts Board, whose membership includes students and also faculty and staff, provides cultural programmes and activities in music, art, drama and films. Performing and interest groups in each area are supported and assisted by this Board, and its three professional directors of music, drama and art. In addition, a series of professional attractions are selected by the Board for presentation throughout the academic year. Groups sponsored by the Creative Arts Board include, in drama: St. Aethelwold's Players, Renison Players Guild and the University Drama Group; in
Federation of Students

music: Chamber Orchestra, Concert Band, Dance Band, Marching Band, Madrigal Singers, Glee Club, and the Opera Chorus; in art: Gallery Exhibitions and lecture series; and, in film: International Film Series and Noon-Hour Film Series.

The Board of External Relations. The Board of External Relations represents the Federation in activities, programmes and organizations which are external to the campus of the University of Waterloo and in which participation is desirable. Federation policy concerning local, national and international affairs is formulated and promulgated by the Board through its four commissions — Representation, Information and Services, International Affairs and Domestic Affairs.

Selected students representing the Federation attend a variety of conferences and seminars of many organizations including those of the Canadian Union of Students (C.U.S.), the Ontario Region of the Canadian Union of Students (O.R.C.U.S.), the Seminar on International Student Affairs (S.I.S.A.), the World University Service (W.U.S.), National Conference, the International Affairs Conference, the Canadian Union of Students Overseas (C.U.S.O.) Conference, the Student United Nations Associations in Canada Conference (S.U.N.A.C.), and the Conference on Inter-American Student Projects (C.I.A.S.P.).

Services provided by the Board have included travel services, the student discount service, the conduct of surveys and the promotion of C.U.S. Life Insurance.

The Board of Publications. The Board of Publications is responsible for all student publications. Its activities can provide experience in all aspects of journalism and publishing as well as advertising and general business experience. Its major publications include:

- Chevron the weekly student newspaper;
- Compendium the University yearbook;
- Volume 63 a biannual poetry magazine;
- Jabberwocky a biannual literary magazine;
- Focus an annual engineering journal and review;
- Student Directory an annual campus directory;
- Events Calendar an annual calendar of university events;

The Board of Student Activities. The Board of Student Activities co-ordinates and supervises all campus-wide programmes including Orientation, Homecoming, Winter Festival, Graduation Ball, House of Debates, and the Federation Lecture Series. In addition, the Board assists the operation of each campus club and society.

There is a wide variety of organizations, some of which are listed below:

Societies Arts, Engineering, Science.

Course Clubs Biology, Chemical Engineering, Civil Engineering, French, Geography, German, Mathematics and Physics, Mechanical Engineering, Philosophy, Politics, Russian.
Political

Liberal, New Democratic, Progressive Conservative, Communist.

Professional

American Society of Mechanical Engineers (ASME), Chemical Institute of Canada (CIC), Engineering Institute of Canada (EIC), Institute of Electrical & Electronic Engineers (IEEE).

Religious

Inter-Varsity Christian Fellowship (IVCF), Newman, Student Christian Movement (SCM).

Service

Circle K.

Special Interest

Chess, Curling, Folk Song, International Folk Dance, International Students Association (ISA), Radio Broadcast, Amateur Radio, Ski, Flying, Judo, Stereo, Student Wives, Ukrainian, Muslim Students Association (MSA), Rowing, Tiddlywinks, Women’s Athletics, Friends of S.N.C.C.

Judicial Committee. The Judicial Committee of the Federation serves as a student court and determines such matters as student suits, breach of Federation rules, the constitutionality of student government actions and matters referred to it by other authorities. The five justices who are graduate or senior students receive the support of university and civic officials in many areas of student self-discipline.

Persons wishing more information on any aspect of Federation activities are advised to write

The Federation of Students,
University of Waterloo,
Waterloo, Ontario, Canada

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Career Planning and Placement.

Career Planning and Placement. The Career Planning and Placement section of the Department of Coordination and Placement provides assistance for graduates seeking permanent employment and undergraduates seeking summer employment. It is customary for employers to interview graduating students on the campus during a three-week period beginning the third week of January. Career Planning and Placement serves students of all faculties and is located on the sixth floor of the Arts Library Building.

The Canadian Officers' Training Corps (COTC)

The Canadian Officers' Training Corps offers undergraduates an opportunity to qualify for commissions in the Canadian Army, either Active or Reserve, through a training programme especially designed to meet their requirements.

Students are eligible who are:

(a) British subjects or Canadian citizens between the ages of seventeen and twenty-five.

(b) Of a physical standard suitable for the Canadian Army Active Force.

(c) Following a course of study leading to a recognized degree.

Training provided is in two parts:

(a) Two hours a week of theoretical training in military subjects during the academic year.

(b) Twelve to fifteen weeks of practical training during the summer.

Students accepted for COTC are appointed Officer Cadets and upon successful completion of two years training are eligible for the rank of Lieutenant in the Canadian Army (Militia) and, on graduation, are eligible for a commission in the Canadian Army (Regular). Members receive pay and allowances for rank. The current rate is $250.00 per month. Each two-hour training period during the academic year entitles the member to half a day's pay. During the summer training food, accommodation, clothing and travelling expenses are provided.

Students wishing to apply for COTC training should present themselves to:

Career Planning and Placement Services
Department of Coordination and Placement

before November 1, after which no applications will be considered.

Regular Officers' Training Plan (ROTP)

Under this plan successful applicants are enrolled as Officer Cadets. They are paid $180.00 per month ($187.00 effective Oct. 1st 1967). Tuition is paid on their behalf and they also receive a book and instrument grant in the amount
of $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
XI

The University Libraries
The University Libraries

University Librarian
(Mrs.) Doris E. Lewis, B.A., B.L.S., (Toronto)

Assistant to the Librarian
(Miss) Helen McKinnon, B.A. (Saskatchewan), B.L.S. (Toronto),
M.L.S. (McGill)

Acquisitions Department
Head
(Mrs.) Enid Waterman, B.A. (McMaster), B.L.S. (Toronto)

Serials Librarian
(Mrs.) Carolyn Pawley, B.A. (McMaster), B.L.S. (Toronto)

Acquisitions Librarian
Paul Dyment, B.A. (Manitoba), B.L.S. (McGill)

Bibliographic Searching Department
Head
(Mrs.) Patricia Noonan, B.A. (Western), B.L.S. (Toronto)

Cataloguing Department
Head
Robert G. Bean, B.A. (Western), B.L.S. (Toronto)

Cataloguers
(Miss) Catherine Blackshaw, B.A. (Carleton), B.L.S. (Toronto)
(Mrs.) Jean Hill, B.A. (Western), B.L.S. (Toronto)
(Miss) Joan Scanlon, B.A., M.A., B.L.S. (Toronto)
Wasyl Sirskyj, B.A., B.L.S. (Toronto)
(Miss) Sylvia Stubbs, B.A. (Waterloo Lutheran), B.L.S. (Toronto)
(Mrs.) Ellen Tom, B.A. (McMaster), B.L.S. (Toronto)

Circulation Department, Arts Library
Head
(Miss) Elaine Reaman, B.A. (McMaster), B.L.S. (Toronto)

Reference Department, Arts Library
Head
(Miss) M. I. Belle Grant, B.Sc. (Columbia), B.L.S. (Wisconsin),
M.A.L.S. (Michigan)
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 65,000 volumes of books and bound periodicals in Science, Mathematics and Technology, 1600 current journals and a fine collection of indexes, abstracts and other reference materials. There are 160 seats at study tables and carrels.

The total library holdings of the University includes approximately 200,000 volumes of books and bound journals, 3,000 current periodical subscriptions and many kinds of special materials. The collection is increasing at the rate of 50,000 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.
XII

Scholarships
Prizes
and
Financial Aid
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 enrolls 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 Program

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 $400 or a lesser amount depending on the amount of other awards.

English or Francais are obligatory subjects and will count as two credits. No application is required.

National and University Scholars

The following students have been named University National and University Scholars for the 1966-67 academic year.

University National Scholars

<table>
<thead>
<tr>
<th>Name</th>
<th>City</th>
<th>Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonnie Ann Barton</td>
<td>Scarborough, ON</td>
<td>Arts III</td>
</tr>
<tr>
<td>Richard Lawrence Ferch</td>
<td>Fort William, ON</td>
<td>Science III</td>
</tr>
<tr>
<td>John Joseph Koval</td>
<td>Sarnia, ON</td>
<td>Science II</td>
</tr>
<tr>
<td>James Keith Lindsey</td>
<td>Mono Road, ON</td>
<td>Science III</td>
</tr>
<tr>
<td>Joseph Micheal Meaden</td>
<td>Fort William, ON</td>
<td>Science II</td>
</tr>
<tr>
<td>Richard Bruce Powell</td>
<td>Niagara Falls, ON</td>
<td>Engineering II</td>
</tr>
<tr>
<td>Ian Timothy Turner</td>
<td>Port Arthur, ON</td>
<td>Science II</td>
</tr>
</tbody>
</table>

University Scholars

<table>
<thead>
<tr>
<th>Name</th>
<th>City</th>
<th>Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>William Robert Ahleson</td>
<td>Sault Ste. Marie, ON</td>
<td>Arts II</td>
</tr>
<tr>
<td>Karen Crystal Adam</td>
<td>Oshawa, ON</td>
<td>Arts I</td>
</tr>
<tr>
<td>Nancy Margaret Adamovits</td>
<td>Bramalea, ON</td>
<td>Science I</td>
</tr>
<tr>
<td>Barry Grant Adams</td>
<td>Paris, ON</td>
<td>Engineering II</td>
</tr>
<tr>
<td>Alan Aage Adamson</td>
<td>Manotick, ON</td>
<td>Arts I</td>
</tr>
<tr>
<td>John Herman Ahrens</td>
<td>Galt, ON</td>
<td>Science III</td>
</tr>
<tr>
<td>Gary George Albach</td>
<td>Ridgeway, ON</td>
<td>Science I</td>
</tr>
<tr>
<td>James Ellsworth Alexander</td>
<td>Port Arthur, ON</td>
<td>Engineering III</td>
</tr>
<tr>
<td>Linda Gail Allems</td>
<td>Kitchener, ON</td>
<td>Arts III</td>
</tr>
<tr>
<td>Lynn Charlotte Allen</td>
<td>Willoldale, ON</td>
<td>Science II</td>
</tr>
<tr>
<td>Robert Keith Allen</td>
<td>Georgetown, ON</td>
<td>Science II</td>
</tr>
<tr>
<td>Lyn Roy Allingham</td>
<td>Agincourt, ON</td>
<td>Science II</td>
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<tr>
<td>Trevor William Anderson</td>
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<td>Donald John Baird</td>
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Scholarships, Prizes, and Financial Aid

Robert James Balahura
Zel Baltman
James Robert Barney
Lynn Margaret Batten
Brent Douglas Beach
Richard John Beach
John Robert Beal
Jutta Margarete Bechmann
Ronald Cecil Bender
John Bergsma
David Ross Bertran
Diane Susan Bidan
Frank Peter Bilewicz
Dorothy Christine Black
Gary William Black
Richard Wayne Black
Brian Robin Blackwell
Thomas David Bobier
John William Boland
Charles Karl Botz
Jane Marguerite Bowen
Jorma Gunnaar Braks
Kenneth Jerome Drenner
Laurie Ernest Bridger
Mara Lee Britney
Diane Sarah Broughton
Russel William Brown
Sanford Roger Brubacher
Christian Bruckschaiger
Jack Allan Bryant
Clayton David Burkholder
Heather Jean Burrill
Sandra Dunn Burt
David John Busch
Kenneth Wayne Butcher
Lynda Joan Bye
Lorne Daniel Byzyna

Robert James Balahura
Kitchener, Ontario
Science IV

Zel Baltman
Toronto, Ontario
Engineering III

James Robert Barney
Fort William, Ontario
Engineering III

Lynn Margaret Batten
Kitchener, Ontario
Arts I

Brent Douglas Beach
Ottawa, Ontario
Science III

Richard John Beach
Ottawa, Ontario
Science I

John Robert Beal
Deep River, Ontario
Engineering I

Jutta Margarete Bechmann
Midland, Ontario
Arts I

Ronald Cecil Bender
Matheson, Ontario
Science III

John Bergsma
St. Catharines, Ontario
Engineering III

David Ross Bertran
Fort Erie, Ontario
Engineering IV

Diane Susan Bidan
Penetang, Ontario
Arts I

Frank Peter Bilewicz
St. Catharines, Ontario
Arts III

Dorothy Christine Black
Rexdale, Ontario
Arts III

Gary William Black
Port Credit, Ontario
Engineering III

Richard Wayne Black
Kitchener, Ontario
Science I

Brian Robin Blackwell
Caledonia, Ontario
Engineering II

Thomas David Bobier
Barrie, Ontario
Science III

John William Boland
Smith Falls, Ontario
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Charles Karl Botz
Owen Sound, Ontario
Engineering II

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Warkworth, Ontario
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Laurie Ernest Bridger
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Mara Lee Britney
Ingleside, Ontario
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Diane Sarah Broughton
Dorion, Ontario
Science II

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Waterloo, Ontario
Arts II

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Jack Allan Bryant
Scarborough, Ontario
Arts II

Clayton David Burkholder
Breslau, Ontario
Science III

Heather Jean Burrill
Ottawa, Ontario
Arts II

Sandra Dunn Burt
Fort Carling, Ontario
Arts II

David John Busch
Guelph, Ontario
Engineering III

Kenneth Wayne Butcher
Preston, Ontario
Arts II

Lynda Joan Bye
Downsview, Ontario
Science III

Lorne Daniel Byzyna
Fort William, Ontario
Engineering III

Ian Stewart Calvert
Willowdale, Ontario
Engineering II

Richard Andrew Cameron
Sault Ste. Marie, Ontario
Science I

Alvin Brian Campbell
Waterloo, Ontario
Engineering I

Graham Roderick Campbell
Burford, Ontario
Engineering I

John Wayne Campbell
St. Catharines, Ontario
Arts II

Keith Lester Carr
Shedden, Ontario
Engineering III

Peter Joseph Catania
Newmarket, Ontario
Engineering IV

Robert Bruce Cavanagh
New Hamburg, Ontario
Engineering III

Valentino Sante Cecco
St. Catharines, Ontario
Engineering IV

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Cooksville, Ontario
Science I
Graham Douglas Chalmers Sarnia, Ontario
Douglas Bracken Chambers Woodstock, Ontario
Richard Owen Chambers Port Credit, Ontario
William Arthur Chambers Kitchener, Ontario
Michael Patrick Chatterson Orillia, Ontario
Jane Ann Chesterfield Don Mills, Ontario
Michael Seymour Church Streetsville, Ontario
Edward Brian Clark Kitchener, Ontario
Kenneth David Clarke Port Credit, Ontario
Stephen Harold Clodman Downsview, Ontario
James Peter Cluchey Scarborough, Ontario
Angelo Colavecchia Thorold, Ontario
William Alfred Cole Milton, Ontario
John Charles Collins Guelph, Ontario
Thomas Christopher Collins Erin, Ontario
Norma Elizabeth Cook London, Ontario
Donald Walter Cooke London, Ontario
Richard Joseph Cooke Kitchener, Ontario
Edward Lawrence Cooper Cambridge, Ontario
Rodney Harold Cooper Willowdale, Ontario
Larry James Copeland Oshawa, Ontario
Louis Maria Cornelis Guelph, Ontario
Dianne Joan Cox Niagara Falls, Ontario
Ronald George Craig Ottawa, Ontario
John Joseph Creech St. Marys, Ontario
Ian Kenneth Crellin Ajax, Ontario
Carl John Cuneo Walkerton, Ontario
Judith Mary Cunliffe Scarborouh, Ontario
Ian Macdonald Cunningham Picton, Ontario
William Harry Cunningham Guelph, Ontario

Renaldo John Daminato Science I
Myrna Jane Davis Science III
Jane Ellen Dawes Science II
Gordon Ralph Dearborn Science III
Ian Gordon Dennett Science II
Donald William Denney Science I
Frederick Theodore Dennis Engineering III
Ronald Peter Dennis Engineering I
Keith Depooter Engineering II
Eugene Peter Dick Engineering I
Russell Dickinson Engineering III
Kenneth Dorian Dietz Engineering I
Julian John Dodson Engineering II
Richard Alfred Dominico Arts II
Martha Christine Dorrance Arts IV

Guelph, Ontario
Stroudsburg, Pennsylvania
Seaforth, Ontario
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Blaine Michael Golec
Keith William Golem
Kenneth John Goll
Robert James Goodall
Shirley Anne Goodfellow
Barry Edward Goodison
Arthur Grant Gordon
Michael John Gordon
Ernest Lindsay Goutrell
John George Gorski
Catherine Joan Gould
John Douglas Graham
John Martin Graham
Alan Charles Gray
Donald William Gregory
Paul Louis Grignon
Arend Groen
Pierrec Edmond Guevremont

Nora Janet Hagey
Robert Henry Hamilton
Thomas Allan Hamilton
Linda Ruth Hardy
Dannie Walter Harrington
Carol Elizabeth Harrison
Bert Lennard Hartnell
William Gerald Haslam
Constance Virginia Hauck
Robert James Henderson
Ross Macrae Hendryck
Norman Andrew Hendrycks
Charles Herder
Linda Sue Hertzman
Susan Lynn Heslip
Frederick Irvin Hill
Clive Hodson
Henry Hugh Hogg
Paige Marie Holland
Susan Jane Honsberger
David Andrew Hook
Herbert Horn
Barbara Joan Howard
Michael Frank Howard
Peter Melvin Huck
Edna Joyce Hughes
Paul William Humphries
Margaret Ann Hunter
Douglas Neil Inkster

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Chesley, Ontario
Waterloo, Ontario
Port Dover, Ontario
Sault Ste. Marie, Ontario
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Dundas, Ontario
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Port Elgin, Ontario
Barrie, Ontario
Goderich, Ontario
Peterborough, Ontario
Cannington, Ontario
Port Lambton, Ontario
Lively, Ontario
Willowdale, Ontario
Guelph, Ontario
Matheson, Ontario

Brantford, Ontario
Dundalk, Ontario
Downsview, Ontario
Vancouver, British Columbia
Brantford, Ontario
Listowel, Ontario
Rainy River, Ontario
Ancaster, Ontario
Waterloo, Ontario
Owen Sound, Ontario
Brockville, Ontario
Sarnia, Ontario
Whitby, Ontario
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Creemore, Ontario
Elora, Ontario
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Richmond Hill, Ontario
Welland, Ontario
Kenora, Ontario
Malton, Ontario
Scarborough, Ontario
Oakville, Ontario

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<td>Niagara-on-the-Lake, Ontario</td>
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<td>Arnold Melvin Nurmi</td>
<td>Port Arthur, Ontario</td>
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<td>Ronald Orin Ojanpera</td>
<td>Whitefish, Ontario</td>
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<td>Henry Gerard Olders</td>
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<td>Lambert Otten</td>
<td>Paris, Ontario</td>
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<td>David Wishart Parker</td>
<td>Port Credit, Ontario</td>
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<td>Giles David Parsons</td>
<td>Cookstown, Ontario</td>
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<td>Anne Elizabeth Pearce</td>
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<td>Eleanor Jean Peavoy</td>
<td>Ariss, Ontario</td>
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<td>Amedeo Mario Peretti</td>
<td>Windsor, Ontario</td>
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<td>Fort William, Ontario</td>
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<td>Victor Peters</td>
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<td>Dryden, Ontario</td>
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<td>Weston Garth Picot</td>
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<td>Lloyd Blair Pierce</td>
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<td>Robert James Poulton</td>
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<td>Wilmer Leo Predinchuk</td>
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<td>Ross Laverne Prentice</td>
<td>Uxbridge, Ontario</td>
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<td>Andreas Prozes</td>
<td>Georgetown, Ontario</td>
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<td>Richard Stanley Purdy</td>
<td>Oakville, Ontario</td>
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<td>St. Catharines, Ontario</td>
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<td>Daniel Peter Rafferty</td>
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<td>Janet Dallas Ransom</td>
<td>Richmond Hill, Ontario</td>
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<td>Lois Mea Rayment</td>
<td>Peterborough, Ontario</td>
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<td>Irene Redekopp</td>
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<td>Philip Owen Redfern</td>
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<td>Lorence John Reed</td>
<td>Harrison, Ontario</td>
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<td>Thomas Christopher Reid</td>
<td>Brampton, Ontario</td>
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<td>Gordon Ross Reier</td>
<td>New Dundee, Ontario</td>
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<td>Richard Charles Renner</td>
<td>Preston, Ontario</td>
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<tr>
<td>James Harry Rennie</td>
<td>St. Catharines, Ontario</td>
<td>Engineering III</td>
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William Lynn Renwick
William Roy Richardson
Linda Susan Riva
Carolyn Elizabeth Roberts
David Robins
Kenneth Edward Robins
James Edward Robinson
John Michael Robinson
Olch Swiatoslau Romanyszchyn
Patricia Ann Rose
Robert Rosehart
James Grafton Ross
Kenneth Lloyd Rossel
Helmut Karl Roth
John William Rothwell
Roger Geoffrey Roulet
Ronald Neil Rourke
Michael Floyd Rowlands
Dorothy Dianne Rumble
David MacElroy Rupar
James Robert Ruppel
George Rusinski
George Thomas Russell
Adrian Ryans
Barbara Anne Samson
Andrew Wilson Sare
Lee Edward Sauer
Gerald Andrew Saunders
Gordon James Savage
Ernest Sawatzky
Brian Morris Schaefer
Janet Louise Schafer
William Grant Schaming
Jane Elizabeth Scherer
Marilyn Jean Schmitt
Heidi Schnegelsberg
Johannes Arie Schriel
Stephen Richard Schroeter
Richard John Schur
Albert Schut
Edward Herbert Sear
Robert Dennis Sedgman
William Arthur Serack
David Allen Sheppard
Carl Albert Silke
Elsa Lynn Sjolander
Edward Lawrence Skiba
David Charles Smart

Fort Frances, Ontario
Ridgeway, Ontario
Scarborough, Ontario
Burlington, Ontario
Thorold, Ontario
Stratford, Ontario
Auburn, Ontario
Don Mills, Ontario
Waterloo, Ontario
Sudbury, Ontario
Tillsonburg, Ontario
Waterloo, Ontario
Bradford, Ontario
Mono Road, Ontario
Toronto, Ontario
Belleville, Ontario
Brantford, Ontario
Sarnia, Ontario
Elmira, Ontario
St. Catharines, Ontario
Oshawa, Ontario
Downsview, Ontario
Waterloo, Ontario
Guelph, Ontario
Ridgeway, Ontario
Brockville, Ontario
Beaverton, Ontario
Waterloo, Ontario
St. Marys, Ontario
Kitchener, Ontario
Simcoe, Ontario
Galt, Ontario
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Campbellville, Ontario
Markham, Ontario
Thorold, Ontario
Woodstock, Ontario
Hespeler, Ontario
Chatham, Ontario
Brantford, Ontario
Sarnia, Ontario
Pembroke, Ontario
Nipigon, Ontario
Brantford, Ontario
Woodstock, Ontario

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Arts III
Science III
Science II
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Science III
Science III
Engineering III
Science II
Scholarships, Prizes, and Financial Aid

Derryck Harold Smith
Donald George Smith
Glen Ronald Smith
Penny Anne Smith
Vaughan Charles Smith
William James Snodgrass
Paul Dennis Snyder
Dino Andrew Spagnolo
Elwood George Sparrow
Karen Elizabeth Steckenreiter
Hans Stelzer
Michael Edwin Stephens
Joanne Elizabeth Stevens
Larry David Stief
Douglas Carl Strahan
Jacqueline Mary Strauss
John Harland Stray
Mary Ann Stribel
Rae William Struthers
Crispin Guy Sumner
Jane Pamela Takaoka
Pamela Kay Tallon
Rickey Wayne Tanaka
Isobel Taylor
Norman Fredrik Taylor
Edward Telford
Douglas Bruce Tennant
Melvin Sutherland Ternan
Richard Roy Thompson
Terry Edward Thompson
John Kenneth Thrasher
Gifford Toole
Peter Richard Tremaine
Frederick Walter Tricker
David Bruce Trowbridge
Murray Ian Turner
Alan Glen Tustin
William Howard Twaites
Donald Norman Tyrrell
Terrance Lee Umbach
David Allan Upshall
Bruce Earl Uttley
Cornelia Jacoba Vankerkoooy
John Robert Verdun
Mary Anne Verdun
Raymond John Vilbikaitis
Ronald Hugh Vogan

Niagara Falls, Ontario
Richmond Hill, Ontario
Port Credit, Ontario
Sault Ste. Marie, Ontario
North Bay, Ontario
Burford, Ontario
Elmira, Ontario
Timmins, Ontario
Willowdale, Ontario
Waterloo, Ontario
West Hill, Ontario
Islington, Ontario
Willowdale, Ontario
Georgetown, Ontario
St. Marys, Ontario
Kitchener, Ontario
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Blair, Ontario
Troy, Ontario
Scarborough, Ontario
Oakville, Ontario
Toronto, Ontario
Windsor, Ontario
Concord, Ontario
Owen Sound, Ontario
Rexdale, Ontario
Arthur, Ontario
Cooksville, Ontario
Stratford, Ontario
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Waterloo, Ontario
Thornhill, Ontario
Dresden, Ontario
Sarnia, Ontario
Agincourt, Ontario
Niagara Falls, Ontario
Islington, Ontario
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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.

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.
Scholarships, Prizes, and Financial Aid

The basis on which the award is made includes the following:
(a) excellence in academic achievement.
(b) indications that the scholar will achieve distinction in the intellectual, cultural, or social life of our society.

J. P. Bickell Foundation Scholarships

For the academic year 1967-68, the Trustees of the J. P. Bickell Foundation will provide twenty-four J. P. Bickell Foundation scholarships of $250 each to be awarded to qualified students in the Chemical Engineering Department in any of the second, third or fourth years of the course.

To be eligible for one of these scholarships a student must obtain an average of 75% in the previous term's examinations and maintain this standing throughout the course. The scholarship will be paid at the rate of $250 a term for up to six terms.

Awards will be made by the Scholarships Committee. No application is necessary.

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, 1967, to the Awards Officer, Office of the Registrar, University of Waterloo.

Rotary Clubs of Kitchener-Waterloo

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, 1967, to the Awards Officer, Office of the registrar, University of Waterloo.

E. L. Ruddy Scholarship

The E. L. Ruddy Company Limited is offering an annual scholarship of $250 to be awarded to a third or fourth year student registered in the Planning option of the Honours Geography programme. The student must have attained high academic standing and indicate an interest in planning. Application should be made to University Registrar.
Concordia Club Scholarship in German

A scholarship in the value of $300 will be awarded annually in the Faculty of Arts by the Kitchener-Waterloo Concordia Club to promote and encourage the study of German language and literature.

Canadian German Society Scholarship in German

A scholarship of $100 will be awarded annually in the Faculty of Arts by the Canadian German Society to an outstanding student majoring in German.

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 $160 and is provided annually by Mr. Friedrich Lehner of Lehner Travel Service, Toronto, Ontario, Canada.

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.

Imperial Oil Higher Education Awards

Imperial Oil Limited offers annually free tuition and other compulsory fees to all children or wards of employees and annuitants who proceed to higher education courses. The courses may be taken at any Canadian university or other approved institution of higher learning. Each award is tenable for a maximum of four years. To be eligible a student must attain an average mark of 70% in the appropriate secondary school examinations in the subjects required for admission to the approved institution. Further information and application forms may be obtained from the Secretary, Committee on Higher Education Imperial Oil Limited, 111 St. Clair Avenue West, Toronto 7, Ontario.

Kitchener-Waterloo Council of Friendship Scholarship Fund

The Kitchener-Waterloo Council of Friendship offers scholarships totalling $1,500 to first year students who were born in a non-English speaking country and are residents of the Kitchener-Waterloo school area. Further details may be obtained from the Office of the Registrar of the University of Waterloo or from your Secondary School.
Scholarships, Prizes, and Financial Aid

Huron County Scholarship

Huron County Council is offering two $100 Scholarships to be awarded to the boy and girl from Huron County who obtain the highest standing regardless of what year in which he or she is registered. No formal application is necessary.

A. S. Eves Scholarship

This Scholarship which has a value up to $500 will be awarded annually to an engineering student in the final year who is specializing in Materials Science.

The award will be made by the Scholarships Committee on recommendation of the Faculty of Engineering.

Ukrainian Credit Union "Buduchnist" Scholarship in Ukrainian Studies

This Scholarship of $100 will be awarded annually to an outstanding full-time student who attains the highest academic standing in a Ukrainian course.

The British American Oil Company Limited Scholarships

Seven university entrance scholarships are awarded annually each valued at $1,000 per annum. Eligible are children of employees or annuitants of the British American Oil Company Ltd. and its subsidiary companies in Canada. Application forms should be requested directly from:

Director of Awards,
Association of Canadian Universities and Colleges,
151 Slater Street
Ottawa 4, Ontario

Completed applications in triplicate are to be sent directly to the above address to arrive not later than June 1.

Cominco Scholarships

To assist in ensuring a continuing supply of qualified graduates in fields vital to industry in Canada, Cominco Ltd. has established a program 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 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.
Undergraduate Bursaries

Note: Second Class standing is normally required of applicants for bursary assistance.

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.

ATA Trucking Industry Educational Foundation Bursaries

The Automotive Transport Association Trucking Industry Educational Foundation was established in 1958 by a group of transport companies who decided to divert monies formerly spent in Christmas customer gift-giving to bursaries for deserving needy students. The funds are to be distributed to students in all faculties, who, because of extenuating circumstances, are deserving of financial help, and would not be in a position to continue their studies without some assistance.

Awards will be made by the Scholarships Committee. Application for a bursary should be made through the Office of the Registrar.

IBM—Thomas J. Watson Memorial Bursaries

The University of Waterloo has been invited to participate annually in the IBM—Thomas J. Watson Memorial Bursary Programme, established by the International Business Machines Company Limited.

The objective of the 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.

Dominion Rubber Student Aid Plan

Beginning with the academic year 1961-62 the Dominion Rubber Co. Limited has included the University of Waterloo in its programme of aid to education. Awards will be made by the Scholarships Committee. A candidate must have completed at least one academic year, should establish a need for financial assistance and be willing to assume a moral obligation to repay to the university over a reasonable period at least twenty-five per cent of any funds received.

Further information and application forms may be obtained from the Office of the Registrar.

Litton Systems Bursary

A bursary, to the value of $500, is offered annually by Litton Systems (Canada) Limited. The bursary may be awarded to students in the Faculty of Engineering.
Scholarships, Prizes, and Financial Aid

with preference being given to those in the electronic or electro-mechanical fields. It is intended to provide financial assistance to undergraduates in need and may be held concurrently with other awards where the need exists.

Awards will be made by the Scholarships Committee and the amount available may be apportioned among two or more students. Applications for a bursary should be made to the Office of the Registrar.

The St. Quentin Chapter I.O.D.E. Bursary

The St. Quentin Chapter I.O.D.E., Waterloo, offers an annual bursary of $100 to a second or third year student in the Faculty of Science, with preference being given to the son or daughter of a veteran.

Application should be made through the Office of the Registrar by October 15.

The Minnesota Mining and Manufacturing of Canada Limited Bursaries

Two bursaries, to the value of $500 each, are offered annually by the Minnesota Mining and Manufacturing of Canada Limited. The bursaries may be awarded to any full-time undergraduate student at the University, who has a good academic record and is in need of financial assistance for continued studies.

Awards will be made by the Scholarships Committee. Application for a bursary should be made to the Office of the Registrar.

Ontario Culvert Bursary

One bursary, valued at $500 (i.e. $250 per academic term), is offered annually by the Ontario Culvert and Metal Products Company Limited. The bursary will normally be awarded to a student registered in Third or Fourth Year Civil Engineering who maintains a satisfactory academic standing.

Awards will be made by the Scholarships Committee. Application for a bursary should be made to the Office of the Registrar.

P. L. Robertson Manufacturing Co. Ltd. Bursary

A Bursary, to the value of $100 is offered annually by the P. L. Robertson Manufacturing Co. Ltd. The bursary is to be awarded to students in the Faculty of Engineering who are in need of financial assistance and who have satisfactory academic standing. Where the need exists the bursary may be held in conjunction with other awards.

The Scholarships Committee will award the bursary and application should be made to the Office of the Registrar.

J. P. Bickell Foundation Bursaries

The Foundation is making available a sum of money to be used in providing
bursary assistance to Chemical Engineering students of good academic standing who need financial assistance.

Awards will be made by the Scholarships Committee. Application for a bursary should be made to the Office of the Registrar.

**Waterloo Young Men's Club Bursary**

A bursary to the value of $100 is offered by the Waterloo Young Men's Club to a full-time student who is a permanent resident of the City of Waterloo, who has a good academic standing and needs financial assistance.

Application should be made through the Office of the Registrar.

**The Business and Professional Women's Club of Kitchener-Waterloo Bursary**

The Business and Professional Women's Club offers a Bursary of $100 to a girl enrolled in an undergraduate course beyond the first year. Good academic standing and financial need are essential.

Application should be made on forms provided by the Office of the Registrar.

**The Hydro-Electric Power Commission of Ontario Bursary**

A bursary, of the value of $500, is offered annually by The Hydro-Electric Power Commission of Ontario to a student in second year in any of the following honours courses: Mathematics, Physics, Applied Science and Engineering. It is to be awarded to undergraduates with good academic standing who are in need of financial assistance. The bursary may be held concurrently with other awards where the need exists. Awards will be made by the Scholarships Committee. Applications should be made through the Office of the Registrar.

**Huron County 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 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.

**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.

**Perth County Bursary**

Perth County Council offers a bursary of $100 to a deserving student beyond...
Scholarships, Prizes, and Financial Aid

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.

The Steel Company of Canada, Limited Bursary

The Steel Company of Canada is offering an admission bursary in the amount of $500 each year for four years to give financial assistance to students of superior ability who might not otherwise go to university because of lack of funds.

Applicants must be permanent residents of Canada and must have completed the final year's work for university entrance in one school year and have attained a minimum average mark of 66%.

The Stelco Bursary is not tenable with scholarships totalling in excess of $200 but may be held with other bursaries at the discretion of the university.

Application may be made by writing to the Office of the Registrar, University of Waterloo.

Lloyd C. Meyer Bursary

This bursary to the value of $300, is awarded annually to a student in the Faculty of Engineering who is in need of financial assistance and who has a satisfactory academic standing.

Application should be made through the Office of the Registrar.

Interprovincial Pipe Line Company Bursary

The Interprovincial Pipe Line Company Bursary Fund, of a total value of $2,500, has been established by Interprovincial Pipe Line Company to benefit students beyond the first year in any faculty who are in need of financial assistance in order to continue their studies.

Application for a bursary should be made through the Office of the Registrar.

Undergraduate Prizes

Association of Professional Engineers Gold Medal for Academic Achievement Award

The Association of Professional Engineers of the Province of Ontario makes this award to the student in the fourth year of an accredited engineering course, who having received honours, has obtained the highest standing in the final examinations of the current academic year. Included with this award is a gift of technical books valued at approximately $50.00.

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.
Faculty and Staff Prize

The University of Waterloo Faculty Association has established a fund to award prizes, of the value of $50 each, to the students who rank first in the final examinations of any non-graduating year of each Faculty. This is provided that the student attains a minimum of 80% in the final examinations, is not repeating his year, has no supplemental examinations, and carries a full course load.

An application is not required. The Faculty Association has the final decision in all cases.

The George Crabbe Prize for Creative Writing

This prize, open annually to all full-time students in all faculties, consists of $100 to be awarded, in whole or in part at the discretion of the judges, for superior creative writing in any of the following categories: short story, novella, one-act play, full-length play, poetry. Contestants should submit their manuscript or manuscripts, typed double space and in duplicate, to the Office of the Registrar by October 31. Each manuscript shall bear a pseudonym and shall be accompanied by a sealed envelope containing the real name of the person using the pseudonym.

The Joseph Addison Essay Prize

This prize, open annually to all full-time students in all faculties, consists of $100 to be awarded, in whole or in part at the discretion of the judges, for the best essay or essays on one or more of a number of themes to be set each year. The themes for 1967 are the following:

(1) The effects of nationalism on literature.

(2) Changing fashions in iconography.

(3) The role of literature in the reform of manners.

Each essay, which may be no shorter than 2,000 words and no longer than 5,000, shall be on one of these themes, and should evince, in addition to a competent handling of the subject, the qualities of grace, clarity, and gentlemanly ease which characterize the essays of Joseph Addison. Contestants should submit their manuscript or manuscripts, typed double space and in duplicate, to the Office of the Registrar by January 31. Each manuscript must bear a pseudonym and must be accompanied by a sealed envelope containing the real name of the person using the pseudonym.

The Bruce Wyler Kelly Memorial Prizes

These book prizes were established in 1960 by relatives and friends in memory of the late Bruce Wyler Kelly, the first Dean of Science at the University of Waterloo, 1958-1960. These prizes are awarded in the General Science Course at the end of the second year to two students, one registered with Bio-
Scholarships, Prizes, and Financial Aid

Biology as major subject and one registered with Chemistry as major subject. Qualifications are (a) a clear pass standing and (b) highest standing in Biology with a minimum of B standing, or highest standing in Chemistry courses taken with a minimum of B standing in the average of these courses.

Senior Physics Prizes

One or two Senior Physics prizes of $100 each will be awarded annually to the highest First Class Honour students registered in the Fourth Year Honours Physics or Applied Physics course.

On occasion, a Second Year prize may be awarded in lieu of one of the Senior Prizes.

Pennsylvania-German Folklore Society of Ontario Prize in German

This prize of $50.00 will be awarded annually to the student in the Faculty of Arts, born in Canada, who has made the most progress in German during the year.

French Department Prize

The French Department Prize, of the value of $50 will be awarded annually to the student who in first year attains the highest mark in the prerequisite course for honours French. To qualify for the prize the student must enrol in the second year of an honours programme offered by the French Department.

The Bobby Bauer Memorial Award

Beginning with the academic year 1966-67, the Bobby Bauer Memorial Foundation will make one or more awards annually to students demonstrating outstanding proficiency in Hockey who qualify for admission to a full-time undergraduate course at a Canadian university.

Application should be made prior to August 31 on forms provided by the Foundation. A letter of reference from a person actively involved in Hockey must accompany each application.

Inquiries and applications should be sent directly to:

Bobby Bauer Memorial Foundation,
60 Victoria Street North,
Kitchener. Ontario.

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.
**Scholarships, Prizes, and Financial Aid**

**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 in the year for which the award has been made. 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 student at the University of Waterloo. It is intended to provide short-term loans, interest free, to students who may be faced with unexpected expenses during their academic year.

Further information may be obtained, and application may be made, through the Office of the Registrar.

**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 of $275 per month. Information concerning these departmental Fellowships may be obtained by applying directly to the department concerned.

Note: Some departments offer research assistantships which provide an opportunity for professional experience, and which may involve light instructional duties in addition to research. Application for these must be filed by March 1.

National Research Council Postgraduate Scholarships and Postdoctorate Overseas Fellowships
The National Research Council awards each year, in open competition, a number of postgraduate scholarships in science and engineering to assist students in undertaking graduate study and research leading to advanced degrees, and a limited number of postdoctorate fellowships for those wishing to add to their experience by specialized training abroad. These scholarships are open to men and women on equal terms, and are awarded on the basis of high scholastic achievement and evidence of capacity to do research.

Applications made on the approved form must be filed not later than January 15.

The Queen Elizabeth II Ontario Scholarships
In honour of the visit of Her Majesty Queen Elizabeth to Ontario in July, 1959, the Government of the Province established a fund to provide annually a number of postgraduate awards to be known as "The Queen Elizabeth II Ontario Scholarships." In 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.
Scholarships, Prizes, and Financial Aid

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 1968/69 Fellowship should be made before April 15, 1967, to the Awards Officer, Office of the Registrar, University of Waterloo.

Woodrow Wilson National Fellowship Foundation

The Woodrow Wilson National Fellowship Foundation offers 1,000 Fellowships annually for the first year of study in any qualified graduate school in the United States or Canada. The Foundation primarily supports candidates in the humanities and social sciences who wish to become college teachers.

A fellow receives $1,500 plus dependency allowances for wife and children, the Foundation also pays directly to the graduate school tuition and fees for the fellow.

A candidate must be nominated by a faculty member no later than October 31, 1967.

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 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.
Scholarships, Prizes, and Financial Aid

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 universities and most awards will be made to candidates who are residents of Ontario.

Application is to be made on the prescribed form which may be obtained from the Office of the Registrar. Deadline date is February 15.

Frank H. Kortright, President, Canadian National Sportsmen’s Show Fellowship

The Canadian National Sportsmen’s Show offers a postgraduate 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.

The Shore Fellowship in Environmental Design

This Fellowship in the amount of $500 was established in 1964, and is awarded to a full-time student registered as a candidate for the M.A.Sc. degree in the Department of Design.

Application should be made on the prescribed form which may be obtained from the Office of the Registrar.

The British American Oil Company Limited Graduate Fellowships

The British American Oil Company Limited offers five graduate fellowships to be awarded annually beginning in 1965-66, and, upon request, each may be renewed for further study, subject to the approval of the selection committee. Each fellowship is valued at $4,000; $3,000 to be paid to the successful candidate and $1,000 to the department of the university in which the Fellow is registered.

The Fellowships are open to any resident of Canada who is a graduate of a Canadian University which is a member of the National Conference of Canadian Universities and Colleges.

Graduate students in any field of study at member institutions of the National Conference of Canadian Universities and Colleges may apply for the awards. Applications are to be sent directly to the Director of Awards, Association of Universities and Colleges of Canada, 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.

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.
Scholarships, Prizes, and Financial Aid

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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Governing Bodies
and Staff
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Vacancies — 7
Senate

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A. M. McLachlin, M.A., B.D. (Principal, St. Paul's United College)
A. W. Rees, M.A. (Principal, Renison College)

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A. N. Sherbourne, B.Sc., M.S., M.A., Ph.D. (Dean of Engineering)
D. A. Sprott, M.A., Ph.D. (Dean of Mathematics)
W. A. E. McBryde, M.A., Ph.D. (Dean of Science)
D. J. Pugliese, B.A., B.P.E., Ed.M. (Director, School of Physical & Health Education)
J. S. Minas, B.A., Ph.D. (Dean of Graduate Studies)

The Academic Dean of each Federated College

Z. T. Ralston, C.R., M.A., Ph.D. (St. Jerome's College)

The Librarian — (Mrs.) D. E. Lewis, B.A., B.L.S.
The Chairman of the Board of Governors — C.A. Pollock, B.A.Sc., B.S.
The Registrar — C. T. Boyes, B.A.
The Director of Extension — A. A. Beveridge, B.A.

Elective Members

Faculty Representatives:

To 1967

A. D. Nelson, A.B., A.M., Ph.D. (Arts)
A. A. Bruneau, B.A.Sc., D.I.C., Ph.D. (Engineering)
G. N. Soulis, B.A.Sc. (Engineering)
H. B. N. Hynes, Ph.D., D.Sc., A.R.C.S. (Science)
I. A. Cummings, A.B., M.A., Ph.D. (St. Jerome's)
To 1968

G. E. Cross, M.A., Ph.D. (Arts)
R. R. Krueger, M.A., Ph.D. (Arts)
W. A. McLaughlin, B.Eng., M.S., Ph.D. (Engineering)
H. G. McLeod, M.A., Ph.D. (Science)
M. G. Rochester, B.A., M.A., Ph.D. (Science)
C. A. W. Totzke, B.A. (Physical & Health Education)
N. L. Choate, C.R., B.A., M.A. (St. Jerome's)

To 1969

R. L. Myers, B.A., M.A., Ph. D. (Arts)
T. A. Brzustowski, B.A.Sc., A.M., Ph.D. (Engineering)
D. Parkinson, B.Sc., Ph.D. (Science)
N. J. Ashton, B.Sc., M.S. (Physical & Health Education)
B. J. Murphy, C.R., M.A., Ph.I. (St Jerome's)

Alumni Representatives:

To 1967

P. Koch, M.A.Sc.
C. W. McNanney, B.A. (St. Jerome's)

To 1968

C. L. Heck, B.A.Sc.
J. H. Shaw, B.A.Sc.
J. McKay, B.A. (St. Jerome's)

To 1969

B. W. Hansler, M.A.Sc.
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To 1967

A. I. Hunsberger, B.A., B.Paed. (Waterloo Collegiate Institute)
K. M. McClelland, B.A. (Owen Sound Collegiate & Vocational Institute)

To 1968

J. C. Herbert, B.A. (Ingersoll District Collegiate Institute)
I. C. Demsey, M. A., B.Ed. (Eastwood Collegiate Institute-Kitchener)

To 1969

T. L. Chapman, B.A. (Grantham High School, St. Catharines)
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President and Vice- Chancellor

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A. P. Gordon, B.A.

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J. D. Adams, B.A.

Computing-Centre

Director

J. W. Graham, B.A., M.A.

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Registrar

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Associate Registrar

B. Ingram, B.A.

Assistant Registrar, Admissions

B. A. Lumsden, B.A.

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Methods Analyst - - - - K. Brooke, B.A.
Supervisor of Examinations and Registration - - - - J. P. Roos, B.A.
Supervisor of Scheduling - - - - M. C. Taylor, B.A.
Student Awards Officer - - - - K. H. Wilms, B.A.

Vice-President, Academic

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Assistant to the Dean - - - - H. C. Mecredy, B.A.

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Associate Dean - - - - E. L. Holmes, B.Sc., M.A.Sc., Ph.D.

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Associate Dean - - - - K. D. Fryer, B.A., M.A., Ph.D.

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Audio Visual Centre
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Vice-President, Operations - - - - A. K. Adlington, B.A.

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Bookings Supervisor - - - (Miss) L. Bonson, B.A.

Development

Director - - - - J. O. Hemphill

Personnel Services

Director - - - - E. S. Lucy, B.A.
Wage and Salary Administrator - - - R. L. Knight, B.A.
Personnel Interviewer - - - R. J. Elliott, B.A.
Personnel Interviewer - - - K. G. McKenzie, B.A.
Personnel Interviewer - - - A. H. G. Taylor

Physical Plant and Planning

Assistant Director (Physical Plant) - A. T. Cairncross, B.Sc., P.Eng.
Assistant Director (Planning) - A. E. Lappin, P.Eng.

Safety & Security

Director - - - - A. E. Romenco

Systems and Procedures

Director - - - - A. Jordan, B.A.
Supervisor, Data Processing - - - O. Schillegger
Supervisor, Programming - - - E. R. Kingham

Provost, Student Affairs

Provost - - - - W. G. Scott, B.A., M.A.
Warden of Student Village - - H. R. N. Eydt, M.Sc., Ph.D.
Assistant Warden, Administration - Student Village - H. C. Vinnicombe, B.Sc. (Eng.)
Dean of Men - - - - to be appointed
Dean of Women - - - (Mrs.) H. Marsden, B.A., M.A.
Director of Counselling Services
C. F. Preston, B.A., B.D., M.A., Ph.D.

Director of Housing and Overseas Student Activities
(Mrs.) E. Beausoleil

Director of Creative Art Activities
(Mrs.) N. L. Patterson, B.A.

Director of Music
A. Kunz

Director of Drama
to be appointed

Director of Art

Health Services
University Physician
(Mrs.) H. Reesor, B.A., M.D.
University Nurse
(Mrs.) P. Livingston, R.N.
University Nurse
(Mrs.) S. Wood, R.N.

Treasurer
A. B. Gellatly, B.A., C.G.A.

Research Grants & Assistant to Treasurer
(Miss) V. E. Leavoy

Business Office
Controller
A. H. Headlam, C.A.
Assistant Accountant
D. T. McClurkin, C.A.
Assistant to Controller
(Miss) D. J. Battae

Purchasing Department
Purchasing Agent
W. G. Deeks
Assistant Purchasing Agent
W. Buzza
Manager—Central Stores
C. A. Lawrence
XIV

Faculty
## Faculty

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Faculty

Totzke, C. A. W. - - - - Physical Education
Trim, D. W. - - - - Mathematics
Tucker, J. W. - - - - Philosophy
Turner, G. A. - - - - Chemical Engineering
Tutte, W. T. - - - - Mathematics
Tuyn, H. - - - - English

Unny, T. E. - - - - Civil Engineering
Uram, F. 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
Vetter, W. J. - - - - Electrical Engineering
Viswanatha, T. - - - - Chemistry
Vogel-Sprott, M. D. - - - - Psychology
Vranch, J. K. - - - - Mathematics
Vuorinen, P. A. - - - - Electrical Engineering

Wahl, J. M. - - - - History
Walter, D. (Mrs.) - - - - French
Walters, R. H. - - - - Psychology
Wang, S. F. - - - - Physics
Watson, K. P. - - - - Political Science
Watt, L. A. K. - - - - Electrical Engineering
Weaver, S. M. (Mrs.) - - - - Sociology and Anthropology
Wei, L. Y. - - - - Electrical Engineering
Wentzell, R. A. - - - - Mathematics
Wertheim, D. G. - - - - Mathematics
White, O. L. - - - - Civil Engineering
Widmeyer, W. N. - - - - Physical Education
Wilkinson, J. - - - - Mathematics
Wilson, J. C. - - - - Mathematics
Wilson, J. M. - - - - Political Science
Wilson, T. H. - - - - History
Wipper, A. (Miss) - - - - Sociology and Anthropology
Woolford, R. G. - - - - Chemistry
Woolner, K. A. - - - - Physics
Wright, D. T. - - - - Civil Engineering
Wubnig, J. (Miss) - - - - Philosophy
Wynne, R. E. - - - - History

Young, M. M. - - - - Chemical Engineering

Zafiriou, L. - - - - Electrical Engineering
**Academic Calendar**

The University of Waterloo reserves the right to change its academic calendar at any time.

**1967-68**

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<td>Registration—Post Degree Programme</td>
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<td>July 24</td>
<td>Monday</td>
<td>Supplemental Examinations Begin</td>
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<td>August 5</td>
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<td>Examinations Begin—Co-operative Programmes</td>
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<td>August 10</td>
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<td>Examinations—Post Degree Programme</td>
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<td>August 11</td>
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<td>Examinations End—Co-operative Programmes</td>
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<td>August 25</td>
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<td>Spring Work Term Ends—Co-operative Programmes</td>
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<td>August 28</td>
<td>Monday</td>
<td>Fall Work Term Begins—Co-operative Programmes</td>
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<td>September 4</td>
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<td>Labour Day—University Buildings Closed</td>
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<td>September 9</td>
<td>Saturday</td>
<td>Registration (Morning Only)—Part-time Undergraduates</td>
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<td>September 13</td>
<td>Wednesday</td>
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<td>Registration—School of Physical and Health Education</td>
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<td>September 14</td>
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<td>September 15</td>
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<td>Registration—Graduate Studies</td>
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<td>Thanksgiving Day—University Buildings Closed</td>
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<td>Meeting—Board of Governors</td>
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<tr>
<td>November 30</td>
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<td>Meeting—Senate Executive Committee</td>
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<td>December 14</td>
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<td>Meeting—University Senate</td>
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<td>December 15</td>
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<tr>
<td>December 16</td>
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<td>Examinations Begin—Fall Term</td>
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<tr>
<td>December 22</td>
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<td>Examinations End—Fall Term</td>
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<td>December 22</td>
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<td>Fall Work Term Ends—Co-operative Programmes</td>
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<td>December 25</td>
<td>Monday</td>
<td>Christmas Day—University Buildings Closed</td>
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<td>December 26</td>
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<td>Winter Work Term Begins—Co-operative Programmes</td>
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<tr>
<td>December 27</td>
<td>Wednesday</td>
<td>Supplemental Examinations—Post Degree</td>
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### Academic Calendar

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<tr>
<th>Date</th>
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<tr>
<td>January 1, 1968 Monday</td>
<td>New Year’s Day</td>
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<tr>
<td>January 2 Tuesday</td>
<td>Registration</td>
<td>Undergraduate Co-operative Programmes</td>
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<td>January 3 Wednesday</td>
<td>Lectures Begin</td>
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<tr>
<td>January 8 Monday</td>
<td>Registration</td>
<td>Winter Term—Graduate Students in Engineering</td>
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<tr>
<td>January 18 Thursday</td>
<td>Meeting</td>
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<td>February 8 Thursday</td>
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<td>March 11 Monday</td>
<td>Supplemental Examinations Begin</td>
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<td>April 12 Friday</td>
<td>Good Friday</td>
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<td>April 29 Monday</td>
<td>Registration</td>
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<td>Spring Work Term Begins</td>
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<tr>
<td>May 26 Friday</td>
<td>Convocation</td>
<td>Arts and Science</td>
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<td>May 27 Saturday</td>
<td>Convocation</td>
<td>Engineering</td>
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<tr>
<td>June 20 Thursday</td>
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Legend
1 Conrad Grebel College
2 St. Paul's College
3 Rennison College
4 St. Jerome's and Notre Dame Colleges
5 Theatre of The Arts — ARTS I
6 Social Science
7 ARTS II — Lecture Building
8 Food Services and Book Store
9 Engineering I (Chemical Engineering)
10 Engineering II
11 Engineering Lecture Building
12 Physics and Mathematics
13 Arts Library
14 Biology and Chemistry
15 Mathematics and Computer Science
16 Campus Centre
17 Physical Education
18 Heating, Central Stores and Commissary
19 Student Village
Calendar for 1967

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<thead>
<tr>
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<th>OCT.</th>
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Calendar for 1968

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